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

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

WRLFMD

Foot-and-Mouth Disease

January-March 2023
Quarterly report

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

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

This report is version 1

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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).*

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	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
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 Turkey
VI	virus isolation
WAHIS	World Animal Health Information System (of the WOAH)
WOAH	World Organisation for Animal Health
WRLFMD	World Reference Laboratory for Foot-and-Mouth Disease

1. Highlights and headlines

During this period, the WRLFMD has reported test results for samples received from Egypt, Ethiopia, Iraq and Jordan. There have also been new sequence submissions from Jordan (JUST), Iran (IVO), Iraq (FMDI, Ankara), Israel (KVI), Malaysia (MFMDL), Palestine (KVI, Israel) and Türkiye (FMDI, Ankara). Individual laboratory reports can be retrieved from http://www.wrlfmd.org/ and further information is provided in this report.

During the past three months, epidemiological events in the European neighbourhood have been overshadowed by the emergence of SAT2/XIV in Iraq, Jordan and Türkiye. Clinical disease in large ruminants appears to be severe, with higher-than-expected mortality levels in older animals being reported. Analyses of sequences collected from these cases confirm that they are caused by viruses from the SAT 2/XIV topotype which are closely related to viruses collected from Ethiopia during 2022. These are the first reports of the SAT-2 serotype in these countries, and since infection is occurring in naïve animals without any history of infection or vaccination for this serotype, there are obvious concerns about the potential for rapid onward spread to other countries in the region and to the FMD-free buffer zone in Thrace via east-to-west virus conveyers that have been described for other FMDV lineages. Vaccine matching data for representative field isolates from Iraq and Ethiopia are provided in this report (section 4.7) and further data for isolates from Jordan will be included in the next report. In response to these cases, a real-time RT-PCR assay has also been designed which can be used by laboratories to specifically identify samples that contain SAT2/XIV FMDV RNA (see: https://www.foot-and-mouth.org/science/lineage-specific-pcr).

During 2022, there were reports of South American viruses (serotype O and A) causing outbreaks in Egypt. For serotype A, this report confirms these findings, since a A/EURO-SA topotype virus was isolated from the batch of Egyptian samples tested by WRLFMD. Elsewhere in North Africa, new sequence data from IZSLER (received during April) describes a new O/EA-3 incursion into Libya which appears to be different to the viruses that caused outbreaks in 2018 and 2022 (data will be reported in the next Quarterly report).

Don King, Pirbright, April 2023

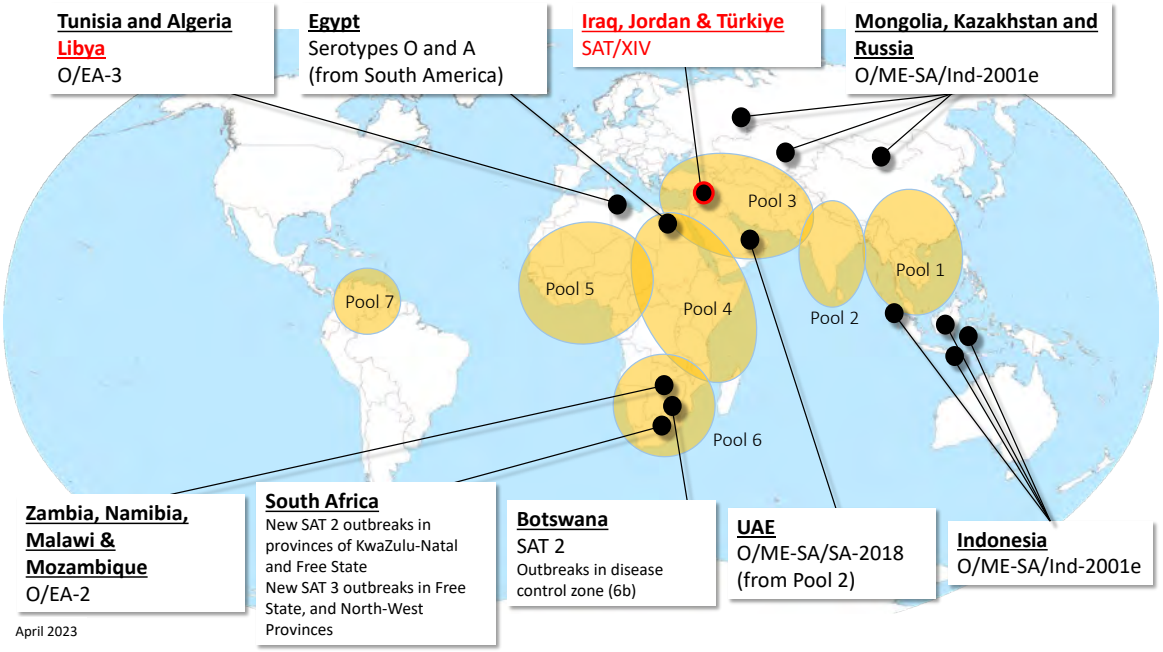


Figure 1: Recent FMD global outbreaks (new headline events reported January to March 2023 are highlighted in red) with endemic pools highlighted in orange. Source: WRLFMD. Map conforms to the United Nations World Map, June 2020.

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, Indonesia, 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[1], 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	**EASTERN AFRICA** Burundi, Comoros, Djibouti, Egypt[3], Eritrea, Ethiopia, Kenya, Rwanda, Somalia, South Sudan, Sudan, Uganda, United Republic of Tanzania, Yemen	O, A, SAT 1, SAT 2 and SAT 3
	NORTH AFRICA[2] Algeria, Libya, Morocco, Tunisia	A, O and SAT 2
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[4], A)
7	**SOUTH AMERICA** Venezuela (Bolivarian Republic of)	O and A

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

[2]Long-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.

[3]Egypt represents a crossroads between East African Pool 4 and the Middle East (Pool 3). NB: Serotypes SAT 1 and SAT 3 have not been detected in this country.

[4]Detection 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.

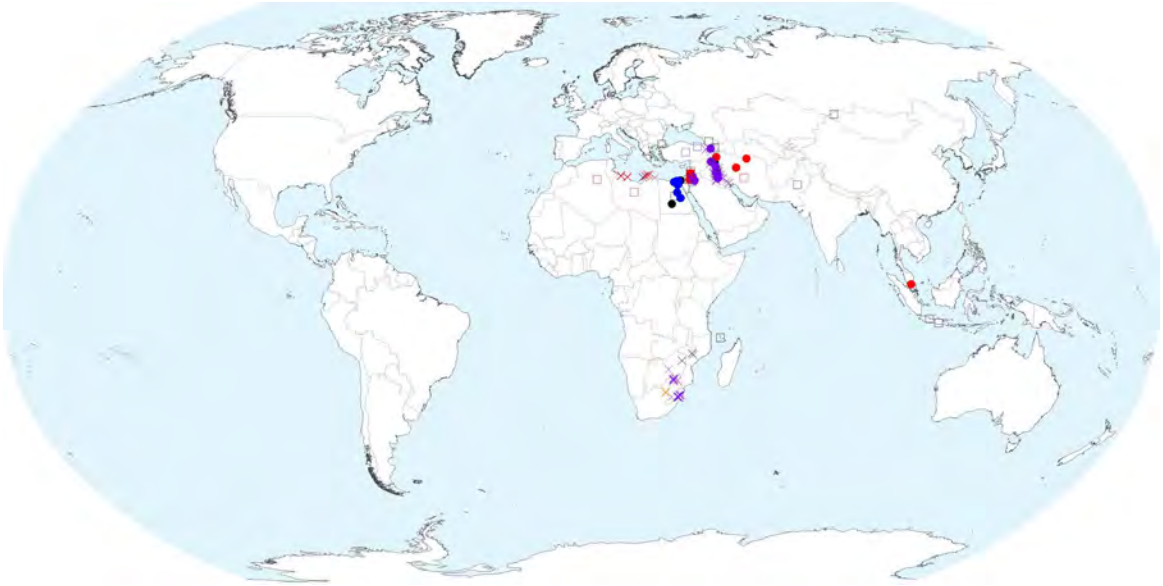
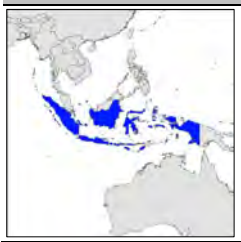


Figure 2: Samples tested by WRLFMD or reported in this quarter. ● indicates samples analysed; × indicates outbreaks reported/updated to the WOAH this quarter; □ indicates reports of FMD from other sources. Shape colours define the serotype detected ●O; ●A; ●C; ●Asia1, ●SAT1, ●SAT2, ●SAT3, ○ FMD not detected,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

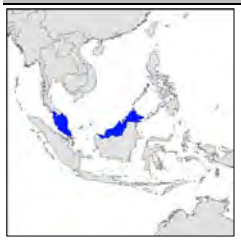
The Republic of Indonesia



Local media reported a sharp increase of FMD cases in Cirebon Regency, Jawa Barat and Ponorogo Regency, Jawa Timur. In Ponorogo Regency the recent increase in cases is suspected to be due to non-optimal vaccination coverage.

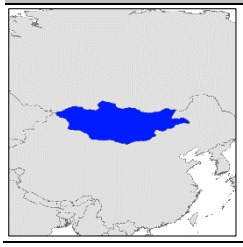
ProMED posts: 20230220.8708496 and 20230306.8708775

Malaysia



On the 8 March 2023, two **FMD type O** VP1 sequences were received from the Malaysian National Foot and Mouth Disease Laboratory (MNFMDL). They were obtained from samples collected on the 2 February 2023 from cattle at Rompin, Jelebu, Negerei Sembilan. Genotyping showed them to belong to the O/ME-SA/PanAsia lineage (see below).

Mongolia



Local media reported that the western Mongolian province of Bayan-Ulgii was been quarantined from 1 February 2023 for 21 days starting due to an outbreak of FMD.

ProMED posts: 20230208.8708232

3.3. Pool 2 (South Asia)

No new outbreaks of FMD were reported in South Asia.

3.4. Pool 3 (West Eurasia and Middle East)

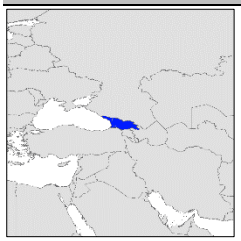
The Republic of Armenia

Surveillance activites have been increased due the introduction of SAT 2 in the region. Clinical surveillence has occured in border and high risk regions, with NSP serological surveillance planned. Awareness campaigns, targeting farmers and veterinary services at various levels, have also been conducted.

The spring vaccination of large ruminants has been completed, achieving >90% coverage. Vaccination of small ruminants will occur in the coming quarter. A SAT 2 vaccine is currently being purchased.

FAO Eu-FMD FAST report Jan-Mar 2023

Georgia



The spring vaccination campaign, targeting more than 900,000 animals, has started. Analysis of sero-surveillance data from 2022 is ongoing.

FAO Eu-FMD FAST report Jan-Mar 2023

The Islamic Republic of Iran

On 21 February 2023, sequence data files were received from the Iran Veterinary Organisation for 11 **FMD type O** samples collected between 19 November 2022 and 5 February 2023 from cattle in six provinces. Analysis of VP1 sequences for eight samples showed that that they all belonged to the O/ME-SA/PanAsia-2^{ANT-10} sublineage (see below).

One hundred and eighteen outbreaks of FMD have been reported this quarter, due to O/PanAsia-2^{ANT-10}. No SAT 2 has yet been identifed

Surveillence is currently ongoing and any sample that tests negative for the currently circulating serotypes is being tested for SAT 2. Vaccination of over 50 million animals with a trivalent (O,A & Asia-1) vaccine has been completed.

FAO Eu-FMD FAST report Jan-Mar 2023

The Republic of Iraq

In January 2023, 36 outbreaks due to **FMD type SAT 2** were reported throughout the country.

On the 2 February 2023 and 14 February 2023, a total of five **FMD type SAT 2** VP1 sequences were submitted by the FMD Institute (FMDI), Ankara, Türkiye. They originated from samples collected in December 2022 and January 2023 from water buffalo and cattle in the governorates of Baghdad and Nineveh. Genotyping revealed that all five belonged to topotype XIV (see below).

On the 15 February 2023, a batch of 12 samples were received the Central Veterinary Laboratories, Baghdad. They had been collected cattle and water buffalo between 6 December 2022 and 17 January 2023 in six governorates (Babil, Baghdad, Erbil, Kirkuk, Najaf and Ninevah). **FMD type SAT 2** was isolated from 10 samples, while two were FMDV-GD. Genotyping revealed that all 10 isolates belonged to topotype XIV (see below).

Across Iraq there have been 235 outbreaks reported this quarter, mainly affecting buffalo and cattle. Thirty of the outbreaks have been due to the SAT 2 serotype (XIV topotype), with the remainder being caused by the O, A, and Asia-1 serotypes. There has been no reported vaccination since 2021, and SAT 2 vaccine is currently being obtained.

ProMED posts: 20230304.8708723, 20230215.8708397, 20230204.8708168, 20230128.8708022, 20230124.8707950 and 20230116.8707801

FAO Eu-FMD FAST report Jan-Mar 2023

Additional sequence data provided by KVI, Israel

On 10 January 2023, a single **FMD type O** VP1 sequence was received from the Kimron Veterinary Institute (KVI). This sequence originated from a cattle sample taken on 18 December 2022 at Buqata/El Rom, Golan Heights. Genotyping showed it to belong to the O/ME-SA/PanAsia-2^{ANT-10} sublineage (see below).

ProMED post: 20230102.8707585

VSAH (Veterinary Services & Animal health) distributed a circular in Israel highlighting FMD preventative measures, in response to the recent spread of SAT 2 in the region.

ProMED post: 20230206.8708207

The Hashemite Kingdom of Jordan

Outbreaks due to **FMD type SAT 2** were reported in cattle at the end of January 2023 in Dhlail, Zarqa.

On 3 February 2023, a single **FMD type SAT 2** VP1 sequence was received from the Jordan University of Science and Technology (JUST). The sequence was derived from a sample collected from cattle in January 2023. Genotyping revealed that it belonged to topotype XIV (see below).

On 8 March 2023, a batch of 27 samples were received. They had been collected between 8 January 2023 and 7 February 2023 from cattle in two governorates (Mafraq and Zarqa). **FMD type SAT 2** was isolated from 23 samples while the remaining four were FMDV-GD. Genotyping revealed that all 23 isolates belonged to topotype XIV (see below).

From mid-December there were reports in local media of FMD despite a successful vaccination campaign. On the 2 February an FMD outbreak was reported to the WOAH and identified as O/ME-SA/PanAsia-2^{ANT10} [a strain of FMD circulating in the region]. Subsequently a second outbreak was reported on 16 February, and this was determined to be caused by SAT 2 - which has not been seen in the country before. In response all livestock markets in all regions of the Kingdom were closed for 14 days in response and a vaccination campaign has been organised (using both imported and locally produced vaccines) around the epicentre of the outbreaks.

Both events were declared resolved by early February - with 501 cases and 2 deaths reported for serotype O and 10963 cases and 379 deaths for SAT 2.

ProMED posts: 20230303.8708700, 20230218.8708464, 20230215.8708398, 20230208.8708236, 20230211.8708308, 20230205.8708191, 20230204.8708162, 20230131.8708068, 20230124.8707940 and 20230113.8707770

Over 10,000 cases of FMD have been reported in Zarqa Governorate. Vaccination in the outbreak zone has been conducted with a vaccine containing inactivated SAT 2 Eritrea.

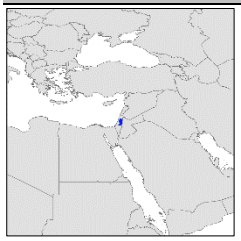
FAO Eu-FMD FAST report Jan-Mar 2023

The Lebanese Republic

Vaccination of animals for 2023 has been completed and a post-vaccination study is in progress. A second phase of vaccination with a booster (targeting large ruminants only) will occur after 6 months.

FAO Eu-FMD FAST report Jan-Mar 2023

The State of Palestine



On 10 January 2023 and 21 February 2023, two **FMD type O** VP1 sequences were received from KVI, Israel. The first was collected in 2022 from sheep (heart) at Bani Naim, Hebron, West Bank and the second in 2023 from Bethlehem, West Bank. Genotyping showed that they belonged to the O/ME-SA/PanAsia-2^{ANT-10} sublineage (see below).

O/ME-SA/PanAsia-2^{ANT10} was identified by Kimron Veterinary Insitute, Israel, in the Hebron Area.

ProMED post: 20230102.8707585

The Islamic Republic of Pakistan

In the second half of 2022, 893 outbreaks were reported caused by O, A and Asia-1 serotypes.

FAO Eu-FMD FAST report Jan-Mar 2023

The Republic of Türkiye

In March 2023, 6 outbreaks due to FMD type SAT 2 were reported in cattle and sheep in eastern Anatolia (Agri, Erzurum, Iğdır, Kars and Van).

On 16 March 2023, a single **FMD type SAT 2** VP1 sequence was received from the FMD Institute (FMDI) in Ankara. It was derived from a sample collected on the 3 March 2023 from cattle in Tuzluca, Igdir Province. Genotyping revealed that it belonged to topotype XIV (see below).

Serotype SAT 2 has been identified in Turkey for the first time from Asagimahalle, Tuzluca, Igdir Provinces. Provincial and district livestock markets have been closed down until further notice and intercity animal transport prohibited to help limit the spread. A new vaccine against the strain has also been quickly developed and is being deployed in the field.

ProMED posts: 20230318.8709006, 20230316.8708982, 20230311.8708881 and 20230310.8708855

Preventative vaccination is occuring in the Thrace region of Turkey (which has been FMD free for the past 13 years) to protect against SAT 2.

ProMED post: 20230329.8709203

SAT 2 has been identified in an outbreak causing 58 cases of FMD so far. A vaccine containing SAT 2 has been produced and was ready for use by 9 March 2023.

Clinical examination (>12,000 animals) and testing of 847 sera samples from the Thrace region found no evidence of FMD.

FAO Eu-FMD FAST report Jan-Mar 2023

3.5. Pool 4 (North and Eastern Africa)

The Arab Republic of Egypt

Eight outbreaks have been reported this quarter. A vaccination campaign, starting in March, has so far vaccinated almost 2.75 million animals.

FAO Eu-FMD FAST report Jan-Mar 2023

The State of Libya

Outbreaks due to **FMD type O** were reported in March and April 2023 in cattle, sheep and goats in AlSiwania, AlZarooq, Jafara, AlSaakit, AlGhayran and alsiwaniu. Genotyping is awaited.

527 cases of FMD from 6 outbreaks were reported from western regions this quarter. Samples tested indicated this was due to serotype O.

FAO Eu-FMD FAST report Jan-Mar 2023

ProMED post: 20230102.8709231

The Union of the Comoros

The FMD outbreak (85 cases with 33 deaths) starting in late 2022 has spread in the islands of Ngazidja and Mwali. Full typing of the outbreak has been delayed due to year end celebrations and export reasons.

ProMED posts: 20230131.8708078, 20230113.8707775

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 Botswana

New cases of **FMD SAT 1** were reported from cattle at Malatso, North-East(n=25) and **FMD SAT 2** from cattle at Butale Crush, North-East district (n=4) in January.

WOAH World Animal Health Information System (event IDs: 3334 & 4594)

The Republic of South Africa	
	Outbreaks (n=235) due to **FMD SAT 2** have been reported in cattle and cape buffalo from Zululand, KwaZulu-Natal Province. Outbreaks of **FMD SAT 3** have been reported from cattle (n=54) in Ventersdorp/Tlokwe, NorthWest Province and in Moqhaka, Free State Province (n=1056). WOAH World Animal Health Information System (event IDs: 3738 & 4368)

3.8. Pool 7 (South America)

No new outbreaks of FMD were reported in South America.

3.9. Extent of global surveillance

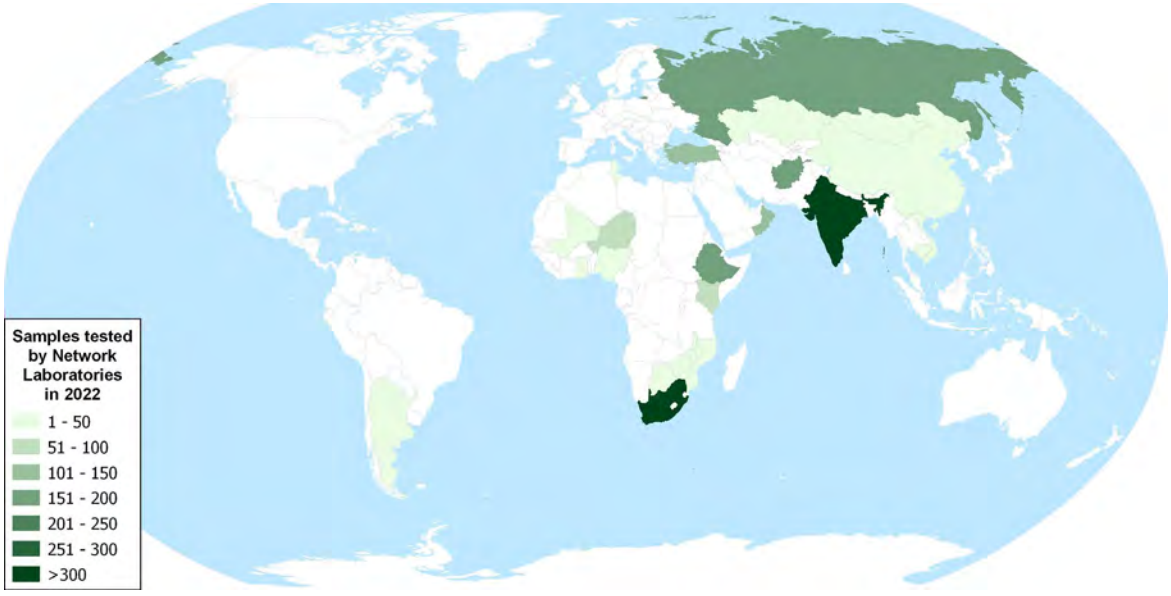


Figure 3: Samples received during 2022 from FMD outbreaks (routine surveillance that is undertaken in countries that are FMD-free without vaccination is not shown). Data from presentations given at the WOAH/FAO FMD reference laboratory network annual meeting (https://www.foot-and-mouth.org/Ref-Lab-Network/Network-Annual-Meeting). 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: 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 [percent] of total FMD cases that occur in domesticated hosts). These scores (reviewed at the WOAH/FAO FMD reference laboratory network meeting in December 2021) 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

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			28					
O ME-SA PanAsia	10							
O SEA Mya-98	21.5							
O ME-SA Ind2001	40	86[1]	5.5	2				
O EA or O WA			2.5	55	55.5	65	16	
O EURO-SA								90
O CATHAY	10.5							
A ASIA Sea-97	18							
A ASIA Iran-05	0		25					
A ASIA G-VII		10	8					
A AFRICA				33	22	17		
A EURO-SA								10
Asia-1	0	4	11					
SAT 1				0	8	3	16	
SAT 2			20	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 Pool 2.

A number of outbreaks have occurred where samples have not been sent to the WRLFMD or other laboratories in the WOAH/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 January to March 2023 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 January to March 2023.

WRLFMD Batch No.	Date received	Country	Total No. samples	Serotype	No. of samples	No. of sequences	Sequencing status
WRLFMD/2023/000008	15/02/2023	Iraq	12	SAT2	10	10	Finished
				FMDV-GD	2		
WRLFMD/2023/000012	08/03/2023	Jordan	27	SAT2	23	23	Finished
				FMDV-GD	4		
Totals			**39**		**39**	**33**	

Table 3: VP1 sequences submitted by other FMD Network laboratories to the WRLFMD from January to March 2023.

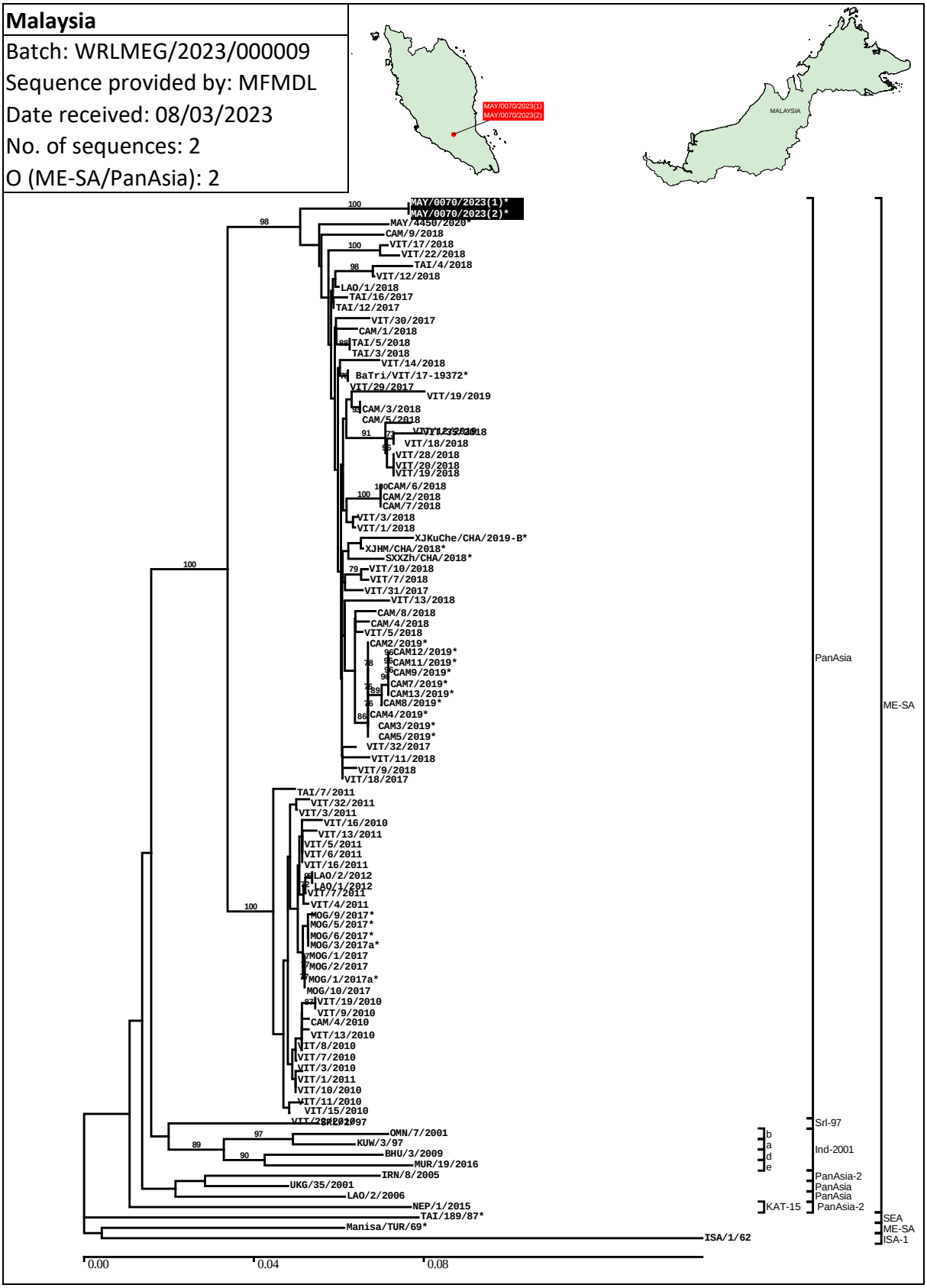
WRLFMD Batch No.	Date received	Country	Serotype	Date Collected	No. of sequences	Submitting laboratory
WRLMEG/2023/000002	10/01/2023	Israel	O	2022	1	KVI
WRLMEG/2023/000003	10/01/2023	Palestine	O	2022	1	KVI
WRLMEG/2023/000004	02/02/2023	Iraq	SAT2	2023	1	FMDI, Ankara
WRLMEG/2023/000005	03/02/2023	Jordan	SAT2	2023	1	JUST
WRLMEG/2023/000006	14/02/2023	Iraq	SAT2	2022-2023	4	FMDI, Ankara
WRLMEG/2023/000007	21/02/2023	Iran	O	2022-2023	11	IVO
WRLMEG/2023/000008	21/02/2023	Palestine	O	2023	1	KVI
WRLMEG/2023/000009	08/03/2023	Malaysia	O	2023	2	MFMDL
WRLMEG/2023/000011	16/03/2023	Türkiye	SAT2	2023	1	FMDI, Ankara
				Total	**23**	

4. Detailed analysis

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

Malaysia

Batch: WRLMEG/2023/000009
Sequence provided by: MFMDL
Date received: 08/03/2023
No. of sequences: 2
O (ME-SA/PanAsia): 2

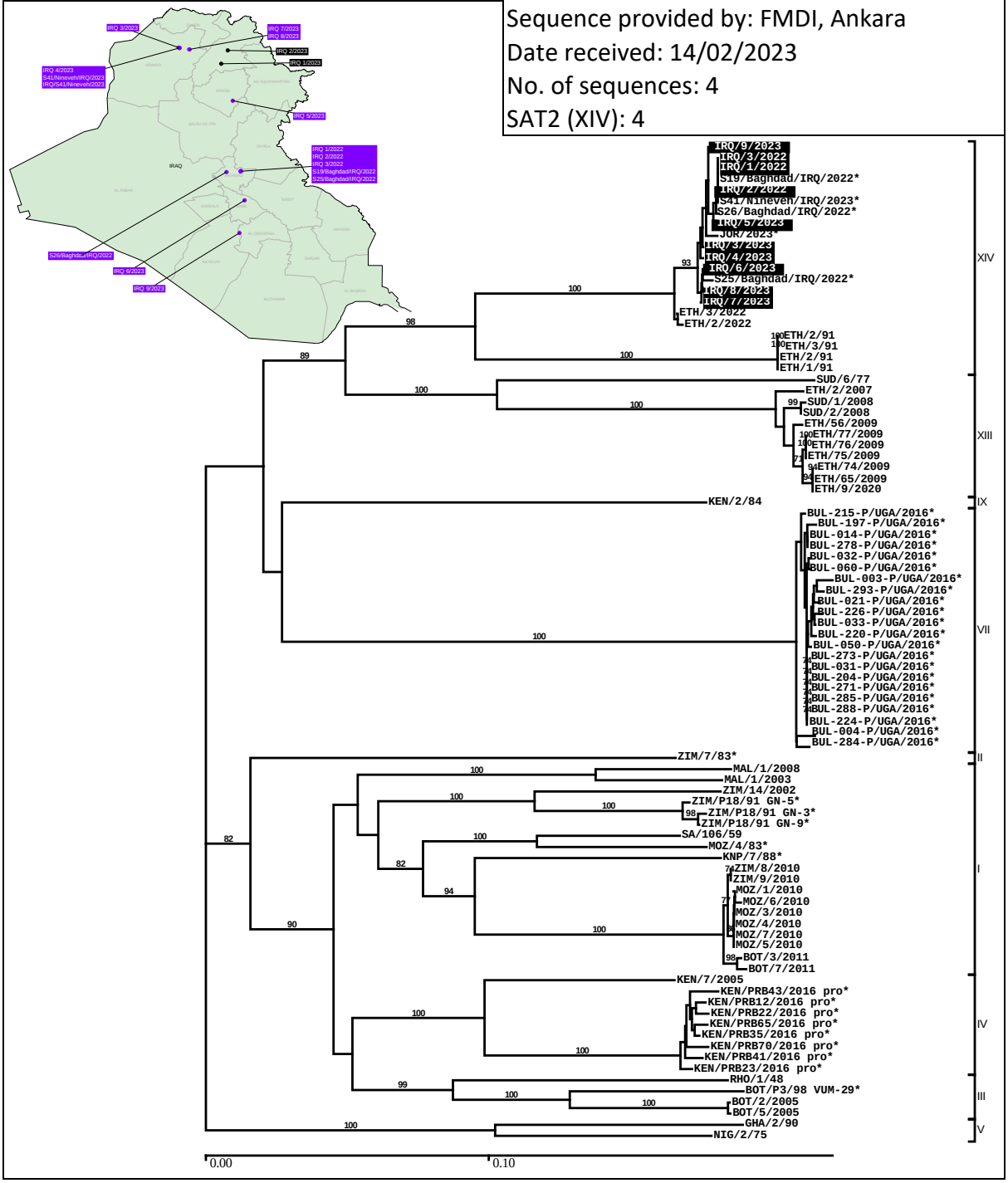


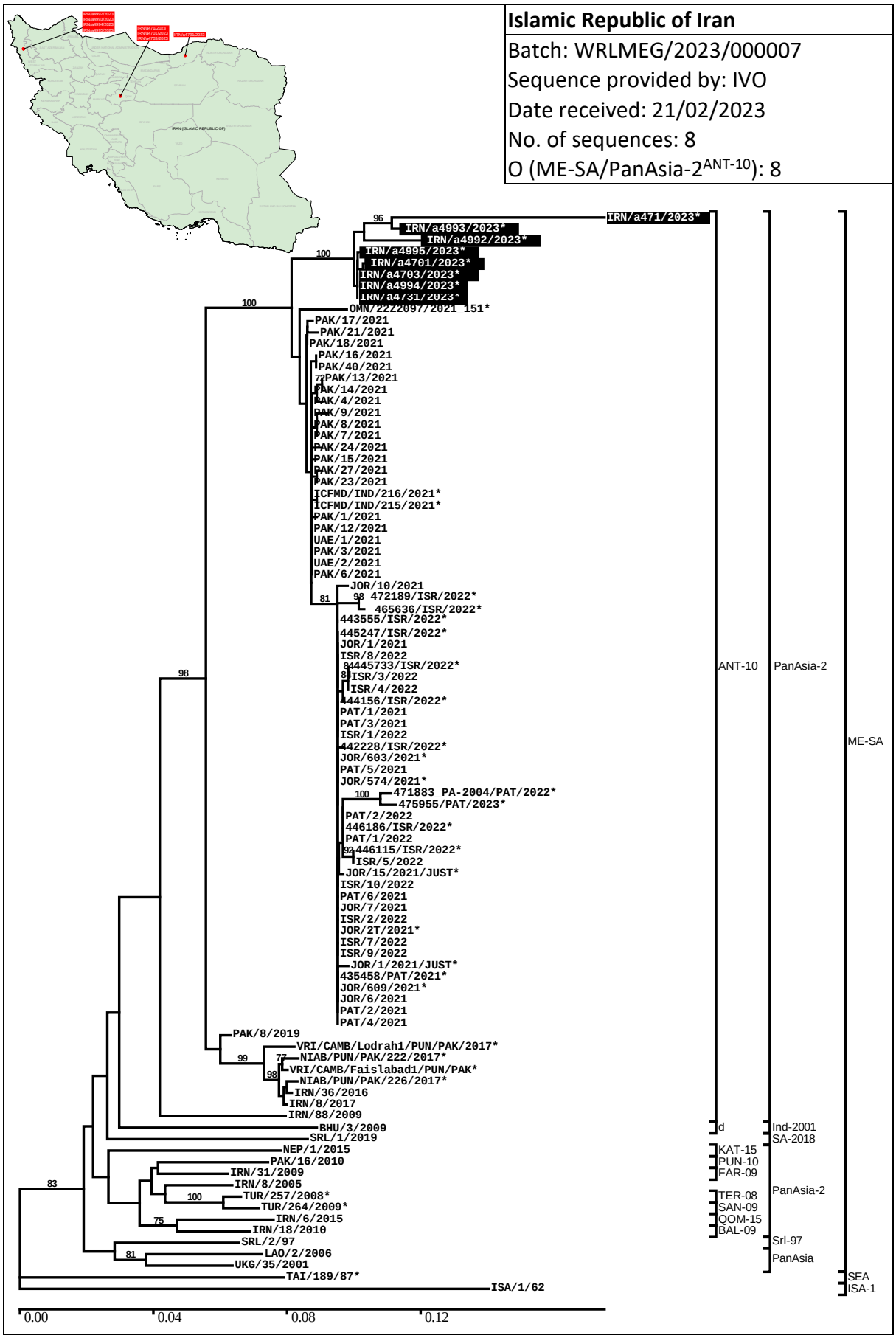
4.2. Pool 2 (South Asia)

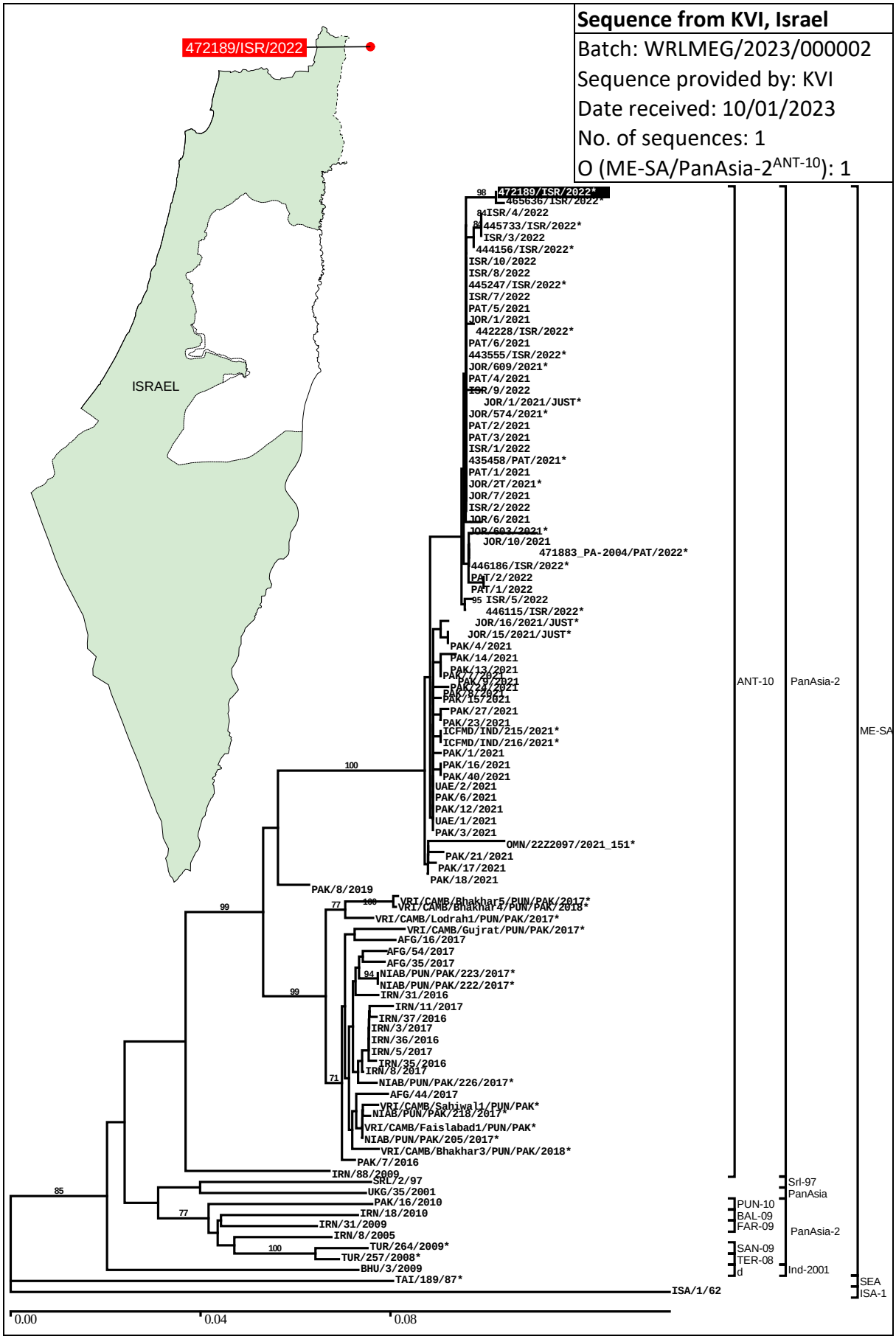
No samples/sequences received.

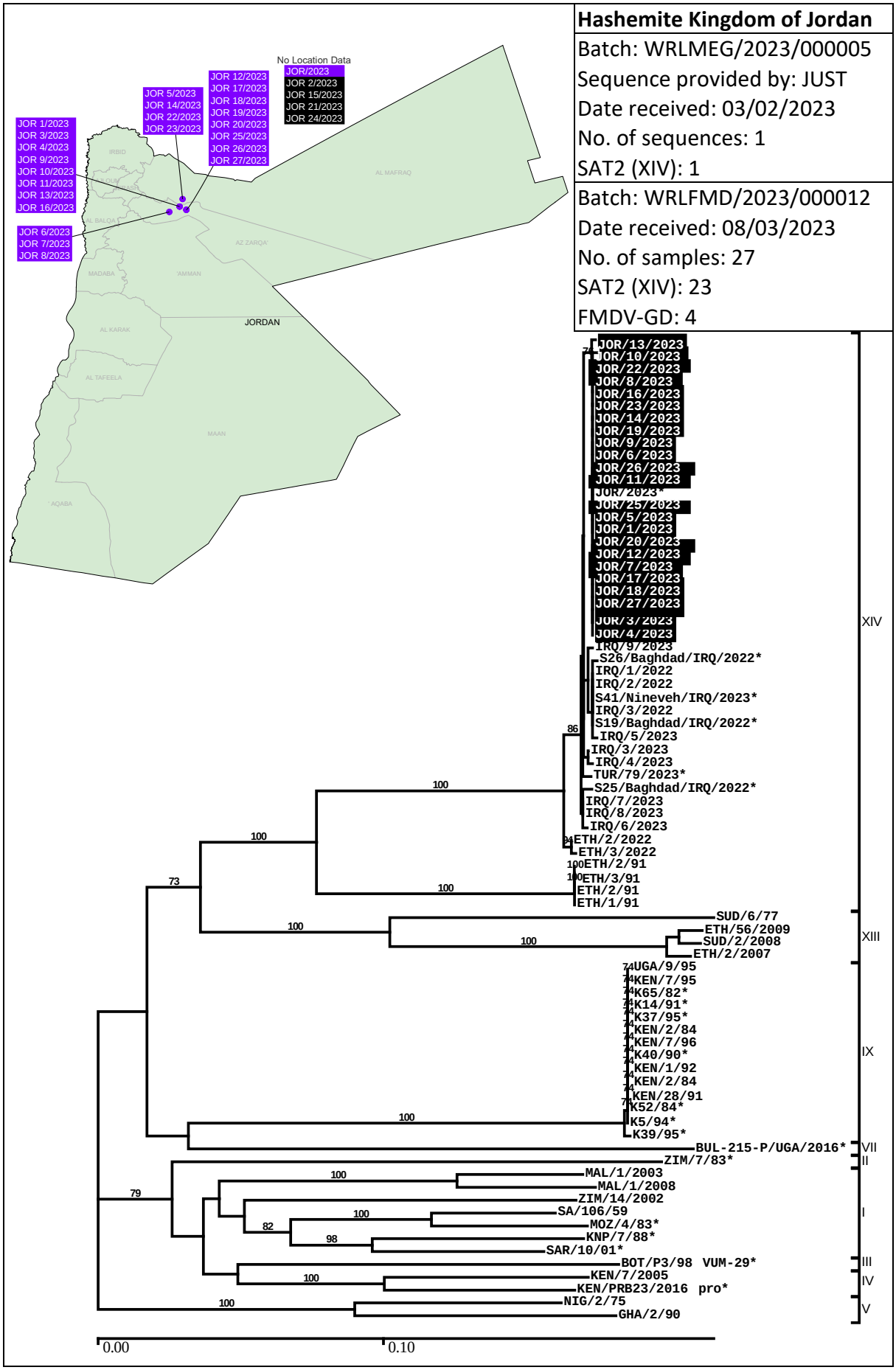
4.3. Pool 3 (West Eurasia and Middle East)

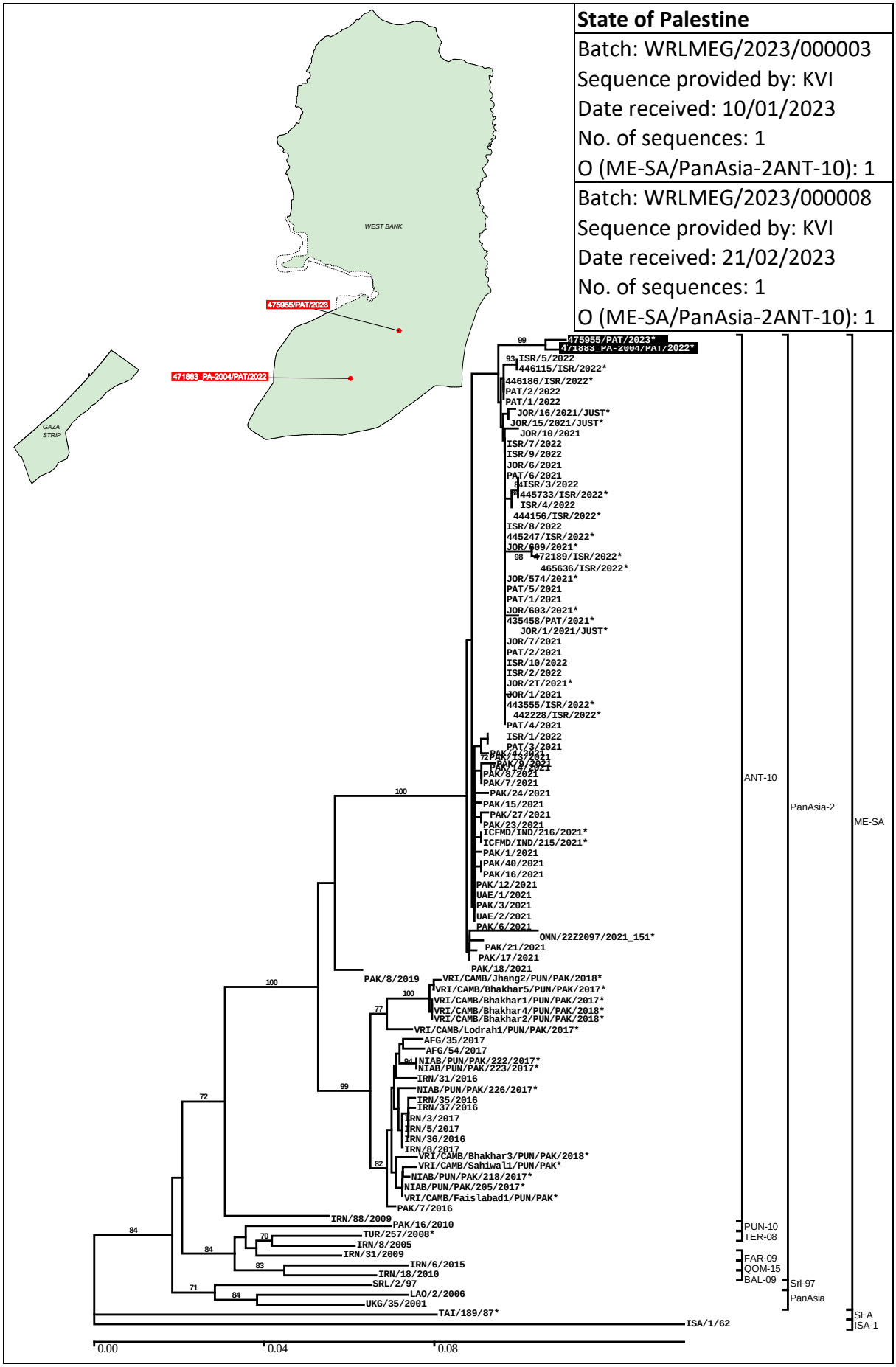
Republic of Iraq	Batch: WRLMEG/2023/000004 Sequence provided by: FMDI, Ankara Date received: 02/02/2023 No. of sequences: 1 SAT2 (XIV): 1
Batch: WRLFMD/2023/000008 Date received: 15/02/2023 No. of samples: 12 SAT2 (XIV): 10 FMDV-GD: 2	Batch: WRLMEG/2023/000006 Sequence provided by: FMDI, Ankara Date received: 14/02/2023 No. of sequences: 4 SAT2 (XIV): 4

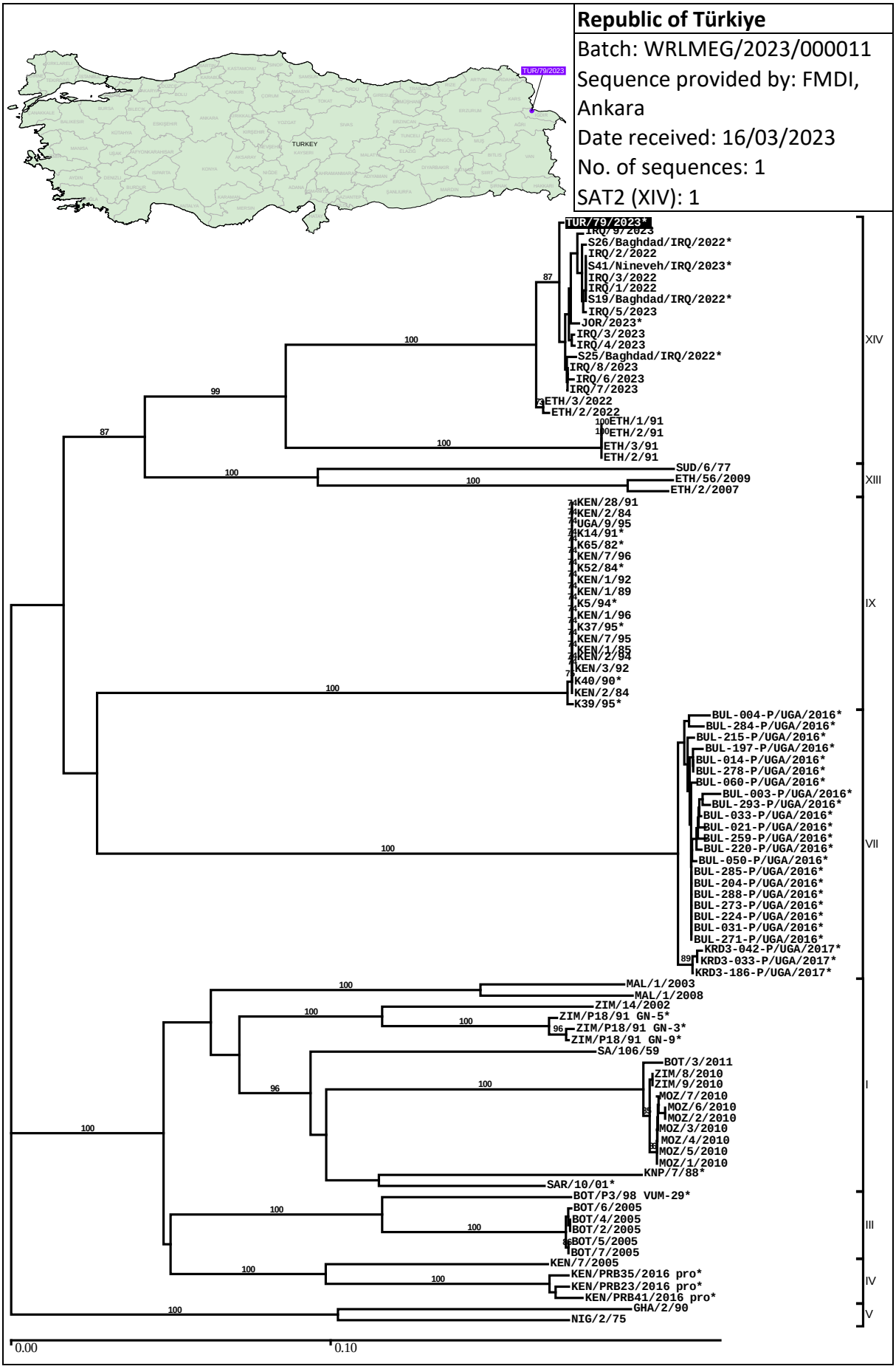



Islamic Republic of Iran
Batch: WRLMEG/2023/000007
Sequence provided by: IVO
Date received: 21/02/2023
No. of sequences: 8
O (ME-SA/PanAsia-2ANT-10): 8
IRN/a471/2023*
IRN/a4993/2023*
IRN/a4992/2023*
IRN/a4995/2023*
IRN/a4701/2023*
IRN/a4703/2023*
IRN/a4994/2023*
IRN/a4731/2023*
OMN/22Z2097/2021_151*
PAK/17/2021
PAK/21/2021
PAK/18/2021
PAK/16/2021
PAK/40/2021
PAK/13/2021
PAK/14/2021
PAK/4/2021
PAK/9/2021
PAK/8/2021
PAK/7/2021
PAK/24/2021
PAK/15/2021
PAK/27/2021
PAK/23/2021
ICFMD/IND/216/2021*
ICFMD/IND/215/2021*
PAK/1/2021
PAK/12/2021
UAE/1/2021
PAK/3/2021
UAE/2/2021
PAK/6/2021
JOR/10/2021
472189/ISR/2022*
465636/ISR/2022*
443555/ISR/2022*
445247/ISR/2022*
JOR/1/2021
ISR/8/2022
445733/ISR/2022*
ISR/3/2022
ISR/4/2022
444156/ISR/2022*
PAT/1/2021
PAT/3/2021
ISR/1/2022
442228/ISR/2022*
JOR/603/2021*
PAT/5/2021
JOR/574/2021*
471883_PA-2004/PAT/2022*
475955/PAT/2023*
PAT/2/2022
446186/ISR/2022*
PAT/1/2022
446115/ISR/2022*
ISR/5/2022
JOR/15/2021/JUST*
ISR/10/2022
PAT/6/2021
JOR/7/2021
ISR/2/2022
JOR/2T/2021*
ISR/7/2022
ISR/9/2022
JOR/1/2021/JUST*
435458/PAT/2021*
JOR/609/2021*
JOR/6/2021
PAT/2/2021
PAT/4/2021
PAK/8/2019
VRI/CAMB/Lodrah1/PUN/PAK/2017*
NIAB/PUN/PAK/222/2017*
VRI/CAMB/Faislabad1/PUN/PAK*
NIAB/PUN/PAK/226/2017*
IRN/36/2016
IRN/8/2017
IRN/88/2009
BHU/3/2009
SRL/1/2019
NEP/1/2015
PAK/16/2010
IRN/31/2009
IRN/8/2005
TUR/257/2008*
TUR/264/2009*
IRN/6/2015
IRN/18/2010
SRL/2/97
LAO/2/2006
UKG/35/2001
TAI/189/87*
ISA/1/62
0.00
0.04
0.08
0.12
ANT-10
PanAsia-2
ME-SA
d
Ind-2001
SA-2018
KAT-15
PUN-10
FAR-09
PanAsia-2
TER-08
SAN-09
QOM-15
BAL-09
Srl-97
PanAsia
SEA
ISA-1


Sequence from KVI, Israel
Batch: WRLMEG/2023/000002
Sequence provided by: KVI
Date received: 10/01/2023
No. of sequences: 1
O (ME-SA/PanAsia-2ANT-10): 1
472189/ISR/2022
ISRAEL
472189/ISR/2022*
465636/ISR/2022*
ISR/4/2022
445733/ISR/2022*
ISR/3/2022
444156/ISR/2022*
ISR/10/2022
ISR/8/2022
445247/ISR/2022*
ISR/7/2022
PAT/5/2021
JOR/1/2021
442228/ISR/2022*
PAT/6/2021
443555/ISR/2022*
JOR/609/2021*
PAT/4/2021
ISR/9/2022
JOR/1/2021/JUST*
JOR/574/2021*
PAT/2/2021
PAT/3/2021
ISR/1/2022
435458/PAT/2021*
PAT/1/2021
JOR/2T/2021*
JOR/7/2021
ISR/2/2022
JOR/6/2021
JOR/10/2021
471883_PA-2004/PAT/2022*
446186/ISR/2022*
PAT/2/2022
PAT/1/2022
ISR/5/2022
446115/ISR/2022*
JOR/16/2021/JUST*
JOR/15/2021/JUST*
PAK/4/2021
PAK/14/2021
PAK/15/2021
PAK/27/2021
PAK/23/2021
ICFMD/IND/215/2021*
ICFMD/IND/216/2021*
PAK/1/2021
PAK/16/2021
PAK/40/2021
UAE/2/2021
PAK/6/2021
PAK/12/2021
UAE/1/2021
PAK/3/2021
OMN/22Z2097/2021_151*
PAK/21/2021
PAK/17/2021
PAK/18/2021
PAK/8/2019
VRI/CAMB/Bhakhar5/PUN/PAK/2017*
VRI/CAMB/Bhakhar4/PUN/PAK/2018*
VRI/CAMB/Lodrah1/PUN/PAK/2017*
VRI/CAMB/Gujrat/PUN/PAK/2017*
AFG/16/2017
AFG/54/2017
AFG/35/2017
NIAB/PUN/PAK/223/2017*
NIAB/PUN/PAK/222/2017*
IRN/31/2016
IRN/11/2017
IRN/37/2016
IRN/3/2017
IRN/36/2016
IRN/5/2017
IRN/35/2016
IRN/8/2017
NIAB/PUN/PAK/226/2017*
AFG/44/2017
VRI/CAMB/Sahiwal1/PUN/PAK*
NIAB/PUN/PAK/218/2017*
VRI/CAMB/Faislabad1/PUN/PAK*
NIAB/PUN/PAK/205/2017*
VRI/CAMB/Bhakhar3/PUN/PAK/2018*
PAK/7/2016
IRN/88/2009
SRL/2/97
UKG/35/2001
PAK/16/2010
IRN/18/2010
IRN/31/2009
IRN/8/2005
TUR/264/2009*
TUR/257/2008*
BHU/3/2009
TAI/189/87*
ISA/1/62
ANT-10
PanAsia-2
ME-SA
Srl-97
PanAsia
PUN-10
BAL-09
FAR-09
PanAsia-2
SAN-09
TER-08
d
Ind-2001
SEA
ISA-1
0.00
0.04
0.08


Hashemite Kingdom of Jordan
Batch: WRLMEG/2023/000005
Sequence provided by: JUST
Date received: 03/02/2023
No. of sequences: 1
SAT2 (XIV): 1
Batch: WRLFMD/2023/000012
Date received: 08/03/2023
No. of samples: 27
SAT2 (XIV): 23
FMDV-GD: 4
No Location Data
JOR/2023
JOR 2/2023
JOR 15/2023
JOR 21/2023
JOR 24/2023
JOR 1/2023
JOR 3/2023
JOR 4/2023
JOR 9/2023
JOR 10/2023
JOR 11/2023
JOR 13/2023
JOR 16/2023
JOR 5/2023
JOR 14/2023
JOR 22/2023
JOR 23/2023
JOR 12/2023
JOR 17/2023
JOR 18/2023
JOR 19/2023
JOR 20/2023
JOR 25/2023
JOR 26/2023
JOR 27/2023
JOR 6/2023
JOR 7/2023
JOR 8/2023
IRBID
AL MAFRAQ
AZ ZARQA'
'AMMAN
MADABA
AL BALQA'
AL KARAK
AL TAFEELA
MA'AN
'AQABA
JORDAN
JOR/13/2023
JOR/10/2023
JOR/22/2023
JOR/8/2023
JOR/16/2023
JOR/23/2023
JOR/14/2023
JOR/19/2023
JOR/9/2023
JOR/6/2023
JOR/26/2023
JOR/11/2023
JOR/2023*
JOR/25/2023
JOR/5/2023
JOR/1/2023
JOR/20/2023
JOR/12/2023
JOR/7/2023
JOR/17/2023
JOR/18/2023
JOR/27/2023
JOR/3/2023
JOR/4/2023
IRQ/9/2023
S26/Baghdad/IRQ/2022*
IRQ/1/2022
IRQ/2/2022
S41/Nineveh/IRQ/2023*
IRQ/3/2022
S19/Baghdad/IRQ/2022*
IRQ/5/2023
IRQ/3/2023
IRQ/4/2023
TUR/79/2023*
S25/Baghdad/IRQ/2022*
IRQ/7/2023
IRQ/8/2023
IRQ/6/2023
ETH/2/2022
ETH/3/2022
ETH/2/91
ETH/3/91
ETH/2/91
ETH/1/91
SUD/6/77
ETH/56/2009
SUD/2/2008
ETH/2/2007
UGA/9/95
KEN/7/95
K65/82*
K14/91*
K37/95*
KEN/2/84
KEN/7/96
K40/90*
KEN/1/92
KEN/2/84
KEN/28/91
K52/84*
K5/94*
K39/95*
BUL-215-P/UGA/2016*
ZIM/7/83*
MAL/1/2003
MAL/1/2008
ZIM/14/2002
SA/106/59
MOZ/4/83*
KNP/7/88*
SAR/10/01*
BOT/P3/98 VUM-29*
KEN/7/2005
KEN/PRB23/2016 pro*
NIG/2/75
GHA/2/90
XIV
XIII
IX
VII
II
I
III
IV
V
0.00
0.10


State of Palestine
Batch: WRLMEG/2023/000003
Sequence provided by: KVI
Date received: 10/01/2023
No. of sequences: 1
O (ME-SA/PanAsia-2ANT-10): 1
Batch: WRLMEG/2023/000008
Sequence provided by: KVI
Date received: 21/02/2023
No. of sequences: 1
O (ME-SA/PanAsia-2ANT-10): 1
WEST BANK
GAZA STRIP
475955/PAT/2023
471883_PA-2004/PAT/2022
475955/PAT/2023*
471883_PA-2004/PAT/2022*
ISR/5/2022
446115/ISR/2022*
446186/ISR/2022*
PAT/2/2022
PAT/1/2022
JOR/16/2021/JUST*
JOR/15/2021/JUST*
JOR/10/2021
ISR/7/2022
ISR/9/2022
JOR/6/2021
PAT/6/2021
ISR/3/2022
445733/ISR/2022*
ISR/4/2022
444156/ISR/2022*
ISR/8/2022
445247/ISR/2022*
JOR/609/2021*
472189/ISR/2022*
465636/ISR/2022*
JOR/574/2021*
PAT/5/2021
PAT/1/2021
JOR/603/2021*
435458/PAT/2021*
JOR/1/2021/JUST*
JOR/7/2021
PAT/2/2021
ISR/10/2022
ISR/2/2022
JOR/2T/2021*
JOR/1/2021
443555/ISR/2022*
442228/ISR/2022*
PAT/4/2021
ISR/1/2022
PAT/3/2021
PAK/8/2021
PAK/7/2021
PAK/24/2021
PAK/15/2021
PAK/27/2021
PAK/23/2021
ICFMD/IND/216/2021*
ICFMD/IND/215/2021*
PAK/1/2021
PAK/40/2021
PAK/16/2021
PAK/12/2021
UAE/1/2021
PAK/3/2021
UAE/2/2021
PAK/6/2021
OMN/22Z2097/2021_151*
PAK/21/2021
PAK/17/2021
PAK/18/2021
PAK/8/2019
VRI/CAMB/Jhang2/PUN/PAK/2018*
VRI/CAMB/Bhakhar5/PUN/PAK/2017*
VRI/CAMB/Bhakhar1/PUN/PAK/2017*
VRI/CAMB/Bhakhar4/PUN/PAK/2018*
VRI/CAMB/Bhakhar2/PUN/PAK/2018*
VRI/CAMB/Lodrah1/PUN/PAK/2017*
AFG/35/2017
AFG/54/2017
NIAB/PUN/PAK/222/2017*
NIAB/PUN/PAK/223/2017*
IRN/31/2016
NIAB/PUN/PAK/226/2017*
IRN/35/2016
IRN/37/2016
IRN/3/2017
IRN/5/2017
IRN/36/2016
IRN/8/2017
VRI/CAMB/Bhakhar3/PUN/PAK/2018*
VRI/CAMB/Sahiwal1/PUN/PAK*
NIAB/PUN/PAK/218/2017*
NIAB/PUN/PAK/205/2017*
VRI/CAMB/Faislabad1/PUN/PAK*
PAK/7/2016
IRN/88/2009
PAK/16/2010
TUR/257/2008*
IRN/8/2005
IRN/31/2009
IRN/6/2015
IRN/18/2010
SRL/2/97
LAO/2/2006
UKG/35/2001
TAI/189/87*
ISA/1/62
ANT-10
PUN-10
TER-08
FAR-09
QOM-15
BAL-09
PanAsia-2
Srl-97
PanAsia
ME-SA
SEA
ISA-1
0.00
0.04
0.08


Republic of Türkiye
Batch: WRLMEG/2023/000011
Sequence provided by: FMDI, Ankara
Date received: 16/03/2023
No. of sequences: 1
SAT2 (XIV): 1
TURKEY
TUR/79/2023*
IRQ/9/2023
S26/Baghdad/IRQ/2022*
IRQ/2/2022
S41/Nineveh/IRQ/2023*
IRQ/3/2022
IRQ/1/2022
S19/Baghdad/IRQ/2022*
IRQ/5/2023
JOR/2023*
IRQ/3/2023
IRQ/4/2023
S25/Baghdad/IRQ/2022*
IRQ/8/2023
IRQ/6/2023
IRQ/7/2023
ETH/3/2022
ETH/2/2022
ETH/1/91
ETH/2/91
ETH/3/91
ETH/2/91
SUD/6/77
ETH/56/2009
ETH/2/2007
KEN/28/91
KEN/2/84
UGA/9/95
K14/91*
K65/82*
KEN/7/96
K52/84*
KEN/1/92
KEN/1/89
K5/94*
KEN/1/96
K37/95*
KEN/7/95
KEN/1/85
KEN/2/84
KEN/3/92
K40/90*
KEN/2/84
K39/95*
BUL-004-P/UGA/2016*
BUL-284-P/UGA/2016*
BUL-215-P/UGA/2016*
BUL-197-P/UGA/2016*
BUL-014-P/UGA/2016*
BUL-278-P/UGA/2016*
BUL-060-P/UGA/2016*
BUL-003-P/UGA/2016*
BUL-293-P/UGA/2016*
BUL-033-P/UGA/2016*
BUL-021-P/UGA/2016*
BUL-259-P/UGA/2016*
BUL-220-P/UGA/2016*
BUL-050-P/UGA/2016*
BUL-285-P/UGA/2016*
BUL-204-P/UGA/2016*
BUL-288-P/UGA/2016*
BUL-273-P/UGA/2016*
BUL-224-P/UGA/2016*
BUL-031-P/UGA/2016*
BUL-271-P/UGA/2016*
KRD3-042-P/UGA/2017*
KRD3-033-P/UGA/2017*
KRD3-186-P/UGA/2017*
MAL/1/2003
MAL/1/2008
ZIM/14/2002
ZIM/P18/91 GN-5*
ZIM/P18/91 GN-3*
ZIM/P18/91 GN-9*
SA/106/59
BOT/3/2011
ZIM/8/2010
ZIM/9/2010
MOZ/7/2010
MOZ/6/2010
MOZ/2/2010
MOZ/3/2010
MOZ/4/2010
MOZ/5/2010
MOZ/1/2010
KNP/7/88*
SAR/10/01*
BOT/P3/98 VUM-29*
BOT/6/2005
BOT/4/2005
BOT/2/2005
BOT/5/2005
BOT/7/2005
KEN/7/2005
KEN/PRB35/2016 pro*
KEN/PRB23/2016 pro*
KEN/PRB41/2016 pro*
GHA/2/90
NIG/2/75
XIV
XIII
IX
VII
I
III
IV
V
0.00
0.10

4.4. Pool 4 (North and East Africa)

No samples/sequences received.

4.5. Pool 6 (Southern Africa)

No samples/sequences received.

4.6. Pool 7 (South America)

No samples/sequences received.

4.7. Vaccine matching

Antigenic characterisation of FMD field isolates by matching with vaccine strains by 2dmVNT from January to March 2023.

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
Egypt	2	3	-	-	-	-	-
Ethiopia	-	-	-	-	-	1	-
Iraq	-	-	-	-	-	3	-
Total	**2**	**3**	**0**	**0**	**0**	**4**	**0**

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_1 Campos *Biogénesis Bagó*		O Manisa *Boehringer Ingelheim*		PanAsia 2 *Boehringer Ingelheim*		O/TUR/5/09 *MSD*	
	Topotype	Lineage	r_1	*titre*	r_1	*titre*	r_1	*titre*	r_1	*titre*	r_1	*titre*	r_1	*titre*
EGY/8/2021	EA-3	-	0.66	*1.99*	0.69	*2.20*	0.76	*2.81*	0.54	*2.32*	0.73	*2.51*	0.89	*2.44*
EGY/10/2021	EA-3	-	0.36	*1.73*	0.39	*1.96*	0.46	*2.60*	0.48	*2.27*	0.39	*2.23*	0.39	*2.08*

Table 6: Vaccine matching studies for A FMDV

Isolate	Serotype A		A22 Iraq *Boehringer Ingelheim*		A Iran 2005 *Boehringer Ingelheim*		A GVII 2015 *Boehringer Ingelheim*		A Saudi 95 *Boehringer Ingelheim*		A/TUR/20/06 *MSD*		A Eritrea 98 *Boehringer Ingelheim*	
	Topotype	Lineage	r_1	*titre*	r_1	*titre*	r_1	*titre*	r_1	*titre*	r_1	*titre*	r_1	*titre*
EGY/1/2022	AFRICA	G-IV	0.13	*1.86*	0.22	*1.98*	0.01	*0.14*	0.03	*0.92*	0.03	*1.03*	0.16	*1.86*
EGY/7/2021	AFRICA	G-IV	0.08	*1.62*	0.07	*1.47*	0.04	*0.62*	0.11	*1.51*	0.05	*1.26*	0.21	*1.98*
EGY/2/2022	EURO-SA		0.07	*1.57*	0.06	*1.42*	0.13	*1.13*	0.10	*1.48*	0.07	*1.42*	0.10	*1.65*

Table 7: Vaccine matching studies for SAT 2 FMDV

Isolate	Serotype SAT 2		Eritrea 98 *Boehringer Ingelheim*		SAT2 Zim 83 *Boehringer Ingelheim*	
	Topotype	Lineage	r_1	*titre*	r_1	*titre*
ETH/3/2022	XIV	-	0.49	*1.66*	0.15	*1.70*
IRQ/9/2023	XIV	-	0.42	*1.51*	0.31	*1.95*
IRQ/2/2022	XIV	-	0.73	*1.75*	0.38	*2.04*
IRQ/5/2023	XIV	-	0.53	*1.61*	0.74	*2.33*

Annex 1: Sample data

Summary of submissions

Table 7: Summary of samples collected and received to WRLFMD January to March 2023

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*
Egypt	34	3	13	-	-	-	-	-	18	32	2
Iraq	12	-	-	-	-	10	-	-	2	12	-
Jordan	27	-	-	-	-	23	-	-	4	27	-
TOTAL	**73**	**3**	**13**	**0**	**0**	**33**	**0**	**0**	**24**	**71**	**2**

Clinical samples

Table 8: Clinical sample diagnostics made by the WRLFMD January to March 2023

Country	Date		WRL for FMD Sample Identification	Animal	Date of Collection	Results		
	Received	Reported				VI/ELISA	RT-PCR	Final report
Egypt	08/12/2022	10/02/2023	EGY 1/2020	CATTLE	28-Jul-20	NVD	FMDV GD	FMDV GD
			EGY 2/2020	CATTLE	28-Jul-20	A	FMDV GD	A
			EGY 3/2020	CATTLE	28-Jul-20	NVD	FMDV GD	FMDV GD
			EGY 4/2020	BUFFALO	08-Sep-20	NVD	FMDV GD	FMDV GD
			EGY 5/2020	BUFFALO	08-Sep-20	NVD	FMDV GD	FMDV GD
			EGY 6/2020	BUFFALO	08-Sep-20	NVD	FMDV GD	FMDV GD
			EGY 7/2020	BUFFALO	08-Sep-20	NVD	FMDV GD	FMDV GD
			EGY 8/2020	CATTLE	05-Oct-20	NVD	FMDV GD	FMDV GD
			EGY 9/2020	CATTLE	05-Oct-20	A	FMDV GD	A
			EGY 10/2020	CATTLE	11-Oct-20	NVD	FMDV GD	FMDV GD
			EGY 11/2020	BUFFALO	11-Oct-20	NVD	FMDV GD	FMDV GD
			EGY 12/2020	CATTLE	02-Nov-20	NVD	FMDV GD	FMDV GD
			EGY 13/2020	CATTLE	08-Nov-20	A	FMDV GD	A
			EGY 14/2020	CATTLE	08-Nov-20	A	FMDV GD	A
			EGY 15/2020	CATTLE	18-Nov-20	NVD	NGD	NVD
			EGY 16/2020	CATTLE	18-Nov-20	NVD	NGD	NVD
			EGY 17/2020	CATTLE	19-Nov-20	A	FMDV GD	A
			EGY 18/2020	CATTLE	19-Nov-20	A	FMDV GD	A

Country	Date		WRL for FMD Sample Identification	Animal	Date of Collection	Results		
	Received	Reported				VI/ELISA	RT-PCR	Final report
			EGY 19/2020	CATTLE	19-Nov-20	A	FMDV GD	A
			EGY 20/2020	CATTLE	19-Nov-20	A	FMDV GD	A
			EGY 21/2020	CATTLE	30-Dec-20	A	FMDV GD	A
			EGY 1/2021	BUFFALO	18-Jan-21	A	FMDV GD	A
			EGY 2/2021	BUFFALO	21-Feb-21	NVD	FMDV GD	FMDV GD
			EGY 3/2021	BUFFALO	21-Feb-21	NVD	FMDV GD	FMDV GD
			EGY 4/2021	CATTLE	21-Feb-21	NVD	FMDV GD	FMDV GD
			EGY 5/2021	CATTLE	25-Apr-21	A	FMDV GD	A
			EGY 6/2021	CATTLE	25-Apr-21	NVD	FMDV GD	FMDV GD
			EGY 7/2021	CATTLE	26-Apr-21	A	FMDV GD	A
			EGY 8/2021	CATTLE	19-Oct-21	O	FMDV GD	O
			EGY 9/2021	BUFFALO	24-Oct-21	O	FMDV GD	O
			EGY 10/2021	BUFFALO	24-Oct-21	O	FMDV GD	O
			EGY 1/2022	CATTLE	21-Apr-22	A	FMDV GD	A
			EGY 2/2022	CATTLE	09-Jun-22	FMD	FMDV GD	FMDV GD
			EGY 3/2022	CATTLE	14-Jun-22	NVD	FMDV GD	FMDV GD
Iraq	15/02/2023	01/03/2023	IRQ 1/2022	BUFFALO	06-Dec-22	SAT2	FMDV GD	SAT 2
			IRQ 2/2022	BUFFALO	18-Dec-22	SAT2	FMDV GD	SAT 2
			IRQ 3/2022	BUFFALO	28-Dec-22	SAT2	FMDV GD	SAT 2
			IRQ 1/2023	DAIRY CATTLE	15-Jan-23	NVD	FMDV GD	FMDV GD
			IRQ 2/2023	CATTLE	17-Jan-23	NVD	FMDV GD	FMDV GD
			IRQ 3/2023	CATTLE	18-Jan-23	SAT2	FMDV GD	SAT 2
			IRQ 4/2023	CATTLE	18-Jan-23	SAT2	FMDV GD	SAT 2
			IRQ 5/2023	CATTLE	26-Jan-23	SAT2	FMDV GD	SAT 2
			IRQ 6/2023	CATTLE	29-Jan-23	SAT2	FMDV GD	SAT 2
			IRQ 7/2023	CATTLE	30-Jan-23	SAT2	FMDV GD	SAT 2
			IRQ 8/2023	CATTLE	30-Jan-23	SAT2	FMDV GD	SAT 2
			IRQ 9/2023	BUFFALO	02-Feb-23	SAT2	FMDV GD	SAT 2
Jordan	08/03/2023	20/03/2023	JOR 1/2023	CATTLE	08-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 2/2023	CATTLE	08-Jan-23	NVD	FMDV GD	FMDV GD
			JOR 3/2023	CATTLE	08-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 4/2023	CATTLE	09-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 5/2023	CATTLE	09-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 6/2023	CATTLE	15-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 7/2023	CATTLE	15-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 8/2023	CATTLE	15-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 9/2023	CATTLE	18-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 10/2023	CATTLE	18-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 11/2023	CATTLE	18-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 12/2023	CATTLE	18-Jan-23	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
			JOR 13/2023	CATTLE	20-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 14/2023	CATTLE	23-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 15/2023	CATTLE	23-Jan-23	NVD	FMDV GD	FMDV GD
			JOR 16/2023	CATTLE	23-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 17/2023	CATTLE	23-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 18/2023	CATTLE	23-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 19/2023	CATTLE	23-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 20/2023	CATTLE	23-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 21/2023	CATTLE	25-Jan-23	NVD	FMDV GD	FMDV GD
			JOR 22/2023	CATTLE	25-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 23/2023	CATTLE	25-Jan-23	SAT2	FMDV GD	SAT 2
			JOR 24/2023	CATTLE	05-Feb-23	NVD	FMDV GD	FMDV GD
			JOR 25/2023	CATTLE	06-Feb-23	SAT2	FMDV GD	SAT 2
			JOR 26/2023	CATTLE	07-Feb-23	SAT2	FMDV GD	SAT 2
			JOR 27/2023	CATTLE	07-Feb-23	SAT2	FMDV GD	SAT 2
TOTAL					**73**			

Annex 2: FMD publications

Recent FMD Publications January to March 2023 cited by Web of Science.

1. Araghi, A., M. Taghizadeh, S.R.H. Doust, A. Paradise, and S.M.A. Dezfouli (2022). Field evaluation of novel combination vaccines against *Foot-and-mouth disease virus* and *Clostridium perfringens* toxoid using different immunization protocols. *Jundishapur Journal of Microbiology*, **15**(12): 7. DOI: 10.5812/jjm-132415.

2. Avalos, A., B. Durand, J. Naranjo, V. Maldonado, L. Canini, and G. Zanella (2022). Analysis of cattle movement networks in Paraguay: Implications for the spread and control of infectious diseases. *PLOS One*, **17**(12): 22. DOI: 10.1371/journal.pone.0278999.

3. Bazid, A.H., H.M. Amer, M. Nayel, M. Attia, N. Maklad, M. Wasfy, M. Abdelmegeid, M.M. El-Sayed, A. Magouz, and Y. Badr (2023). Assessment of the potency and effectiveness of a heptavalent oil-adjuvanted (ISA 206) foot-and-mouth disease vaccine in Egypt. *Archives of Virology*, **168**(2): 8. DOI: 10.1007/s00705-022-05624-2.

4. Beck-Johnson, L.M., E.E. Gorsich, C. Hallman, M.J. Tildesley, R.S. Miller, and C.T. Webb (2023). An exploration of within-herd dynamics of a transboundary livestock disease: A foot-and-mouth disease case. *Epidemics*, **42**: 10. DOI: 10.1016/j.epidem.2023.100668.

5. Caetano, A.L. and A.P.P. dos Santos (2022). Quantitative losses from vaccine reactions on bovine carcasses in Brazil. *Brazilian Journal of Hygiene and Animal Sanity*, **16**(4): 1-13.

6. de Cecco, B.S., I.R. dos Santos, F.A. Molossi, C.W. Canal, C.S.L. de Barros, D. Driemeier, L. Sonne, and S.P. Pavarini (2023). Viral diseases of sheep in Brazil: a review and current status. *Ciencia Rural*, **53**(8): 25. DOI: 10.1590/0103-8478cr202202181.

7. ElAshmawy, W.R., S.S. Aly, and M.M. Farouk (2023). Decision tree risk analysis for FMD outbreak prevention in Egyptian feedlots. *Preventive Veterinary Medicine*, **211**: 8. DOI: 10.1016/j.prevetmed.2022.105820.

8. Ellis, J., E. Brown, C. Colenutt, and S. Gubbins (2023). Assessing the effectiveness of environmental sampling for surveillance of *Foot-and-mouth disease virus* in a cattle herd. *Frontiers in Veterinary Science*, **10**: 9. DOI: 10.3389/fvets.2023.1074264.

9. Eweis, A.R.F., K.M. Hassan, S.A.H. Shoman, H.A. Taha, and E.E.S. Mohamed (2022). Investigation of honey bee venom effect on the immunogenicity of foot-and-mouth disease vaccine in sheep. *Open Veterinary Journal*, **12**(6): 919-928. DOI: 10.5455/OVJ.2022.v12.i6.18.

10. Fan, Q., Z.X. Xie, Y. Wei, Y.F. Zhang, Z.Q. Xie, L.J. Xie, J.L. Huang, T.T. Zeng, S. Wang, S.S. Luo, and M. Li (2022). Development of a visual multiplex fluorescent LAMP assay for the detection of foot-and-mouth disease, vesicular stomatitis and bluetongue viruses. *PLOS One*, **17**(12): 16. DOI: 10.1371/journal.pone.0278451.

11. Gordon, L., N. Mabbott, J. Wells, L. Kulik, N. Juleff, B. Charleston, and E. Perez-Martin (2022). *Foot-and-mouth disease virus* localisation on follicular dendritic cells and

sustained induction of neutralising antibodies is dependent on binding to complement receptors (CR2/CR1). *PLOS Pathogens*, **18**(5): 27. DOI: 10.1371/journal.ppat.1009942.

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20. Kim, D., W.S. Kwon, J. Ha, J. Kim, D. Kim, W. Lee, J. Moon, and J. Yi. Effect of oestrus synchronisation through ovulation delay by vaccination against foot-and-mouth disease in Hanwoo (*Bos taurus coreanae*) cows. *Veterinary Medicine and Science*: 8. DOI: 10.1002/vms3.1074.

21. Kim, J., S.H. Lee, H. Kim, J.H. Park, and C.K. Park (2023). Heterologous prime-boost vaccination with commercial FMD vaccines elicits a broader immune response than homologous prime-boost vaccination in pigs. *Vaccines*, **11**(3): 13. DOI: 10.3390/vaccines11030551.

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33. Pozzi, P., M. Arraf, E. Karboush, M. Etinger, and Y. Hadani (2022). FMD vaccination of pig breeders designed to give newborn piglets adequate immunity after birth. *Israel Journal of Veterinary Medicine*, **77**(4): 177-183.

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35. Ranjitha, H.B., V.V. Dhanesh, M. Hosamani, B.P. Sreenivasa, U. Jabeen, J.K. Biswal, P. Saravanan, A. Sanyal, V. Bhanuprakash, and S.H. Basagoudanavar. Thermostable negative-marker *Foot-and-mouth disease virus* serotype O induces protective immunity in guinea pigs. *Applied Microbiology and Biotechnology*: 13. DOI: 10.1007/s00253-023-12359-w.

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42. Zainuddin, N., E.B. Susila, H. Wibawa, R.S.D. Daulay, P.E. Wijayanti, D. Fitriani, D.N. Hidayati, S. Idris, J. Wadsworth, N. Polo, H.M. Hicks, V. Mioulet, N.J. Knowles, and D.P. King. Genome Sequence of a *Foot-and-mouth disease virus* Detected in Indonesia in 2022. *Microbiology Resource Announcements*: 3. DOI: 10.1128/mra.01081-22.

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mouth disease virus both in PK15 cells and mice. *Viruses-Basel*, **15**(2): 10. DOI: 10.3390/v15020390.

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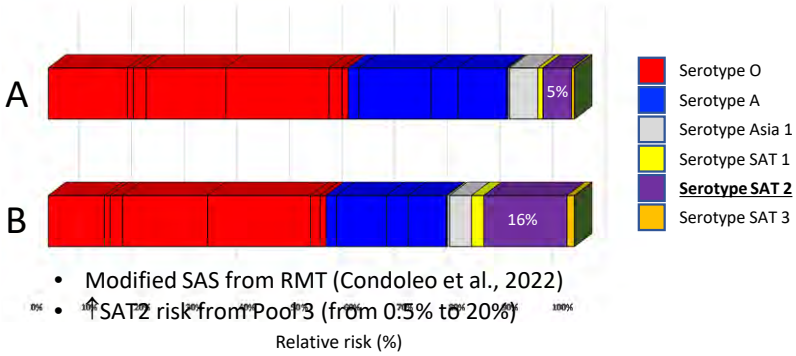
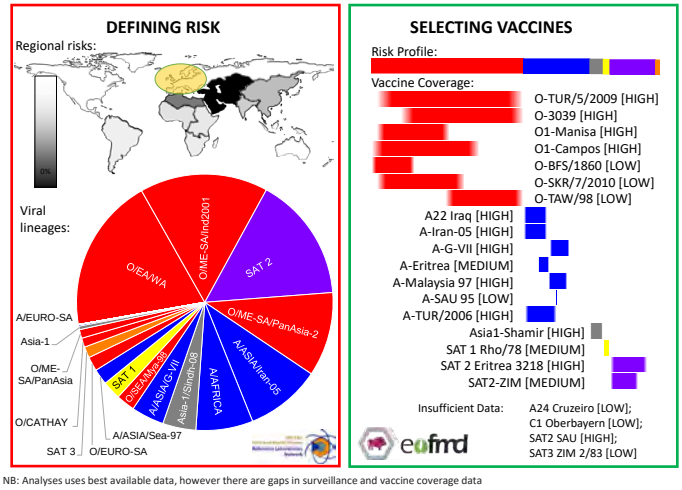
Annex 3: Vaccine recommendations

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 WOAH/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.

FMD risk profiles for Europe: April 2023:

NB: The two outputs below define FMD risks for Europe which reflect the on-going situation in Pool 3 where FMD cases due to SAT2/XIV have been reported in three countries (Iraq, Jordan and Türkiye). These outputs use Score Area Scores from PRAGMATIST that have been parameterised with data from the FMD EURL meeting in 2017 (A) or the approach describe by Condoleo *et al.*, 2022). The PRAGMATIST figure (below) uses the worst case SAT2 scenario.





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.

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

Condoleo *et al.*, 2022: Risk monitoring tool for FAST diseases (RMT-FAST): a semi-quantitative framework to estimate the risk of disease introduction. EuFMS Open Session, Marseille. (https://www.eufmd.info/os22)

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. There are currently 8 courses in English and 1 in Arabic:
  - **Introduction to Foot-and-Mouth Disease** (available in English and French), introducing foot-and-mouth disease (FMD), its importance, diagnosis, outbreak investigation and the control measures 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 facing 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.
  - **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 (WOAH), applying public-private partnerships to the control of FMD and similar transboundary animal diseases.
- **Simulation Exercises for Animal Disease Emergencies** (available through FAO eLearning academy) aiming at building your understanding of simulation exercises and their value as part of the emergency preparedness cycle.
- A course on **Introduction to the FMD Minimum Biorisk Management Standards** is currently in development. The virtual course will be open access, will target National Competent Authorities, Institute directors for FMD facilities, biorisk managers and laboratory personnel in laboratories handling infectious FMD. The learning objectives will include introduce the importance, implications and responsibilities of implementing the FMD Minimum Biorisk Management Standards.
- The next **WRLFMD residential training course on FMD diagnostic methods** is scheduled for 15-26 May 2023.
- **Laboratory training on FMD diagnosis** with Istituto Zooprofilattico Sperimentale della Lombardia e dell'Emilia Romagna (IZSLER) - 1st Training session is scheduled for 15th to 26 th May 2023.
- **FMD Emergency Preparation Course - Spain** (26 April 2023; Spain). The course helps raise awareness of FMD and on the importance of early detection amongst a wider group of practitioners. It is particularly suitable for field level government and private veterinarians.

Other resources

Podcasts

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

- The EuFMD has opened the Emergency Toolbox.
- A series of videos on foot-and-mouth disease in English, Bulgarian, Greek and Turkish (https://www.fao.org/eufmd/en/).
- Leaflets on FMD in English, Turkish, Bulgarian and Greek, for the Thrace region (https://www.fao.org/publications/card/en/c/CB4903EN).
- Join our Telegram channel to receive EuFMD updates (https://t.me/eufmd).
- Find out who TOM is and why you need him (https://www.eufmd.info/tom-training).

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

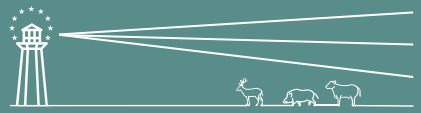
The Emergency Preparedness Network is a forum for emergency preparedness experts to share information and experience. You will regularly receive the latest information on topics related to prevention and control of foot-and-mouth and other similar transboundary animal diseases ("FAST" diseases).

Meetings

- **45th General Session** of the European Commission for the control Foot-and-Mouth Disease (EuFMD) will be held in Rome, Italy, on 4-5 May 2023.
- **Executive Committee** (18 October 2023; Online)

Proficiency test scheme organised by WRLFMD

All sample panels for Phase XXXIV have been dispatched and all participating laboratories need to send their results as soon as possible to WRLFMD otherwise their data will not be included in the final report and analyses. A new PTS (with funding from EuFMD and Defra) is being organised and invitations letters should be expected during before the end of July 2023. Any interested laboratories should contract the WRLFMD for further information. Progress of this PTS will be described in future quarterly reports.



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Hold-FAST tools

GET PREPARED, E-learning, FMD-PCP, EuFMDiS, Pragmatist, Impact Risk Calculator, Virtual Learning Center, SMS Disease reporting, Global Vaccine Security, Outbreak Investigation app, PCP-Support Officers, PCP Self-Evaluation tool, AESOP, Telegram, Whatssap, Quarterly Global Reports, Real Time Traning.

EuFMD Committees

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

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Department for Environment Food & Rural Affairs

The Pirbright Institute