



WRLFMD Quarterly Report April to June 2016

Reference Laboratory Contract Report

Foot-and-Mouth Disease





CONTENTS

1.	Summary of samples tested and reported FMD outbreaks	3
1.1.	ASIA.....	3
1.2.	AFRICA.....	4
1.4.	Uncharacterised FMD viruses	4
2.	Detailed Analysis.....	6
3.	Vaccine matching.....	10
3.1.	Serotype Asia 1.....	10
3.2.	Serotype A	10
3.3.	Serotype O.....	10
3.4.	Serotype SAT 1, SAT 2 and SAT 3.....	10
4.	Annex 1	11
4.1.	Summary of Submissions	11
4.2.	Clinical Samples.....	12
4.3.	Antigenic Characterisation	17
5.	Annex 2 New Scientific Papers	19
6.	Annex 3 Vaccine Antigen Recommendations	28

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1. Summary of samples tested and reported FMD outbreaks

1.1. ASIA

People's Republic of China

An outbreak of **FMD type O** was reported to the OIE in cattle on a farm in Qiannen State, Guizhou. No genotyping has been reported.

Laos

Three virus isolates were received from water buffalo. Real time RT-PCR was able to detect FMDV genome, but no virus could be isolated. Conventional RT-PCR of the VP1 region was positive in one case and the resultant amplicon was genotyped as **FMDV O/SEA/Mya-98**.

Saudi Arabia

FMD type A was isolated from cattle at Al Kharj (collected 27/03/2016) and genotyped as ASIA/G-VII (aka G-18). Two probang samples were received from a second farm at Durma (collected 27/04/2016), however, no FMD virus could be isolated on cell cultures. One of the probang samples was positive in the real-time RT-PCR and the VP1 sequence was determined following conventional RT-PCR; it was genotyped as **FMDV O/ME-SA/Ind-2001d**.

Thailand

FMD viruses were isolated from 17 of 18 samples from cattle (and in one case pigs) collected between 13/11/2015 and 07/03/2016 in various parts of the country. Five viruses belonged to **FMD type O** and were genotyped as SEA/Mya-98 while 12 were **FMD type A** and were identified as ASIA/Sea-97.

United Arab Emirates

FMD type O (ME-SA/Ind-2001d) was identified in five samples collected on the 16/02/2016 from cattle in Sharjah.

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1.2. AFRICA

Angola

FMD (untyped) was reported to the OIE in cattle on 29/04/2016 in Bondo Caíla Sede, Bondo Caíla, Cuangar, Cunado Cubango.

South Africa

A further outbreak due to **FMD SAT 3** was reported to the OIE on 09/05/2016 in cattle in Thulamela, Limpopo within the vaccination zone?

1.3. SOUTH AMERICA

No new outbreaks of FMD were reported in the region.

1.4. Uncharacterised FMD viruses

A number of outbreaks have occurred where samples have not been sent to the WRLFMD. It is probable that the countries involved have performed their own genetic characterisation; however, through the OIE/FAO laboratory network we would also like to encourage the submission of samples (or complete VP1 sequences) to the WRLFMD.

An up-to-date list and reports of FMD viruses characterised by sequencing can be found at the following website: http://www.wrlfmd.org/fmd_genotyping/2016.htm.

Results from samples received at WRLFMD (status of samples being tested) are shown in Table 1 and a complete list of clinical sample diagnostics made by the WRLFMD between April and June 2016 is shown in Annex 1 (Summary of Submissions). A record of all samples received by WRLFMD (April to June 2016) is shown in Annex 1 (Clinical Samples).



Table 1: Status of sequencing of samples received by the WRLFMD from April to June 2016 (* indicates samples carried over from the last quarter)

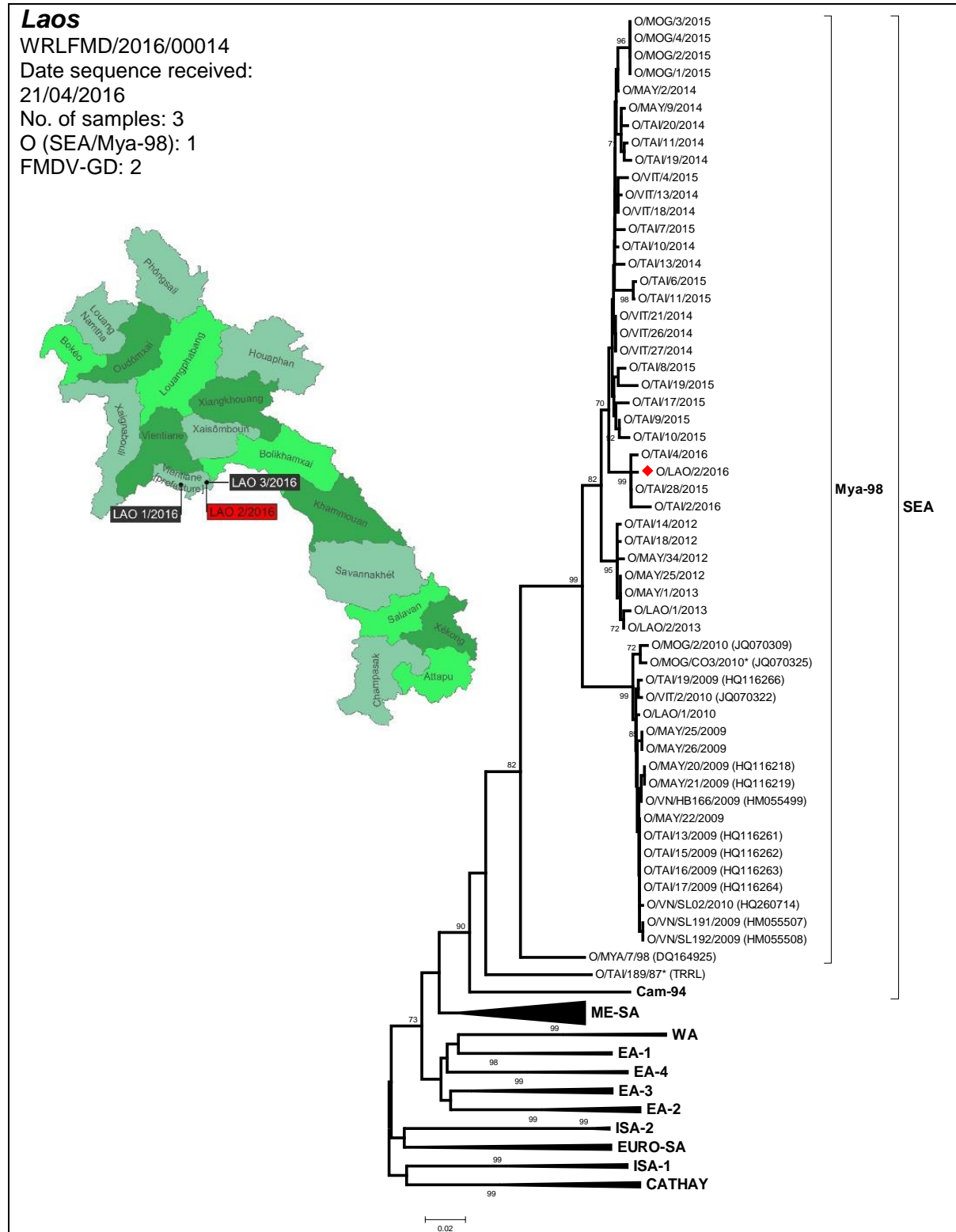
WRLFMD Batch No.	Date received	Country	Serotype	No. of samples	No. of sequences	Sequencing status
WRLFMD/2016/00012	20/04/2016	United Arab Emirates	O	5	5	Completed
WRLFMD/2016/00013	21/04/2016	Thailand	O	5	5	Completed
WRLFMD/2016/00013	21/04/2016	Thailand	A	12	12	Completed
WRLFMD/2016/00014	21/04/2016	Laos	O	1	1	Completed
WRLFMD/2016/00015	17/05/2016	Saudi Arabia	O	1	1	Completed
WRLFMD/2016/00015	17/05/2016	Saudi Arabia	A	1	1	Completed
WRLFMD/2016/00017	14/06/2016	Egypt	O	1		Pending
WRLFMD/2016/00017	14/06/2016	Egypt	SAT 2	1		Pending
WRLFMD/2016/00018	15/06/2016	Iran	O	16		Pending
WRLFMD/2016/00018	15/06/2016	Iran	A	7		Pending
WRLFMD/2016/00018	15/06/2016	Iran	Asia 1	1		Pending
WRLFMD/2016/00019	10/06/2016	Botswana	Pending	7		Pending
WRLFMD/2016/00020	10/06/2016	Malawi	Pending	1		Pending
WRLFMD/2016/00021	10/06/2016	Mozambique	Pending	2		Pending
WRLFMD/2016/00022	10/06/2016	Zambia	Pending	3		Pending
WRLFMD/2016/00023	10/06/2016	Zimbabwe	Pending	4		Pending
Total				68	25	

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2. Detailed Analysis

2.1. ASIA



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Saudi Arabia

WRLFMD/2016/00015

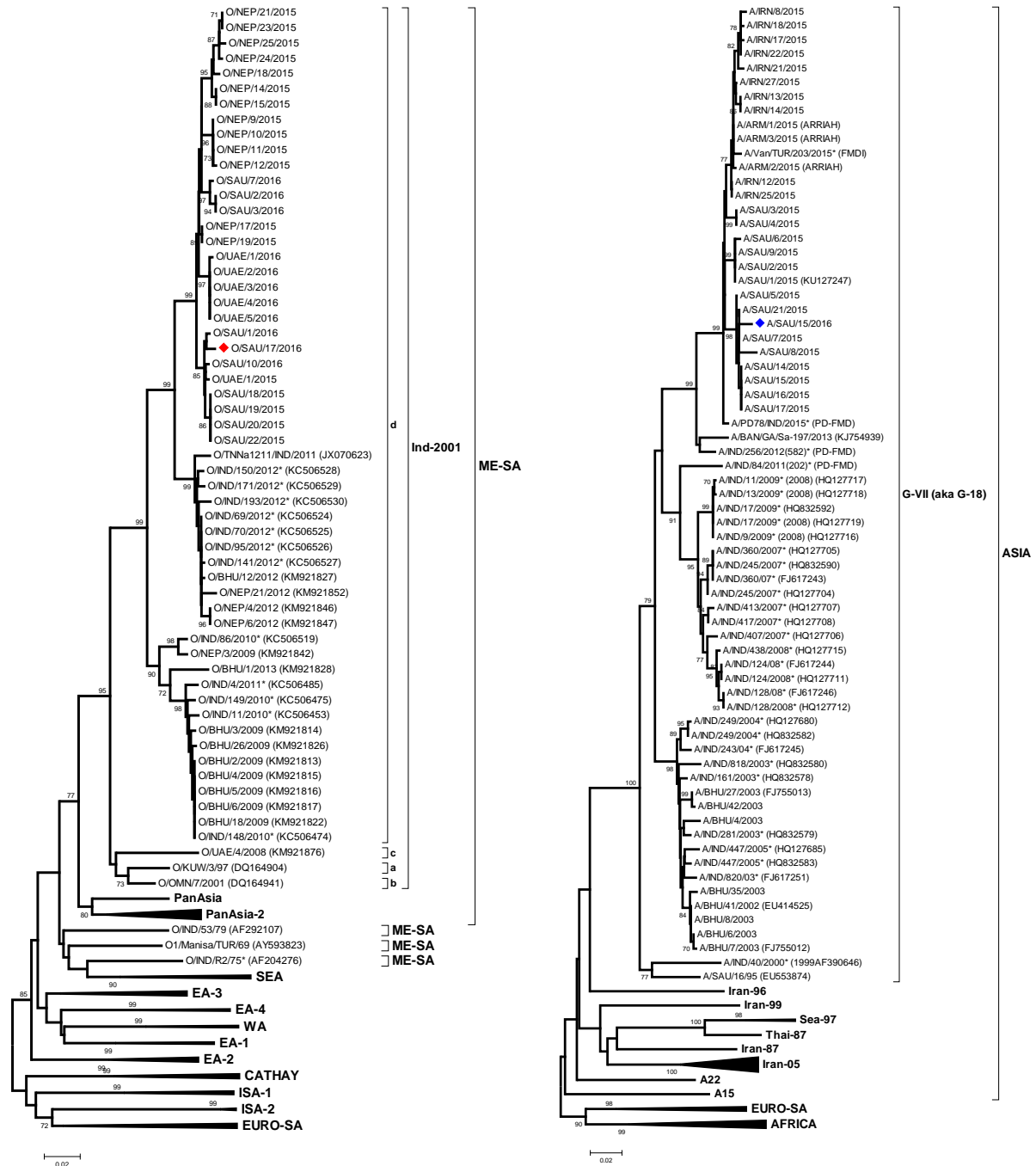
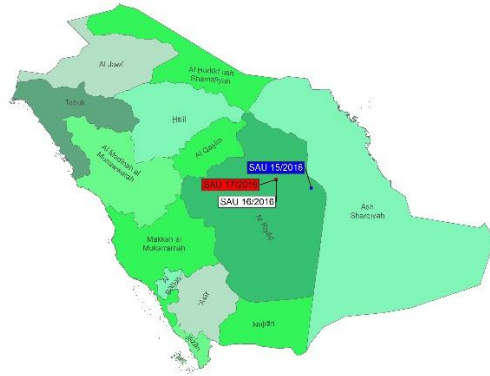
Date sequence received: 17/05/2016

No. of samples: 3

O (ME-SA/Ind-2001d): 1

A (ASIA/G-VII (G-18)): 1

NVD: 1



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Thailand

WRLFMD/2016/00013

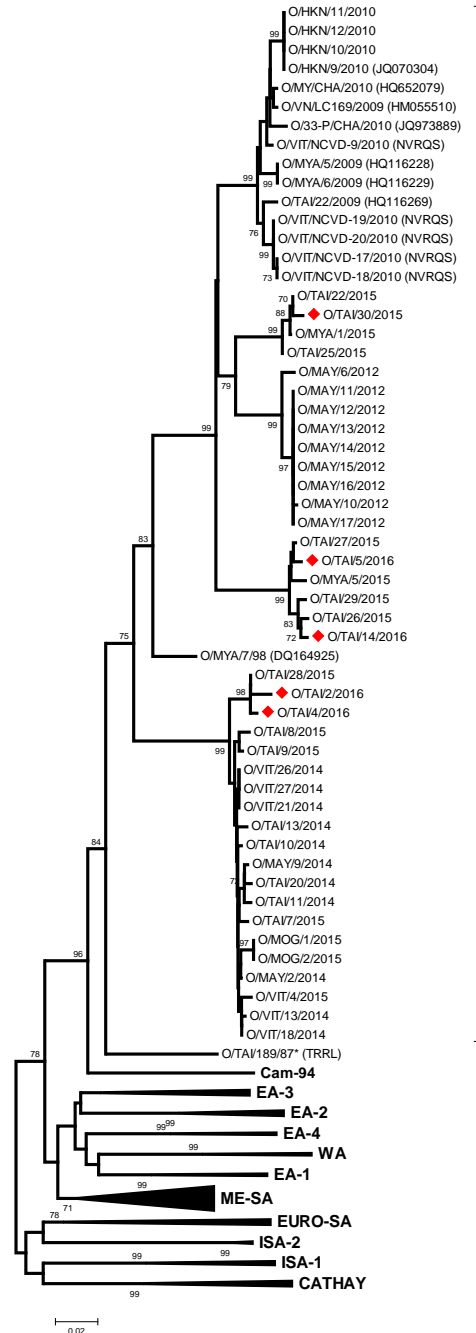
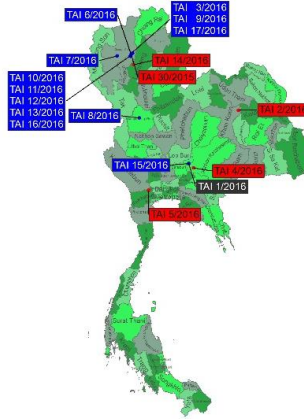
Date sequence received: 21/04/2016

No. of samples: 18

O (SEA/Mya-98): 5

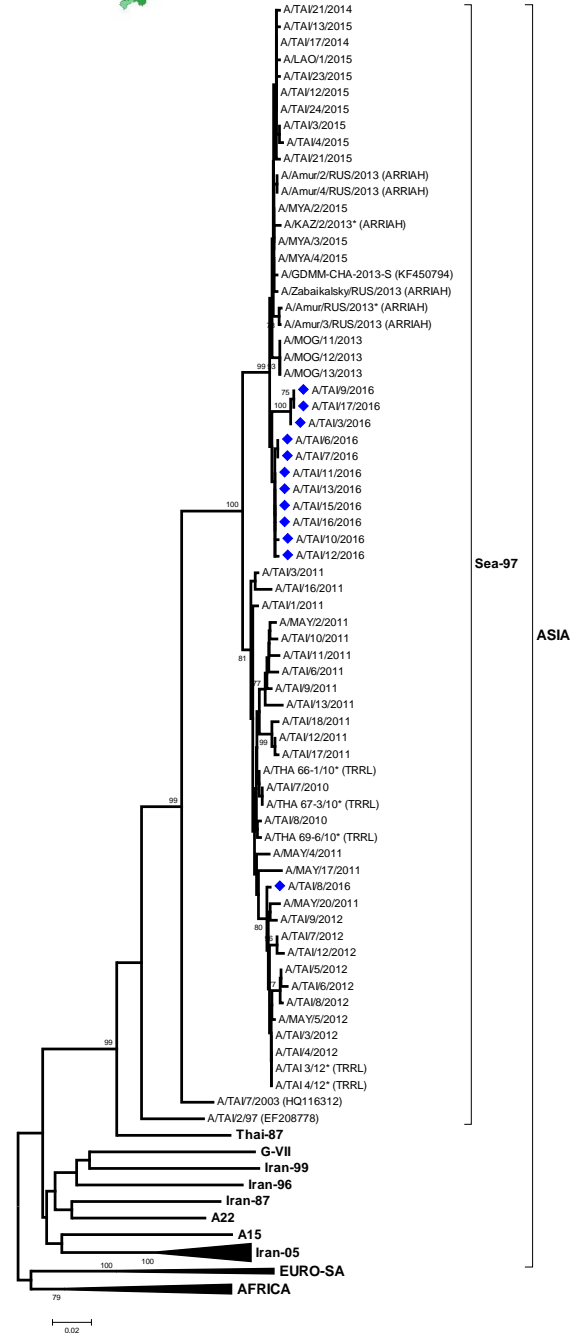
A (ASIA/Sea-97): 12

FMDV-GD: 1



Mya-98

SEA



Sea-97

ASIA

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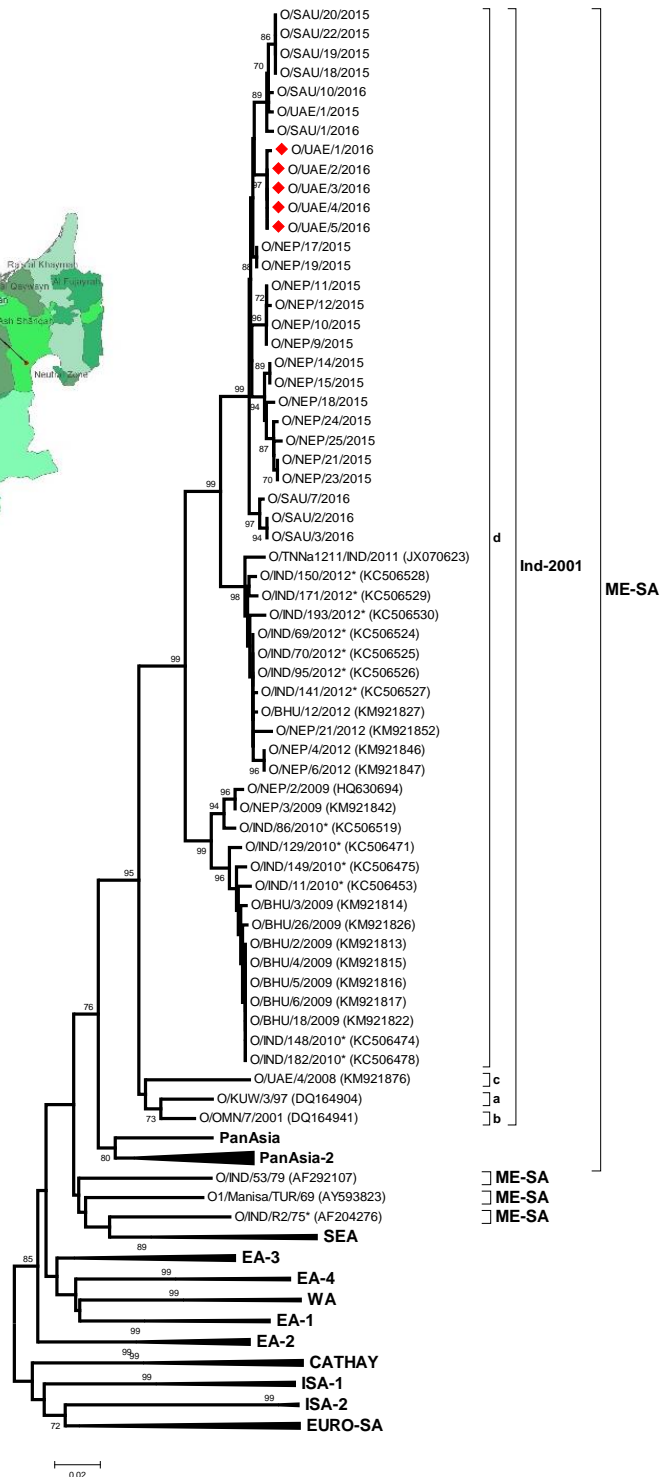
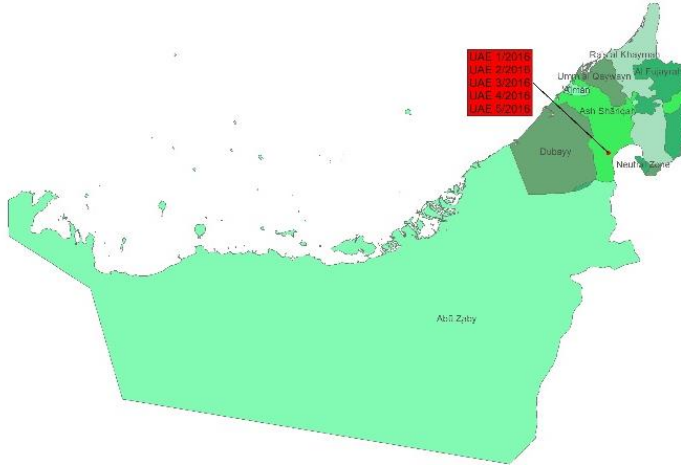
United Arab Emirates

WRLFMD/2016/000012

Date sequence received: 20/04/2016

No. of samples: 5

O (ME-SA/Ind-2001d): 5



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3. Vaccine matching

For individual data see Annex 1, section 4.3 (Antigenic Characterisation).

3.1. Serotype Asia 1

Two viruses from Pakistan were tested against the Asia 1 Shamir vaccine virus. Both of these recent field FMD isolates (from the Sindh-08 lineage) had r_1 -values below the 0.3 cut-off that is indicative of an adequate antigenic match.

3.2. Serotype A

Two viruses from Pakistan and one virus from Ethiopia were tested against A22 IRQ, A IRN 05 and A/TUR/20/2006 vaccine strains. All three field isolates were not antigenically matched to A22 IRQ. A/PAK/53/2015 matched against A IRN 05 and A/PAK/31/2015 matched against A/TUR/20/2006. All other vaccine matching was negative.

3.3. Serotype O

During this quarter, isolates from Ethiopia, Pakistan, Saudi Arabia and Thailand were tested for vaccine-matching. These represent viruses from the EA-4, ME-SA and SEA topotypes (see table 6). All viruses were antigenically matched for O 3039 and O/TUR/5/2009 vaccine strains. All members of the ME-SA topotype were also matched to O Manisa, while the O/SEA/Mya-98 isolates generated only borderline r_1 -values, and the Ethiopian isolate was not matched using the VNT.

3.4. Serotype SAT 1, SAT 2 and SAT 3

One serotype SAT 2 virus from Ethiopia was tested and was matched to SAT 2 Eritrea vaccine. There were no SAT 1 and SAT 3 viruses to test during this reporting period.

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4. Annex 1

4.1. Summary of Submissions

Table 2: Summary of samples collected and received to WRLFMD (April to June 2016)

Country	N ^o of samples	Virus isolation in cell culture/ELISA								RT-PCR for FMD (or SVD)		
		FMD virus serotypes								No Virus Detected	virus (where appropriate)	
		O	A	C	SAT 1	SAT 2	SAT 3	ASIA-1	Positive		Negative	
Botswana	6	-	-	-	-	-	-	-	-	-	-	-
Egypt	35	1	-	-	-	1	-	-	1	2	1	
Hong Kong, SAR of PRC	1	-	-	-	-	-	-	-	1	-	1	
Iran	29	16	7	-	-	-	-	1	5	27	2	
Laos	3	-	-	-	-	-	-	-	3	3	-	
Malawi	1	-	-	-	-	-	-	-	-	-	-	
Mozambique	2	-	-	-	-	-	-	-	-	-	-	
Namibia	4	-	-	-	-	-	-	-	-	-	-	
Thailand	18	5	12	-	-	-	-	-	1	18	-	
Saudi Arabia	3	-	1	-	-	-	-	-	2	2	1	
United Arab Emirates	5	5	-	-	-	-	-	-	-	5	-	
Zambia	3	-	1	-	-	1	1	-	-	3	-	
Zimbabwe	4	-	-	-	-	-	-	-	-	-	-	
TOTAL	114	27	21	-	-	2	1	1	13	60	5	

Abbreviations used in table

VI / ELISA	FMD (or SVD) virus serotype identified following virus isolation in cell culture and antigen detection ELISA
FMD	Foot-and-mouth disease
SVD	Swine vesicular disease

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NVD	No FMD, SVD or vesicular stomatitis virus detected
NT	Not tested
rRT-PCR	Real-time reverse transcription polymerase chain reaction for FMD (or SVD) viral genome

4.2. Clinical Samples

Table 3: Clinical sample diagnostics made by the WRLFMD® April to June 2016

Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results		
				VI/ELISA	RT-PCR	Final report
Botswana	BOT 3/2015	Bovine	08-Mar-15	Pending	Pending	Pending
	BOT 4/2015	Bovine	27-Jun-15	Pending	Pending	Pending
	BOT 5/2015	Bovine	27-Jun-15	Pending	Pending	Pending
	BOT 6/2015	Bovine	28-Jul-15	Pending	Pending	Pending
	BOT 7/2016	Bovine	28-Jul-15	Pending	Pending	Pending
	BOT 8/2015	Bovine	02-Aug-15	Pending	Pending	Pending
Egypt	EGY 11/2011	Cattle	01-Jan-11	O	Pos	O
	EGY 44/2012	Cattle	01-Jan-15	SAT 2	Pos	SAT 2
	EGY 1/2015	Cattle	01-Jan-12	Neg	Neg	NVD
	EGY 2/2015	Cattle	05-May-15	Pending	Pending	Pending
	EGY 3/2015	Cattle	27-May-15	Pending	Pending	Pending
	EGY 4/2015	Cattle	17-Jun-15	Pending	Pending	Pending
	EGY 5/2015	Cattle	26-Jul-15	Pending	Pending	Pending
	EGY 6/2015	Cattle	16-Aug-15	Pending	Pending	Pending
	EGY 7/2015	Cattle	31-Aug-15	Pending	Pending	Pending
	EGY 8/2015	Cattle	21-Sep-15	Pending	Pending	Pending
	EGY 9/2015	Cattle	21-Sep-15	Pending	Pending	Pending
EGY 10/2015	Cattle	07-Oct-15	Pending	Pending	Pending	
EGY 11/2015	Buffalo	05-Nov-15	Pending	Pending	Pending	

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Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results		
				VI/ELISA	RT-PCR	Final report
	EGY 12/2015	Buffalo	18-Nov-15	Pending	Pending	Pending
	EGY 13/2015	Cattle	03-Dec-15	Pending	Pending	Pending
	EGY 14/2015	Cattle	29-Dec-15	Pending	Pending	Pending
	EGY 15/2015	Cattle	30-Dec-15	Pending	Pending	Pending
	EGY 1/2016	Cattle	04-Jan-16	Pending	Pending	Pending
	EGY 2/2016	Cattle	06-Jan-16	Pending	Pending	Pending
	EGY 3/2016	Cattle	11-Jan-16	Pending	Pending	Pending
	EGY 4/2016	Cattle	19-Jan-16	Pending	Pending	Pending
	EGY 5/2016	Cattle	19-Jan-16	Pending	Pending	Pending
	EGY 6/2016	Cattle	06-Feb-16	Pending	Pending	Pending
	EGY 7/2016	Buffalo	20-Feb-16	Pending	Pending	Pending
	EGY 8/2016	Cattle	22-Feb-16	Pending	Pending	Pending
	EGY 9/2016	Cattle	24-Feb-16	Pending	Pending	Pending
	EGY 10/2016	Cattle	07-Mar-16	Pending	Pending	Pending
	EGY 11/2016	Cattle	07-Mar-16	Pending	Pending	Pending
	EGY 12/2016	Cattle	07-Mar-16	Pending	Pending	Pending
	EGY 13/2016	Cattle	10-Mar-16	Pending	Pending	Pending
	EGY 14/2016	Cattle	10-Mar-16	Pending	Pending	Pending
	EGY 15/2016	Cattle	14-Mar-16	Pending	Pending	Pending
	EGY 16/2016	Cattle	24-Mar-16	Pending	Pending	Pending
	EGY 17/2016	Cattle	24-Mar-16	Pending	Pending	Pending
	EGY 18/2016	Cattle	27-Mar-16	Pending	Pending	Pending
Hong Kong, SAR Of PRC	HKN 1/2016	Pig	25-Apr-16	Neg	Neg	NVD

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Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results		
				VI/ELISA	RT-PCR	Final report
Iran	IRN 1/2016	Cattle	04-Jan-16	A	Pos	A
	IRN 2/2016	-	04-Jan-16	NVD	Pos	FMDVGD
	IRN 3/2016	-	04-Jan-16	NVD	Pos	FMDVGD
	IRN 4/2016	-	04-Jan-16	O	Pos	O
	IRN 5/2016	-	04-Jan-16	O	Pos	O
	IRN 6/2016	Cattle	06-Jan-16	A	Pos	A
	IRN 7/2016	Cattle	26-Jan-16	NVD	Neg	NVD
	IRN 8/2016	Cattle	04-Feb-16	A	Pos	A
	IRN 9/2016	Dog	14-Feb-16	O	Pos	O
	IRN 10/2016	Lamb	26-Feb-16	O	Pos	O
	IRN 11/2016	Cattle	27-Feb-16	A	Pos	A
	IRN 12/2016	Cattle	29-Feb-16	A	Pos	A
	IRN 13/2016	Cattle	13-Mar-16	O	Pos	O
	IRN 14/2016	Cattle	16-Mar-16	NVD	Neg	NVD
	IRN 15/2016	Sheep	17-Mar-16	O	Pos	O
	IRN 16/2016	Lamb	18-Mar-16	O	Pos	O
	IRN 17/2016	Lamb	21-Mar-16	O	Pos	O
	IRN 18/2016	Sheep	24-Mar-16	O	Pos	O
	IRN 19/2016	Lamb	29-Mar-16	O	Pos	O
	IRN 20/2016	Cattle	02-Apr-16	A	Pos	A
	IRN 21/2016	Cattle	04-Apr-16	O	Pos	O
	IRN 22/2016	Sheep	05-Apr-16	O	Pos	O
	IRN 23/2016	Cattle	07-Apr-16	A	Pos	A
	IRN 24/2016	Cattle	07-Apr-16	NVD	Pos	FMDVGD

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Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results		
				V/ELISA	RT-PCR	Final report
	IRN 25/2016	Cattle	12-Apr-16	O	Pos	O
	IRN 26/2016	Cattle	18-Apr-16	Asia-1	Pos	Asia-1
	IRN 27/2016	Sheep	19-Apr-16	O	Pos	O
	IRN 28/2016	Sheep	25-Apr-16	O	Pos	O
	IRN 29/2016	Sheep	28-Apr-16	O	Pos	O
Laos	LAO 1/2016	Buffalo	23-Mar-16	Neg	Pos	FMDVGD
	LAO 2/2016	Buffalo	23-Mar-16	Neg	Pos	FMDVGD
	LAO 3/2016	Buffalo	23-Mar-16	Neg	Pos	FMDVGD
Malawi	MAL 1/2015	Bovine	10-Sep-15	Pending	Pending	Pending
Mozambique	MOZ 3/2015	Bovine	11-Jun-15	Pending	Pending	Pending
	MOZ 4/2015	Bovine	11-Jun-15	Pending	Pending	Pending
Namibia	Four (4) samples. Awaiting outstanding information					
Thailand	TAI 30/2015	Dairy Cow	13-Nov-15	O	Pos	O
	TAI 1/2016	Dairy Cow	05-Jan-16	Neg	Pos	FMDVGD
	TAI 2/2016	Dairy Cow	11-Jan-16	O	Pos	O
	TAI 3/2016	Dairy Cow	12-Jan-16	A	Pos	A
	TAI 4/2016	Dairy Cow	14-Jan-16	O	Pos	O
	TAI 5/2016	Swine	26-Jan-16	O	Pos	O
	TAI 6/2016	Cattle	02-Feb-16	A	Pos	A
	TAI 7/2016	Cattle	05-Feb-16	A	Pos	A
	TAI 8/2016	Cattle	12-Feb-16	A	Pos	A
	TAI 9/2016	Cattle	16-Feb-16	A	Pos	A
TAI 10/2016	Cattle	16-Feb-16	A	Pos	A	

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Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results		
				VI/ELISA	RT-PCR	Final report
	TAI 11/2016	Cattle	16-Feb-16	A	Pos	A
	TAI 12/2016	Cattle	21-Feb-16	A	Pos	A
	TAI 13/2016	Cattle	27-Feb-16	A	Pos	A
	TAI 14/2016	Cattle	03-Mar-16	O	Pos	O
	TAI 15/2016	Cattle	04-Mar-16	A	Pos	A
	TAI 16/2016	Cattle	06-Mar-16	A	Pos	A
	TAI 17/2016	Cow	07-Mar-16	A	Pos	A
Saudi Arabia	SAU 17/2016	Cattle	27-Apr-16	A	Pos	A
	SAU 16/2016	Cattle	27-Apr-16	Neg	Neg	NVD
	SAU 15/2016	Cattle	27-Mar-16	Neg	Pos	FMDVGD
United Arab Emirates	UAE 1/2016	Bovine	16-Feb-16	O	Pos	O
	UAE 2/2016	Bovine	16-Feb-16	O	Pos	O
	UAE 3/2016	Bovine	16-Feb-16	O	Pos	O
	UAE 4/2016	Bovine	16-Feb-16	O	Pos	O
	UAE 5/2016	Bovine	16-Feb-16	O	Pos	O
Zambia	ZAM 1/2015	Bovine	04-Feb-15	A	Pos	A
	ZAM 2/2015	Bovine	28-Feb-15	SAT 2	Pos	Sat 2
	ZAM 3/2015	Bovine	23-Oct-15	SAT 3	Pos	SAT 3
Zimbabwe	ZIM 23/2015	Bovine	15-Apr-15	Pending	Pending	Pending
	ZIM 24/2015	Bovine	15-Apr-15	Pending	Pending	Pending
	ZIM 25/2015	Bovine	15-Apr-15	Pending	Pending	Pending
	ZIM 26/2015	Bovine	17-Aug-15	Pending	Pending	Pending
TOTAL :		114				

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Abbreviations used in table

FMD(V)	Foot-and-mouth disease (virus)
FMDV GD	Genome detected
FMDV NGD	Genome not detected (samples submitted in Trizol, only rRT-PCR carried out)
VI/ELISA	FMDV serotype identified following virus isolation in cell culture and antigen ELISA
rRT-PCR	Real-time reverse transcription polymerase chain reaction on epithelial suspension for FMD (or SVD) viral genome
NVD	No foot-and-mouth disease, swine vesicular disease or vesicular stomatitis virus detected
NT	Not tested

4.3. Antigenic Characterisation

Antigenic characterisation of FMD field isolates by matching with vaccine strains by 2dmVNT from April to June 2016.

Table 4: Vaccine matching studies for Asia 1 FMDV by VNT

Strain	Serotype	Topotype	Strain	Asia 1 Shamir
PAK/28/2015	Asia 1	ASIA	Sindh-08	N
PAK/38/2015	Asia 1	ASIA	Sindh-08	N

Table 5: Vaccine matching studies for A FMDV by VNT

Strain	Serotype	Topotype	Strain	A22 IRQ	A IRN 05	A/TUR/20/2006
ETH/19/2015	A	AFRICA	G-IV	N	N	N
PAK/31/2015	A	ASIA	Iran-05 ^{FAR-11}	N	N	M
PAK/53/2015	A	ASIA	Iran-05 ^{FAR-09}	N	M	N

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Table 6: Vaccine matching studies for O FMDV by VNT

Strain	Serotype	Topotype	Strain	O 3039	O Manisa	O/TUR/5/2009
ETH/1/2016	O	EA-4	-	M	N	M
PAK/22/2015	O	ME-SA	Pak-98	M	M	M
PAK/30/2015	O	ME-SA	BAL-09	M	M	M
PAK/49/2015	O	ME-SA	ANT-10	M	M	M
SAU/1/2016	O	ME-SA	IND-2001d	M	M	M
SAU/7/2016	O	ME-SA	IND-2001d	M	M	M
TAI/16/2015	O	ME-SA	PanAsia	M	M	M
TAI/26/2015	O	SEA	Mya-98	M	B	M
TAI/9/2015	O	SEA	Mya-98	M	B	M

Table 7: Vaccine matching studies for SAT 2 FMDV by VNT

Strain	Serotype	Topotype	Strain	SAT 2 Eritrea	SAT 2 ZIM/7/83
ETH/16/2015	SAT 2	VII	Alx-12	M	N

Abbreviations used in tables

M	<p>Vaccine Match</p> <p>$r_1 = \geq 0.3$. Suggests that there is a close relationship between field isolate and vaccine strain. A potent vaccine containing the vaccine strain is likely to confer protection.</p>
N	<p>No Vaccine Match</p> <p>$r_1 = < 0.3$. Suggests that the field isolate is so different from the vaccine strain that the vaccine is unlikely to protect</p>
B	<p>Borderline</p> <p>Any r_1 values between 0.28 to 0.32</p>
NT	<p>Not tested against this vaccine</p>

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5. Annex 2

Recent FMD Publications (April-June 2016) cited by Web of Science (Pirbright Institute papers and authors are highlighted in **BOLD AND GREY**)

1. (2015). Plurithematic issue of the scientific and technical review, 2015. *Revue Scientifique et Technique - Office International des Epizooties*, **34**(3): 667-1010.
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6. Annex 3

RECOMMENDATIONS FROM WRLFMD® ON FMD VIRUS STRAINS TO BE INCLUDED IN FMDV ANTIGEN BANKS (FOR FMD-FREE COUNTRIES) June 2016

Note: Virus strains are NOT listed in order of importance

High Priority	A/ASIA/G-VII(G-18)* O Manisa O PanAsia-2 (or equivalent) O BFS or Campos A24 Cruzeiro Asia 1 Shamir A Iran-05 (or A TUR 06) A22 Iraq SAT 2 Saudi Arabia (or equivalent i.e. SAT 2 Eritrea)
Medium Priority	A Eritrea SAT 2 Zimbabwe SAT 1 South Africa A Malaysia 97 (or Thai equivalent such as A/Sakolnakorn/97) A Argentina 2001 O Taiwan 97 (pig-adapted strain or Philippine equivalent)
Low Priority	A Iran '96 A Iran '99 A Iran 87 or A Saudi Arabia 23/86 (or equivalent) A15 Bangkok related strain A87 Argentina related strain C Noville SAT 2 Kenya SAT 1 Kenya SAT 3 Zimbabwe

NB: Discussions are currently underway to adopt a risk-based approach for different FMD viral lineages to identify priority vaccines for use in Europe and other FMD-free settings.

*Recent *in vitro* data from WRLFMD for serotype A viruses from Saudi Arabia and Iran highlights an apparent gap in vaccine coverage. Work is urgently required to evaluate whether there is adequate *in vitro* match with Indian vaccine strains (A/IND/40/2000), or whether *in vivo* protection may be provided by high potency international vaccines.

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