



WRLFMD Quarterly Report July-September 2014

Reference Laboratory Contract Report

Foot-and-Mouth Disease



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Summary of samples tested and reported FMD outbreaks

ASIA

Cambodia

Three **FMD type O** viruses collected in 2013 were submitted to the WRLFMD by the RRL Pakchong, Thailand. Genotyping showed them to belong to the ME-SA toptotype, PanAsia lineage (see below).

Hong Kong SAR, P.R. China

A single sample submitted to the WRLFMD was found to contain **FMD type O** virus. Genotyping showed it to belong to the CATHAY toptotype and to be closely related to viruses present in Hong Kong SAR since 2010 (see below).

Kyrgyzstan

An outbreak of **FMD** was reported in cattle at Otmok, Talas on 12/08/2014. The results of serotyping are pending.

Lao PDR

Three **FMD type O** and three **FMD type A** viruses collected in 2013 and 2014, respectively, were submitted to the WRLFMD by the Thailand RRL. Genotyping showed them to belong to the O/SEA/Mya-98 and A/ASIA/Sea-97 lineages (see below).

Malaysia

Fifty-one samples were submitted to the WRLFMD. **FMD type O and A** viruses were isolated from 15 of these. Ten FMD type O viruses belonged to the SEA toptotype (nine to the Mya-98 lineage and one to an unnamed lineage) and five viruses belonged to the A/ASIA/Sea-97 lineage (see below).

Pakistan

Thirty-one samples were submitted to the WRLFMD and FMD viruses isolated from all of them, however, 34 viruses were identified. Twenty-two belonged to O/ME-SA/PanAsia-2^{ANT-10}; one to O/ME-SA/unnamed; one to A/ASIA/Iran-05^{SIS-12}; three to A/ASIA/Iran-05^{FAR-09}; three to A/ASIA/Iran-05^{FAR-11}; and four to Asia 1/Sindh-08. One sample (PAK/23/2014) contained both O/ME-SA/PanAsia-2^{ANT-10} and A/ASIA/Iran-05^{FAR-11}, while another (PAK/14/2014) contained three viruses O/ME-SA/PanAsia-2^{ANT-10}, A/ASIA/Iran-05^{FAR-11} and A/ASIA/Iran-05^{FAR-09} (see below).

People's Republic of China

Two outbreaks due to **FMD type A** were reported on 23/06/2014 at Lianghong company, Sihong, Suqian, Jiangsu (in pigs) and on the 15/09/2014 in Renqincai Village, Lasa, Tibet (in cattle). No genotyping has been reported.

Republic of Korea (South Korea)

Three outbreaks of **FMD type O** were reported in July in pigs in Gyeongsangbuk-do and Gyeongsangnam-do. VP1 sequencing at the Animal and Plant Quarantine Agency (ROK) and the WRLFMD showed that the viruses belonged to the SEA toptotype, Mya-98 lineage being most closely related to O/Primorskiy/RUS/2014 recovered from outbreaks in the Russian Federation in May 2014 (reported previously). These data (see below) are indicative of a new FMD virus incursion into South Korea (within the O/SEA/Mya-98 lineage), rather than re-emergence of a FMD virus from previous outbreaks in 2010-11.

Russian Federation

An outbreak of **FMD type A** was reported on 11/09/2014 at Kuti, Priargunsky, Zabajkal'skij Kray (in cattle). No genotyping has been reported.

Sri Lanka

Two batches of samples were received by the WRLFMD in July and September. From a total of 40 samples (collected between 2011 and 2014), 22 **FMD type O** viruses were isolated. One virus, from 2011 belonged to an unnamed ME-SA lineage and was related to FMD type O viruses present in Sri Lanka from 1997 to 2012. However, 21 viruses (all collected between December 2013 and September 2014) belonged to the ME-SA/Ind-2001d lineage which has become prevalent in the Indian sub-continent and recently spread to the Middle East and North Africa (see below for reports of outbreaks in Tunisia and Algeria). This is the first time this sub-lineage has been detected in Sri Lanka.

Thailand

Two **FMD type O** and 19 **FMD type A** viruses collected in 2013 and 2014 were submitted to the WRLFMD by the Thailand RRL (Pakchong). The type O viruses belonged to the O/SEA/Mya-98 lineage and the type A viruses belonged to the A/ASIA/Sea-97 lineage (see below).

AFRICA

Algeria

Between 23/07/2014 and 31/08/2014, 418 outbreaks of **FMD type O** in various locations (in 26 of the 48 provinces). Outbreaks were mainly in cattle. Genotyping of three virus isolates at Istituto Zooprofilattico Sperimentale della Lombardia e dell'Emilia Romagna (IZSLER), Brescia, and the WRLFMD showed the virus to belong to the ME-SA toptotype, Ind-2001d lineage and to be most closely related to viruses recently isolated from Tunisia (see below).

Botswana

On 20/08/2014, sub-clinical infection due to **FMD SAT 1** was reported in goats at Mohembo East, Kauxwi, Xakao I & II, Shakawe, Ngamiland, Ngamiland. No genotyping has been reported. Previous clinical disease was recorded in the same area in May/June 2014 and was caused by a SAT 1 virus belonging to toptotype III (WZ).

Cameroon

Forty-six samples submitted to the WRLFMD from various locations were analysed. Thirteen FMD viruses were isolated. Four **FMD type A** viruses (G-IV) and nine **FMD type SAT 2** viruses (VII); four of the SAT 2's belonged to the Lib-12 sub-lineage and five to an unnamed sub-lineage (see below).

Mozambique

Between 24/07/2014 and 02/08/2014, three outbreaks due to **FMD SAT 2** were reported in cattle in Maputo province. Sequences submitted to the WRLFMD by the Botswana Vaccine Institute (BVI) showed the virus to belong to toptotype I, but were not closely related to any other sequences in the database (see below).

Namibia

On 21/08/2014, **FMD** was reported in cattle at Ihaha, Kabbe, Caprivi. Serotyping is pending.

Tunisia

Between 29/06/2014 and 08/09/2014, 27 new outbreaks of **FMD type O** were reported in 17 of the 24 Governorates (mostly in cattle). These outbreaks have been previously shown to belong to the ME-SA toptotype, Ind-2001d lineage. Two viruses were submitted to the WRLFMD by IZSLER and their VP1 sequences determined (see below).

Uganda

On 14/08/2014 a general report was received documenting an increased incidence of **FMD type O** in the country.

Zimbabwe

Five clusters of outbreaks due to **FMD type SAT 1** were reported in cattle at communal dip tanks in Maranda, Mwenezi, Masvingo (27/06/2014); Chitanga, Mwenezi, Masvingo (03/07/2014); Sovelele, Mberengwa, Midlands (13/07/2014); Manyenge, Zvishavane, Midlands (30/08/2014); and Silikwe, Gwanda, Matabeleland South (13/09/2014). No genotyping has been reported, so it isn't clear if they are all related to each other and to previous outbreaks in Masvingo in April 2014.

SOUTH AMERICA

No new outbreaks of FMD were reported in the region.

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/2014.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 July and September 2014 is shown in Annex 1 Table A. A record of all samples received to The Pirbright Institute (July-September 2014) is shown in Annex 1 Table B.

Table 1: Status of sequencing of samples received by the WRLFMD from July-September 2014.

WRLFMD Batch No.	Date received	Country	Serotype	No. of samples	No. of sequences	Sequencing status
WRLFMD/2014/00019*	07/05/2014	Cameroon	A	4	4	Completed
WRLFMD/2014/00019*	07/05/2014	Cameroon	SAT 2	9	9	Completed
WRLFMD/2014/00020*	28/05/2014	Hong Kong SAR	O	1	1	Completed
WRLFMD/2014/00021*	22/05/2014	Pakistan	O	21	23	Completed
WRLFMD/2014/00021*	22/05/2014	Pakistan	A	6	7	Completed
WRLFMD/2014/00021*	22/05/2014	Pakistan	Asia 1	4	4	Completed
WRLFMD/2014/00022*	19/06/2014	Thailand	O	2	2	Completed
WRLFMD/2014/00022*	19/06/2014	Thailand	A	19	19	Completed
WRLFMD/2014/00023*	19/06/2014	Laos	O	3	3	Completed
WRLFMD/2014/00023*	19/06/2014	Laos	A	3	3	Completed
WRLFMD/2014/00024*	19/06/2014	Cambodia	O	3	3	Completed
WRLFMD/2014/00025	10/07/2014	Sri Lanka	O	15	15	Completed
WRLFMD/2014/00026	19/06/2014	Malaysia	O	10	10	Completed
WRLFMD/2014/00026	19/06/2014	Malaysia	A	5	5	Completed
WRLFMD/2014/00027	31/07/2014	Republic of Korea	O	1	1	Completed
WRLFMD/2014/00028	08/09/2014	Algeria	O	3	3	Completed
WRLFMD/2014/00029	08/09/2014	Tunisia	O	2	2	Completed
WRLFMD/2014/00030	25/09/2014	Sri Lanka	O	8	8	Completed
				119	122	

*, received during the second quarter of 2014.

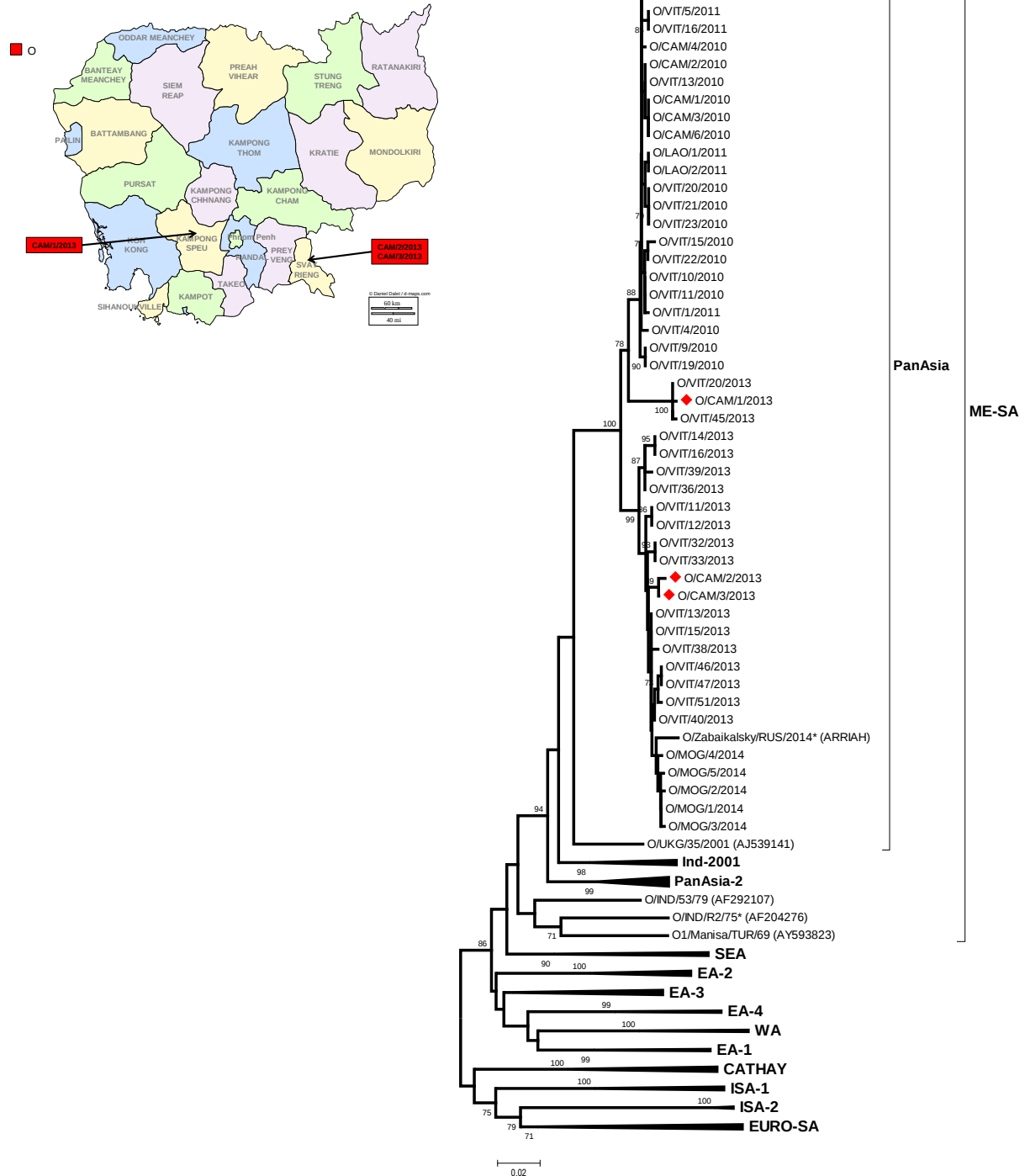
Detailed Analysis:**ASIA****Cambodia**

WRLFMD/2014/00024

Date received: 19/06/2014

No. of samples: 3

O (ME-SA/PanAsia): 3



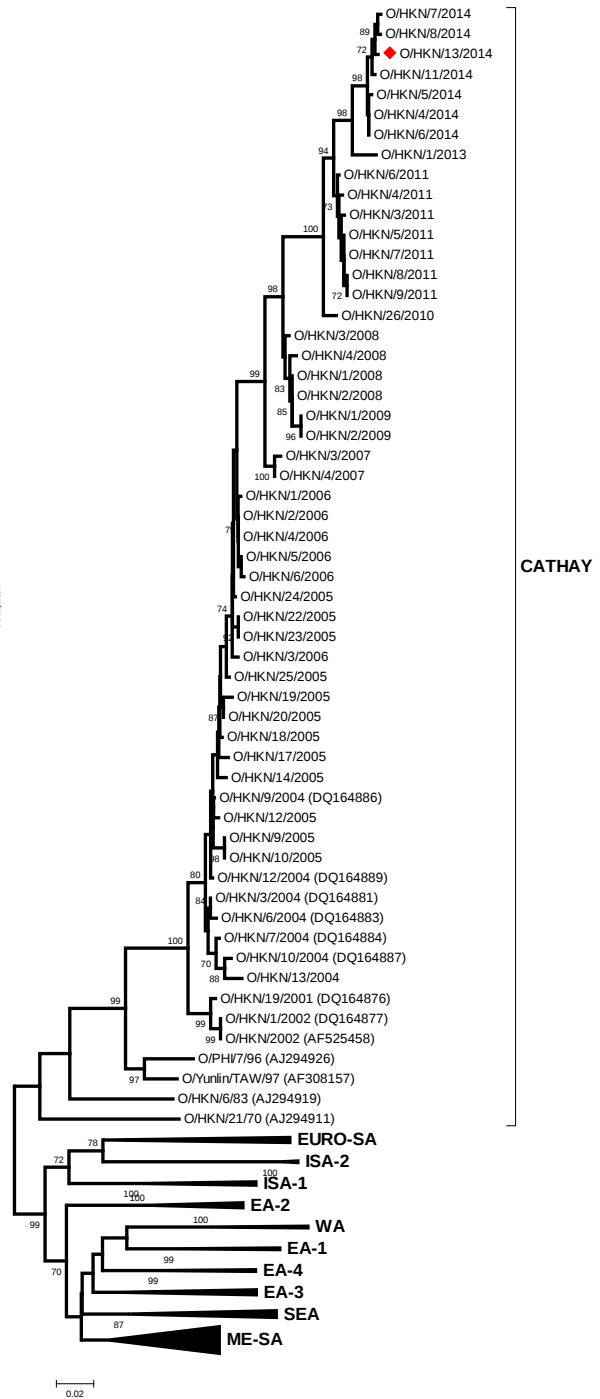
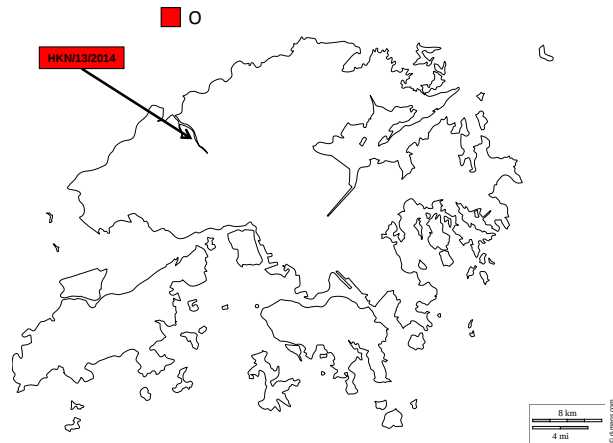
Hong Kong SAR

WRLFMD/2014/00020

Date received: 28/05/2014

No. of samples: 1

O (CATHAY/unnamed): 1



Pakistan

WRLFMD/2014/00021

Date received: 22/05/2014

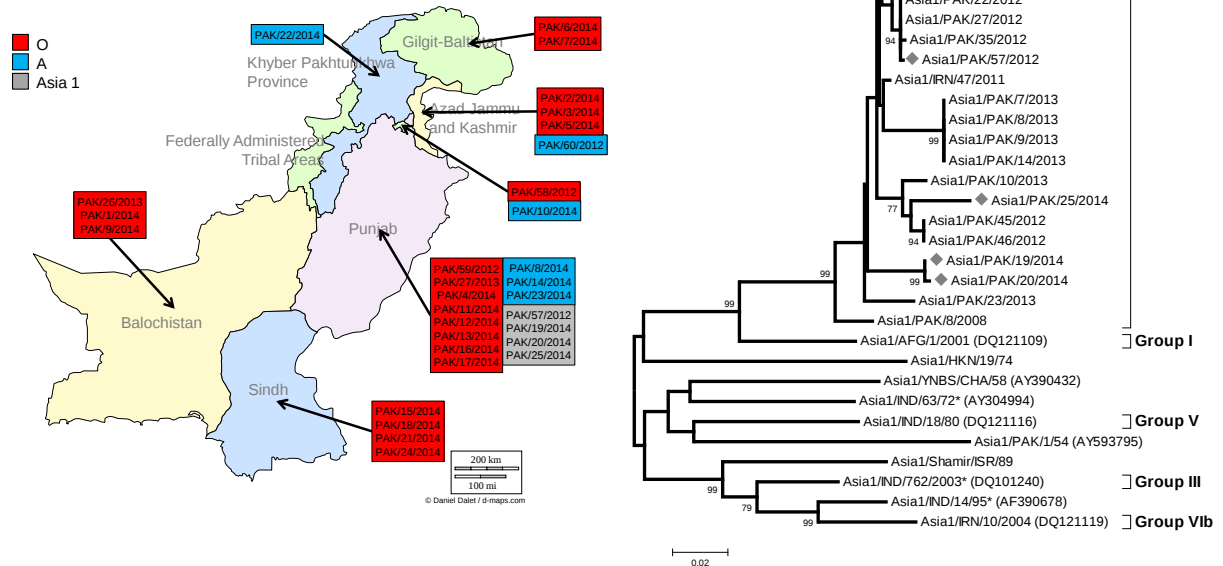
No. of samples: 34

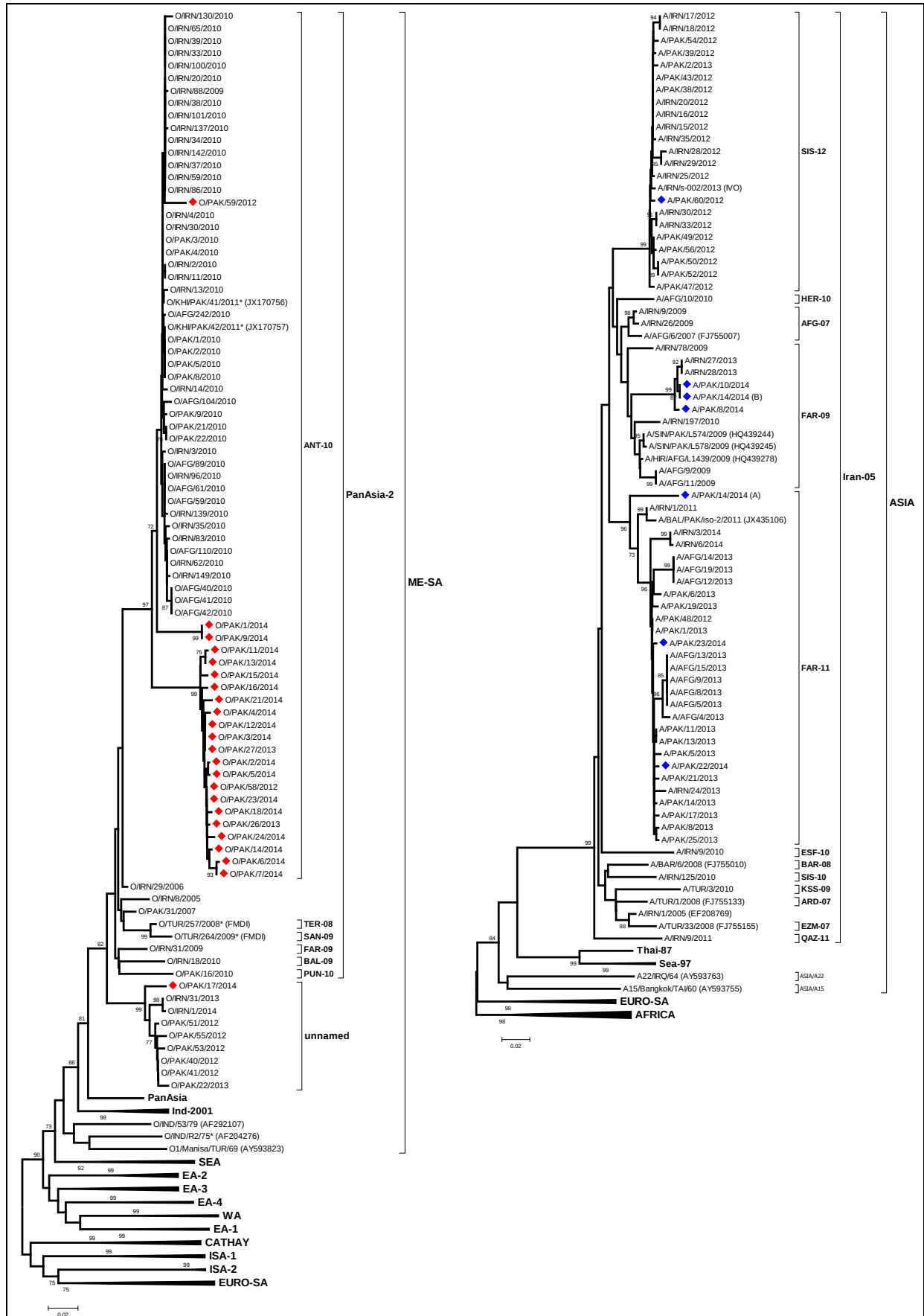
O (ME-SA/PanAsia-2^{ANT-10}): 22

O (ME-SA/unnamed): 1

A (ASIA/Iran-05^{SIS-12}): 1A (ASIA/Iran-05^{FAR-09}): 3A (ASIA/Iran-05^{FAR-11}): 3

Asia 1 (Sindh-08): 4





Republic of Korea (South Korea)

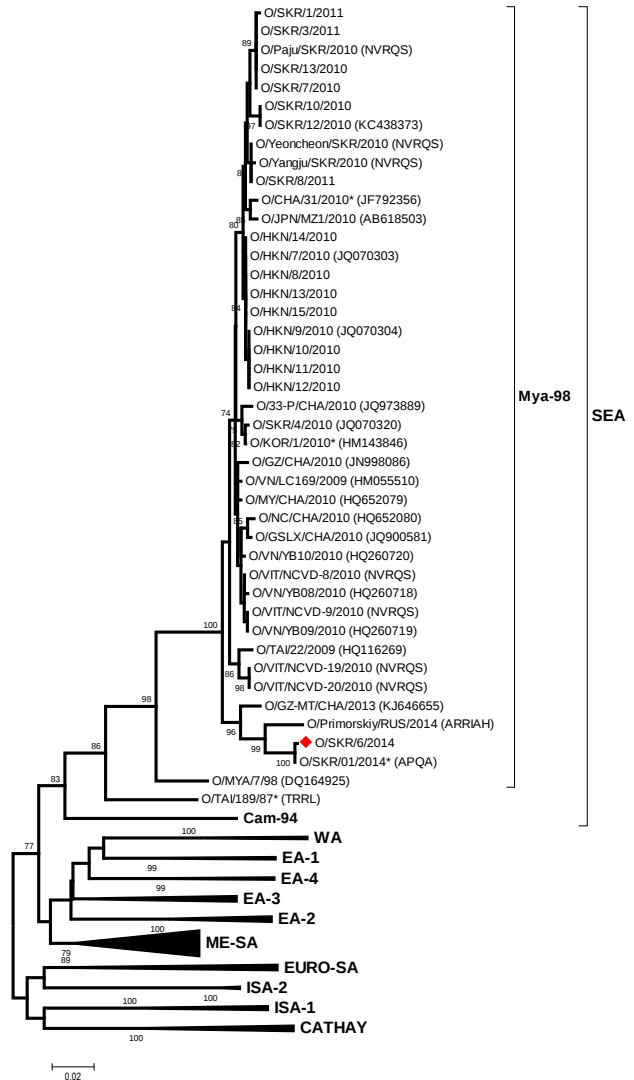
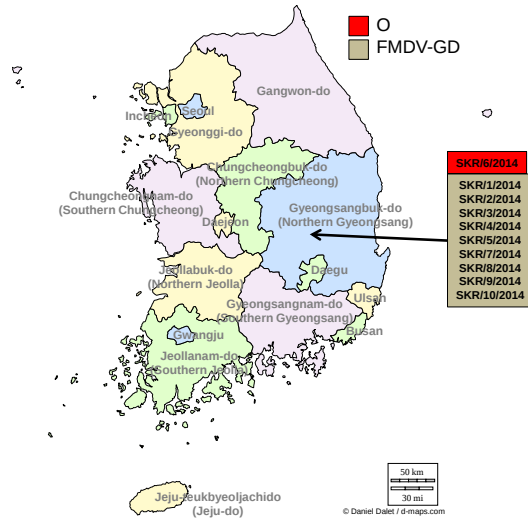
WRLFMD/2014/00027

Date received: 31/07/2014

No. of samples: 10

O (SEA/Mya-98): 1

FMDV-GD: 9



Sri Lanka

WRLFMD/2014/00025

Date received: 10/07/2014

No. of samples: 22

O (ME-SA/Ind-2001d): 14

O (ME-SA/unnamed): 1

FMDV-GD: 7

WRLFMD/2014/00030

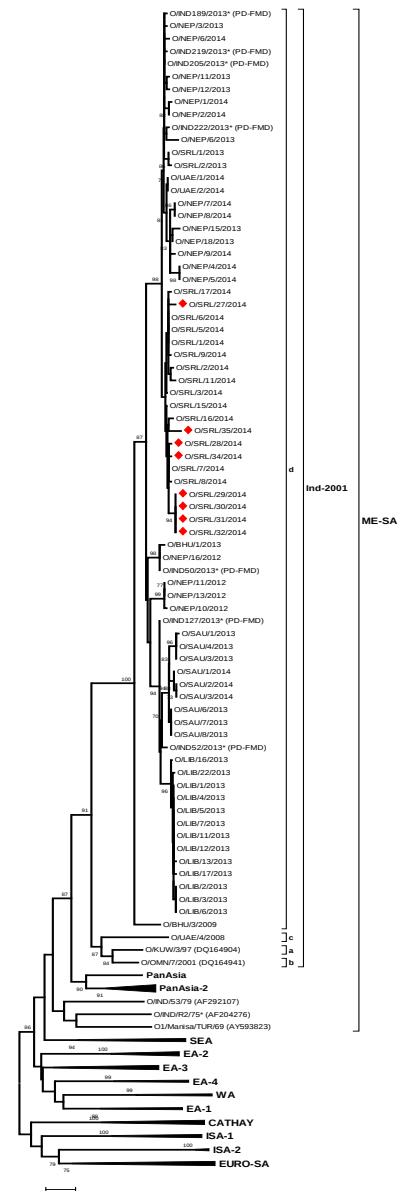
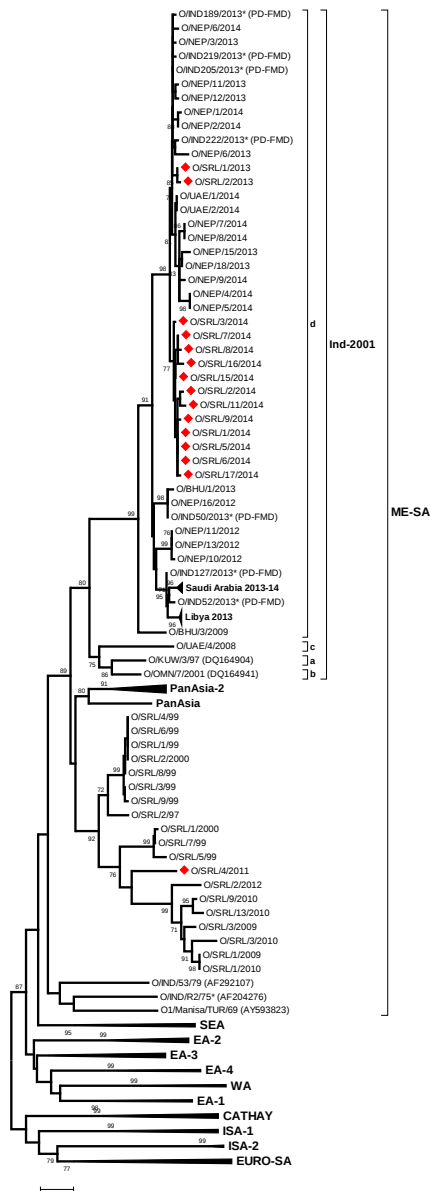
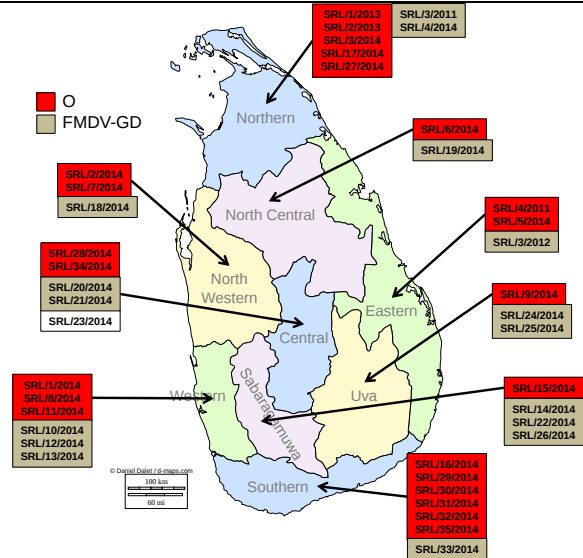
Date received: 25/09/2014

No. of samples: 18

O (ME-SA/Ind-2001d): 8

FMDV-GD: 9

NVD: 1



Thailand

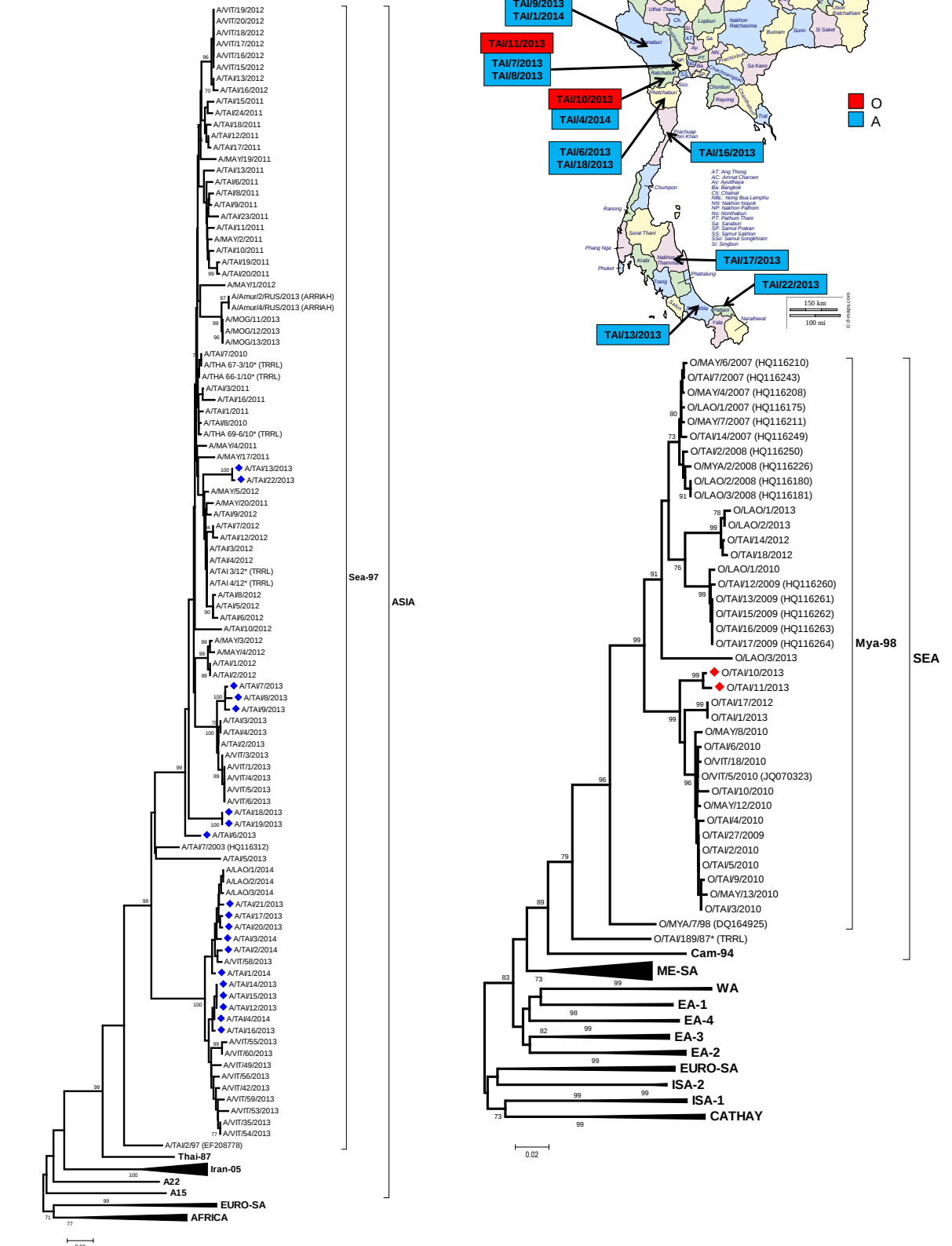
WRLFMD/2014/00022

Date received: 19/06/2014

No. of samples: 21

O (SEA/Mya-98): 2

A (ASIA/Sea-97): 19



AFRICA

Algeria

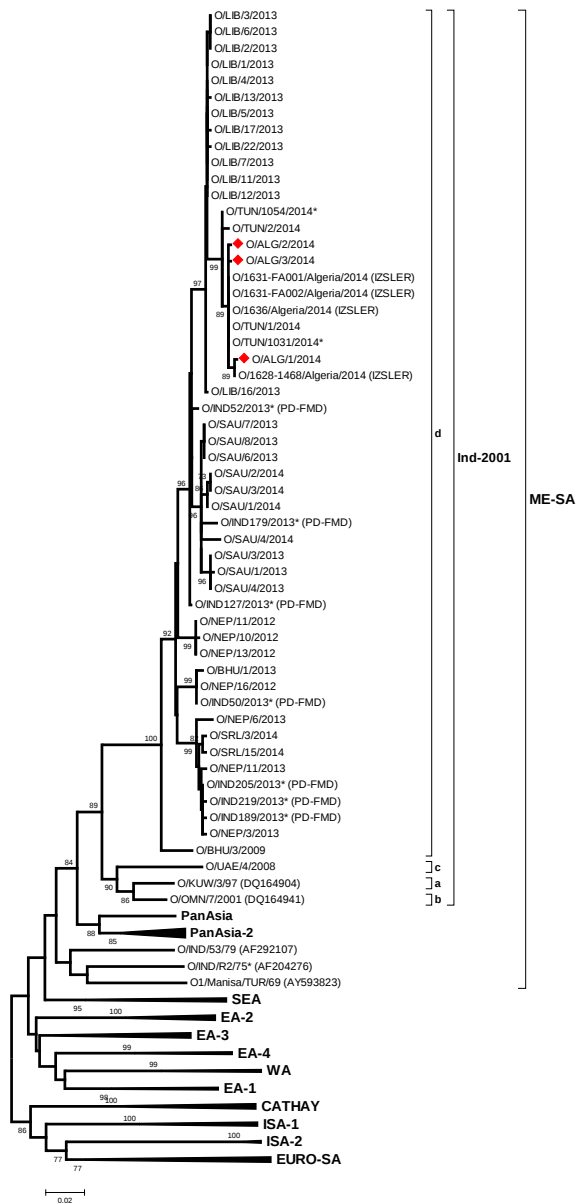
WRLFMD/2014/00028

Date received: 08/09/2014

No. of samples: 3

O (ME-SA/Ind-2001d): 3

Locations not specified.



Tunisia

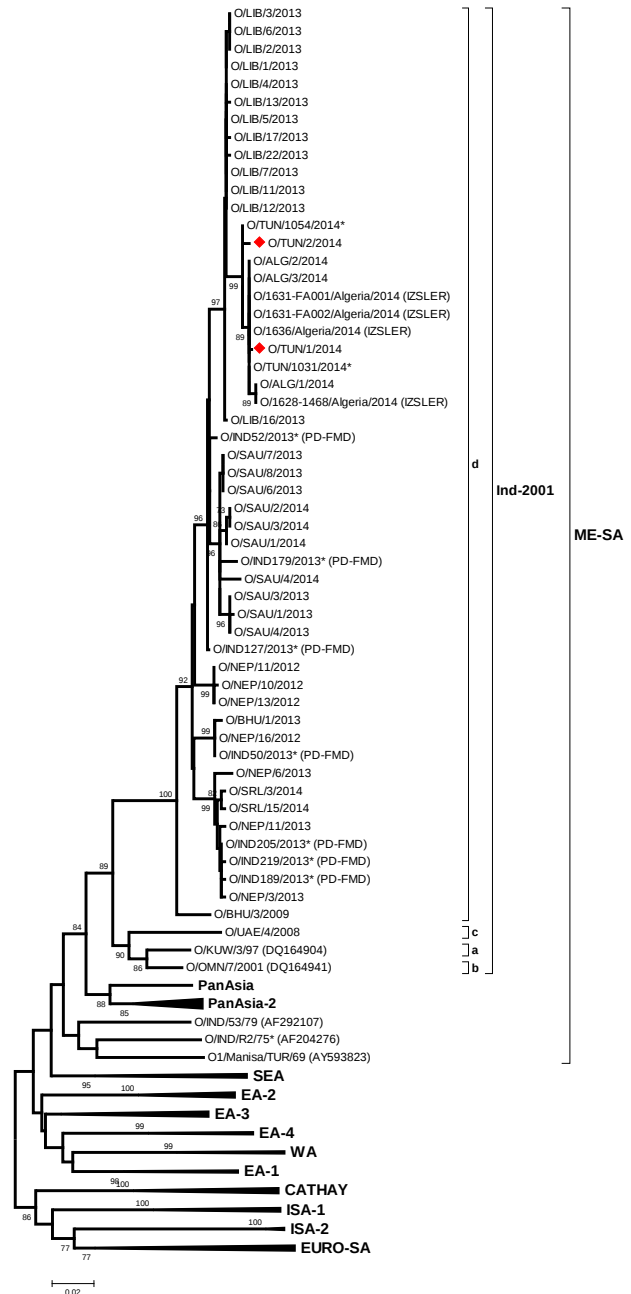
WRLMEG/2014/00029

Date received: 08/09/2014

No. of samples: 2

O (ME-SA/Ind-2001d): 2

Locations not specified.



NVD: 11



Mozambique

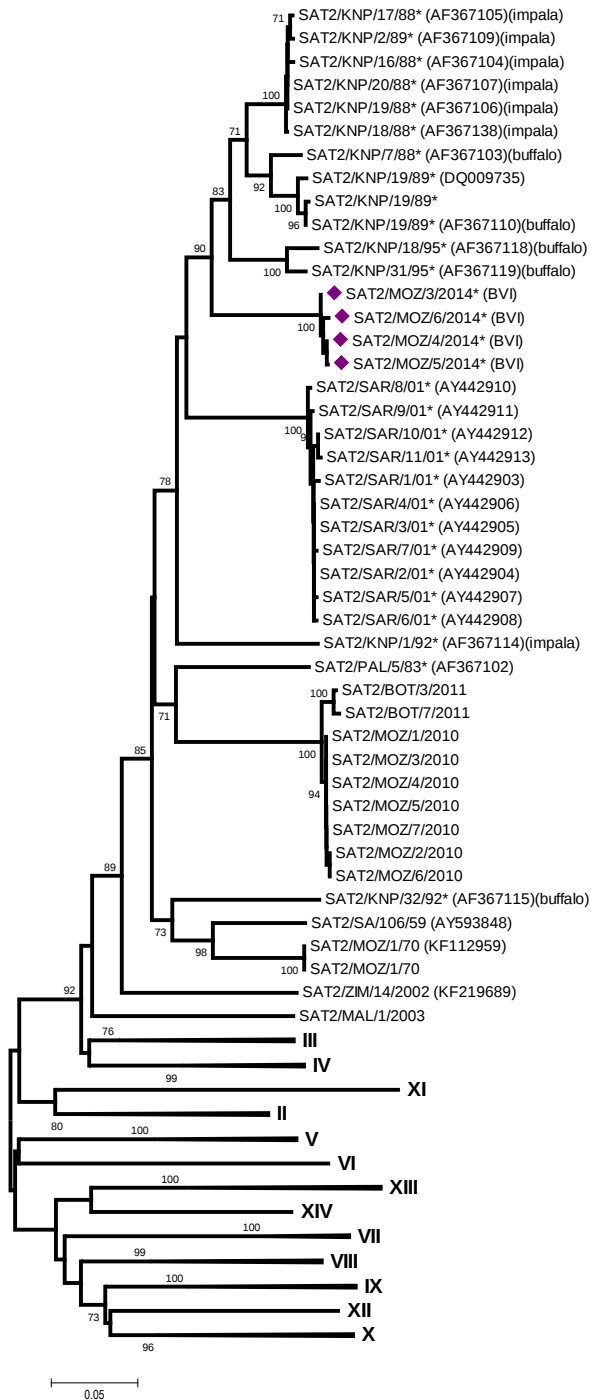
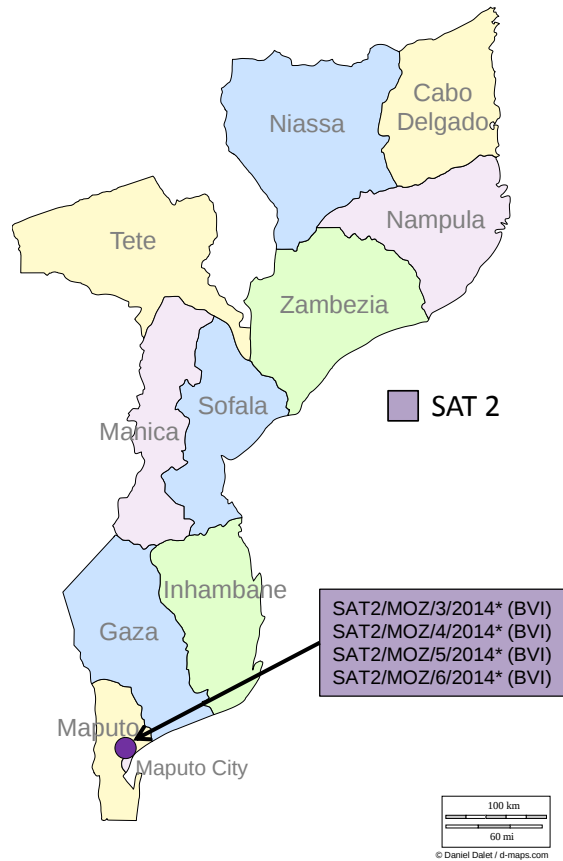
WRLMEG/2014/00032

Date received: 20/08/2014

No. of sequences: 4

SAT2 (I): 4

Sequences submitted by the BVI.



Vaccine matching (for individual data see: Annex 1 Table C)**Serotype O**

Vaccine matching was carried out for Serotype O samples from Algeria (n=1), Cambodia (n=1), Hong Kong (n=1), Laos (n=1), Nigeria (n=2), Pakistan (n=2), South Korea (n=1), Sri Lanka (n=2), Thailand (n=1), Tunisia (n=1). Of particular importance is the vaccine matching for the Northern African countries Tunisia and Algeria due to their proximity to Europe. The VNT provided good evidence for an antigenic match to O TUR/5/09. The isolate from Algeria was also a match against O 3039, while the virus from Tunisia has an r_1 -value of 0.27 against this vaccine virus. The individual neutralization values for these strains for vaccine viruses O 3039, O Manisa and O BFS indicate that a high potency vaccine may still protect against these strains and we are currently considering how future reports may accommodate these data.

One FMD virus from Pakistan (O/PAK/17/2014) of an unnamed lineage within PanAsia-2 was unable to neutralise any of the vaccine viruses tested. Currently only a small number of field isolates from Iran and Pakistan within this un-named lineage have been received to WRLFMD: if further isolates from this lineage are received we will continue to monitor the situation.

Serotype A

Vaccine matching was carried out for Serotype A samples from Nigeria (n=2), Pakistan (n=2) and Thailand (n=1). All of these field viruses had at least one vaccine virus that was antigenically matched. There is currently no update on the antigenic pattern of viruses from the Middle East.

Serotype Asia 1

Vaccine matching was carried out against two viruses for Pakistan. Neither of these strains matched to the vaccine viruses: Asia 1 Shamir and IND/8/79.

Serotype SAT 2

Two viruses from Nigeria were tested against SAT 2 ERI 3218 and SAT 2 ZIM/7/83. Only one of these viruses was a match to ZIM/7/83.

Annex 1. TABLE A: Clinical sample diagnostics made by the WRLFMD® between July-August 2014

Country	WRL for FMD		Species	Date of Collection	Results		Final report
	Sample Identification				VI/ELISA	RT-PCR	
CAMBODIA*	CAM 1/2013	CATTLE	19-Sep-13	O	POS	O	
	CAM 2/2013	CATTLE	19-Sep-13	O	POS	O	
	CAM 3/2013	CATTLE	19-Sep-13	O	POS	O	
CAMEROON*	CAR 1/2013	CATTLE	12-Jul-13	NEG	POS	FMDV GD	
	CAR 2/2013	CATTLE	12-Jul-13	NEG	POS	FMDV GD	
	CAR 3/2013	CATTLE	14-Jul-13	NEG	POS	FMDV GD	
	CAR 4/2013	CATTLE	15-Jul-13	A	POS	A	
	CAR 5/2013	CATTLE	15-Jul-13	NEG	POS	FMDV GD	
	CAR 6/2013	CATTLE	16-Jul-13	SAT 2	POS	SAT 2	
	CAR 7/2013	CATTLE	16-Jul-13	NEG	POS	FMDV GD	
	CAR 8/2013	CATTLE	16-Jul-13	NEG	POS	FMDV GD	
	CAR 9/2013	CATTLE	16-Jul-13	NEG	POS	FMDV GD	
	CAR 10/2013	CATTLE	17-Jul-13	A	POS	A	
	CAR 11/2013	CATTLE	17-Jul-13	A	POS	A	
	CAR 12/2013	CATTLE	18-Jul-13	SAT 2	POS	SAT 2	
	CAR 13/2013	CATTLE	19-Jul-13	NEG	POS	FMDV GD	
	CAR 14/2013	CATTLE	19-Jul-13	NEG	POS	FMDV GD	
	CAR 15/2013	CATTLE	20-Jul-13	NEG	POS	FMDV GD	
	CAR 16/2013	CATTLE	20-Jul-13	SAT 2	POS	SAT 2	
	CAR 17/2013	CATTLE	20-Jul-13	NEG	POS	FMDV GD	
	CAR 18/2013	CATTLE	20-Jul-13	NEG	POS	FMDV GD	
	CAR 19/2013	CATTLE	21-Jul-13	NEG	NEG	NVD	
	CAR 20/2013	CATTLE	21-Jul-13	NEG	POS	FMDV GD	
	CAR 21/2013	CATTLE	22-Jul-13	NEG	POS	FMDV GD	
	CAR 22/2013	CATTLE	22-Jul-13	NEG	NEG	NVD	
	CAR 23/2013	CATTLE	22-Jul-13	NEG	NEG	NVD	
	CAR 24/2013	CATTLE	22-Jul-13	SAT 2	POS	SAT 2	
	CAR 25/2013	CATTLE	22-Jul-13	NEG	POS	FMDV GD	
	CAR 26/2013	CATTLE	23-Jul-13	NEG	NEG	NVD	
	CAR 27/2013	CATTLE	23-Jul-13	NEG	POS	FMDV GD	
	CAR 28/2013	CATTLE	23-Jul-13	NEG	NEG	NVD	
	CAR 29/2013	CATTLE	24-Jul-13	SAT 2	POS	SAT 2	
	CAR 30/2013	CATTLE	25-Jul-13	NEG	NEG	NVD	
	CAR 31/2013	CATTLE	25-Jul-13	NEG	POS	FMDV GD	
	CAR 32/2013	CATTLE	25-Jul-13	NEG	POS	FMDV GD	
	CAR 33/2013	CATTLE	25-Jul-13	NEG	POS	FMDV GD	
	CAR 34/2013	CATTLE	26-Jul-13	SAT 2	POS	SAT 2	
	CAR 35/2013	CATTLE	26-Jul-13	NEG	POS	FMDV GD	
	CAR 36/2013	CATTLE	27-Jul-13	A	POS	A	
	CAR 37/2013	CATTLE	28-Jul-13	SAT 2	POS	SAT 2	
	CAR 38/2013	CATTLE	28-Jul-13	NEG	NEG	NVD	
	CAR 39/2013	CATTLE	28-Jul-13	NEG	NEG	NVD	
	CAR 40/2013	CATTLE	28-Jul-13	NEG	POS	FMDV GD	
	CAR 41/2013	CATTLE	28-Jul-13	NEG	POS	FMDV GD	
	CAR 42/2013	CATTLE	29-Jul-13	SAT 2	POS	SAT 2	
	CAR 43/2013	CATTLE	29-Jul-13	SAT 2	POS	SAT 2	

	CAR 44/2013	CATTLE	07-Aug-13	NEG	NEG	NVD
	CAR 45/2013	CATTLE	07-Aug-13	NEG	NEG	NVD
	CAR 46/2013	CATTLE	07-Aug-13	NEG	NEG	NVD
LAOS*	LAO 1/2013	CATTLE	19-Jul-13	O	POS	O
	LAO 2/2013	CATTLE	19-Jul-13	O	POS	O
	LAO 3/2013	CATTLE	19-Jul-13	O	POS	O
	LAO 1/2014	CATTLE	20-Feb-14	A	POS	A
	LAO 2/2014	CATTLE	20-Feb-14	A	POS	A
	LAO 3/2014	CATTLE	20-Feb-14	A	POS	A
MALAYSIA*	MAY 19/2012	CATTLE	03-Sep-12	NEG	POS	FMDV GD
	MAY 20/2012	CATTLE	03-Sep-12	NT	POS	FMDV GD
	MAY 21/2012	CATTLE	17-Sep-12	NT	POS	FMDV GD
	MAY 22/2012	CATTLE	24-Sep-12	NEG	POS	FMDV GD
	MAY 23/2012	CATTLE	24-Sep-12	NT	POS	FMDV GD
	MAY 24/2012	CATTLE	11-Oct-12	O	POS	O
	MAY 25/2012	CATTLE	03-Nov-12	O	POS	O
	MAY 26/2012	CATTLE	06-Nov-12	NEG	POS	FMDV GD
	MAY 27/2012	CATTLE	06-Nov-12	NT	POS	FMDV GD
	MAY 28/2012	CATTLE	09-Nov-12	NEG	POS	FMDV GD
	MAY 29/2012	CATTLE	09-Nov-12	NT	POS	FMDV GD
	MAY 30/2012	CATTLE	09-Dec-12	NEG	POS	FMDV GD
	MAY 31/2012	CATTLE	09-Dec-12	NT	POS	FMDV GD
	MAY 32/2012	CATTLE	10-Dec-12	NEG	POS	FMDV GD
	MAY 33/2012	CATTLE	10-Dec-12	NT	POS	FMDV GD
	MAY 34/2012	CATTLE	10-Dec-12	O	POS	O
	MAY 35/2012	CATTLE	14-Dec-12	O	POS	O
	MAY 36/2012	CATTLE	19-Dec-12	NEG	POS	FMDV GD
	MAY 37/2012	CATTLE	19-Dec-12	NT	POS	FMDV GD
	MAY 1/2013	CATTLE	06-Jan-13	O	POS	O
	MAY 2/2013	CATTLE	06-Feb-13	NEG	POS	FMDV GD
	MAY 3/2013	CATTLE	06-Feb-13	NT	POS	FMDV GD
	MAY 4/2013	CATTLE	05-Mar-13	NEG	NEG	NVD
				NT	NEG	FMDV
	MAY 5/2013	CATTLE	05-Mar-13			NGD
	MAY 6/2013	CATTLE	21-May-13	NEG	POS	FMDV GD
	MAY 7/2013	CATTLE	21-May-13	NT	POS	FMDV GD
	MAY 8/2013	CATTLE	27-Jun-13	NEG	POS	FMDV GD
	MAY 9/2013	CATTLE	27-Jun-13	NT	POS	FMDV GD
	MAY 10/2013	CATTLE	01-Oct-13	NEG	POS	FMDV GD
	MAY 11/2013	CATTLE	01-Oct-13	NT	POS	FMDV GD
	MAY 12/2013	CATTLE	12-Oct-13	A	POS	A
	MAY 13/2013	CATTLE	14-Oct-13	NEG	POS	FMDV GD
	MAY 14/2013	CATTLE	14-Oct-13	NT	POS	FMDV GD
	MAY 15/2013	CATTLE	18-Oct-13	NEG	POS	FMDV GD
	MAY 16/2013	CATTLE	18-Oct-13	NT	POS	FMDV GD
	MAY 17/2013	CATTLE	05-Nov-13	A	POS	A
	MAY 18/2013	CATTLE	13-Nov-13	NEG	POS	FMDV GD
	MAY 19/2013	CATTLE	13-Nov-13	NT	POS	FMDV GD
	MAY 20/2013	CATTLE	25-Nov-13	A	POS	A
	MAY 21/2013	CATTLE	25-Nov-13	A	POS	A
	MAY 22/2013	CATTLE	16-Dec-13	O	POS	O
	MAY 23/2013	CATTLE	26-Dec-13	A	POS	A
	MAY 1/2014	CATTLE	22-Jan-14	NEG	POS	FMDV GD
	MAY 2/2014	CATTLE	06-Feb-14	O	POS	O

	MAY 3/2014	CATTLE	25-Feb-14	O	POS	O
	MAY 4/2014	CATTLE	21-May-14	NEG	POS	FMDV GD
	MAY 5/2014	CATTLE	21-May-14	NEG	POS	FMDV GD
	MAY 6/2014	CATTLE	28-May-14	NEG	POS	FMDV GD
	MAY 7/2014	CATTLE	28-May-14	NEG	POS	FMDV GD
	MAY 8/2014	CATTLE	10-Jun-14	O	POS	O
	MAY 9/2014	CATTLE	15-Jun-14	O	POS	O
PAKISTAN*	PAK 57/2012	BUFFALO	08-May-12	ASIA-1	POS	ASIA-1
	PAK 58/2012	CATTLE	24-Jul-12	O	POS	O
	PAK 59/2012	BUFFALO	16-Oct-12	O	POS	O
	PAK 60/2012	CATTLE	21-Nov-12	A	POS	A
	PAK 26/2013	CATTLE	05-Dec-13	O	POS	O
	PAK 27/2013	BUFFALO	17-Dec-13	O	POS	O
	PAK 1/2014	CATTLE	03-Jan-14	O	POS	O
	PAK 2/2014	BUFFALO	04-Jan-14	O	POS	O
	PAK 3/2014	CATTLE	04-Jan-14	O	POS	O
	PAK 4/2014	BUFFALO	09-Jan-14	O	POS	O
	PAK 5/2014	CATTLE	10-Jan-14	O	POS	O
	PAK 6/2014	CATTLE	12-Jan-14	O	POS	O
	PAK 7/2014	CATTLE	12-Jan-14	O	POS	O
	PAK 8/2014	BUFFALO	15-Jan-14	A	POS	A
	PAK 9/2014	BUFFALO	15-Jan-14	O	POS	O
	PAK 10/2014	CATTLE	17-Jan-14	A	POS	A
	PAK 11/2014	CATTLE	30-Jan-14	O	POS	O
	PAK 12/2014	CATTLE	11-Feb-14	O	POS	O
	PAK 13/2014	CATTLE	11-Feb-14	O	POS	O
	PAK 14/2014	CATTLE	20-Feb-14	A, O	POS	A, O
	PAK 15/2014	CATTLE	06-Mar-14	O	POS	O
	PAK 16/2014	BUFFALO	10-Mar-14	O	POS	O
	PAK 17/2014	BUFFALO	17-Mar-14	O	POS	O
	PAK 18/2014	BUFFALO	20-Mar-14	O	POS	O
	PAK 19/2014	CATTLE	22-Mar-14	ASIA-1	POS	ASIA-1
	PAK 20/2014	BUFFALO	24-Mar-14	ASIA-1	POS	ASIA-1
	PAK 21/2014	CATTLE	02-Apr-14	O	POS	O
	PAK 22/2014	CATTLE	09-Apr-14	A	POS	A
	PAK 23/2014	BUFFALO	10-Apr-14	A, O	POS	A, O
	PAK 24/2014	CATTLE	14-Apr-14	O	POS	O
	PAK 25/2014	CATTLE	15-Apr-14	ASIA-1	POS	ASIA-1
THAILAND*	TAI 6/2013	CATTLE	17-Jul-13	A	POS	A
	TAI 7/2013	CATTLE	19-Jul-13	A	POS	A
	TAI 8/2013	CATTLE	29-Jul-13	A	POS	A
	TAI 9/2013	CATTLE	01-Aug-13	A	POS	A
	TAI 10/2013	CATTLE	01-Oct-13	O	POS	O
	TAI 11/2013	CATTLE	09-Oct-13	O	POS	O
	TAI 12/2013	CATTLE	09-Oct-13	A	POS	A
	TAI 13/2013	CATTLE	12-Oct-13	A	POS	A
	TAI 14/2013	CATTLE	16-Oct-13	A	POS	A
	TAI 15/2013	CATTLE	21-Oct-13	A	POS	A
	TAI 16/2013	CATTLE	31-Oct-13	A	POS	A
	TAI 17/2013	CATTLE	12-Nov-13	A	POS	A
	TAI 18/2013	CATTLE	12-Oct-13	A	POS	A
	TAI 19/2013	CATTLE	12-Oct-13	A	POS	A
	TAI 20/2013	CATTLE	14-Nov-13	A	POS	A

TAI 21/2013	CATTLE	21-Nov-13	A	POS	A
TAI 22/2013	CATTLE	29-Nov-13	A	POS	A
TAI 1/2014	CATTLE	02-Jan-14	A	POS	A
TAI 2/2014	CATTLE	02-Jan-14	A	POS	A
TAI 3/2014	CATTLE	10-Jan-14	A	POS	A
TAI 4/2014	CATTLE	16-Jan-14	A	POS	A

TOTAL: 93

* Sample results pending from previous report

KOREA, REPUBLIC OF (SOUTH)	SKR 1/2014	PIG	23-Jul-14	NEG	POS	FMDV GD
	SKR 2/2014	PIG	23-Jul-14	NEG	POS	FMDV GD
	SKR 3/2014	PIG	23-Jul-14	NEG	POS	FMDV GD
	SKR 4/2014	PIG	23-Jul-14	NEG	POS	FMDV GD
	SKR 5/2014	PIG	23-Jul-14	NEG	POS	FMDV GD
	SKR 6/2014	PIG	23-Jul-14	O	POS	O
	SKR 7/2014	PIG	24-Jul-14	NEG	POS	FMDV GD
	SKR 8/2014	PIG	24-Jul-14	NEG	POS	FMDV GD
	SKR 9/2014	PIG	24-Jul-14	NEG	POS	FMDV GD
	SKR 10/2014	PIG	24-Jul-14	NEG	POS	FMDV GD
SRI LANKA	SRL 3/2011	BOVINE	20-Mar-11	NEG	POS	FMDV GD
	SRL 4/2011	BOVINE	03-May-11	O	POS	O
	SRL 3/2012	BOVINE	06-Jun-12	NEG	POS	FMDV GD
	SRL 1/2013	BOVINE	01-Dec-13	O	POS	O
	SRL 2/2013	BOVINE	26-Dec-13	O	POS	O
	SRL 1/2014	BOVINE	01-Jan-14	O	POS	O
	SRL 2/2014	BOVINE	27-Jan-14	O	POS	O
	SRL 3/2014	BOVINE	27-Jan-14	O	POS	O
	SRL 4/2014	BOVINE	01-Feb-14	NEG	POS	FMDV GD
	SRL 5/2014	BOVINE	06-Feb-14	O	POS	O
	SRL 6/2014	BOVINE	10-Feb-14	O	POS	O
	SRL 7/2014	BOVINE	26-May-14	O	POS	O
	SRL 8/2014	BOVINE	11-Jun-14	O	POS	O
	SRL 9/2014	BOVINE	13-Jun-14	O	POS	O
	SRL 10/2014	BOVINE	16-Jun-14	NEG	POS	FMDV GD
	SRL 11/2014	PIG	16-Jun-14	O	POS	O
	SRL 12/2014	BUFFALO	17-Jun-14	NEG	POS	FMDV GD
	SRL 13/2014	BOVINE	17-Jun-14	NEG	POS	FMDV GD
	SRL 14/2014	BOVINE	17-Jun-14	NEG	POS	FMDV GD
	SRL 15/2014	BOVINE	18-Jun-14	O	POS	O
	SRL 16/2014	BOVINE	23-Jun-14	O	POS	O
	SRL 17/2014	BOVINE	03-Jul-14	O	POS	O
	SRL 18/2014	BOVINE	02-Mar-14	Pending	Pending	Pending
	SRL 19/2014	BOVINE	04-Apr-14	Pending	Pending	Pending
	SRL 20/2014	BOVINE	06-Apr-14	Pending	Pending	Pending
	SRL 21/2014	BOVINE	06-Apr-14	Pending	Pending	Pending
	SRL 22/2014	BOVINE	18-Jun-14	Pending	Pending	Pending
	SRL 23/2014	BOVINE	10-Jul-14	Pending	Pending	Pending
	SRL 24/2014	BOVINE	14-Jul-14	Pending	Pending	Pending
	SRL 25/2014	BOVINE	14-Jul-14	Pending	Pending	Pending
	SRL 26/2014	BOVINE	16-Jul-14	Pending	Pending	Pending
	SRL 27/2014	BOVINE	05-Aug-14	Pending	Pending	Pending
	SRL 28/2014	BOVINE	01-Sep-14	Pending	Pending	Pending
	SRL 29/2014	BUFFALO	10-Sep-14	Pending	Pending	Pending

	SRL 30/2014	BUFFALO	10-Sep-14	Pending	Pending	Pending
	SRL 31/2014	BUFFALO	10-Sep-14	Pending	Pending	Pending
	SRL 32/2014	BUFFALO	10-Sep-14	Pending	Pending	Pending
	SRL 33/2014	BOVINE	11-Sep-14	Pending	Pending	Pending
	SRL 34/2014	BOVINE	15-Sep-14	Pending	Pending	Pending
	SRL 35/2014	BOVINE	18-Sep-14	Pending	Pending	Pending
TUNISIA	TUN 1/2014	BOVINE	19-May-14	O	POS	O
	TUN 2/2014	BOVINE	28-May-14	O	POS	O
TOTAL:			52			

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
RT-PCR	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

TABLE B: Summary of samples collected and received to The Pirbright Institute (July-September 2014)

Country	No. of samples	Virus isolation in cell culture/ELISA							NVD	RT-PCR for FMD (or SVD) virus (where appropriate)	
		O	A	C	SAT 1	SAT 2	SAT 3	Asia 1		Positive	Negative
CAMBODIA*	3	3	-	-	-	-	-	-	-	3	-
CAMEROON*	46	-	4	-	-	9	-	-	33	35	11
LAOS*	6	3	3	-	-	-	-	-	-	6	-
MALAYSIA*	51	10	5	-	-	-	-	-	20	49	2
PAKISTAN*†	31	23	6	-	-	-	-	4	-	31	-
THAILAND*	21	2	19	-	-	-	-	-	-	21	-
TOTAL	158	41	37	-	-	9	-	4	53	145	13
* Sample results pending from previous report											
ALGERIA	3	3	-	-	-	-	-	-	-	3	-
KOREA, REPUBLIC OF (SOUTH)	10	1	-	-	-	-	-	-	9	10	-
SRI LANKA	40	15	-	-	-	-	-	-	7	22	-
TUNISIA	2	2	-	-	-	-	-	-	-	2	-
TOTAL	55	21	-	-	-	-	-	-	16	37	-
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										
NVD	no FMD, SVD or vesicular stomatitis virus detected										
NT	not tested										
RT-PCR	reverse transcription polymerase chain reaction for FMD (or SVD) viral genome										
*	Sample results pending from previous report										
†	2 samples from Pakistan contained a mixture of FMDVs of types O and A										

TABLE C: Antigenic characterisation of FMD field isolates by matching with vaccine strains by 2dmVNT from July to September 2014.**Type O:****Vaccine Matching Studies for Serotype O FMDV by VNT**

Sample Reference	O 3039	O BFS	O Manisa	O TAW/98	O TUR/5/09	
					Two Doses	Single Dose
ALG/1/2014	Borderline	N	N	Borderline		M
CAM/2/2013	Borderline		N	M		M
HKN/13/2014	N		N	N	N	
LAO/1/2013	N		N	M		N
NIG/3/2014	M		N		M	
NIG/4/2014	M		N		M	
PAK/17/2014	N		N	N	N	
PAK/24/2014	M		M	M	M	
SKR/6/2014	M		N	M	M	
SRL/1/2013	M	N	N	M		M
SRL/1/2014	M		Borderline	M		M
TAI/10/2013	N		N	M		M
TUN/1/2014	Borderline	N	N	Borderline		M

Type A:**Vaccine Matching Studies for Serotype A FMDV by VNT**

Sample Reference	A ERI/98	A IRN/05	A22 IRQ	A MAY/97	A TUR/06
NIG/3/2013	M	N	N		M
NIG/7/2013	M	N	N		Borderline
PAK/10/2014		M	M	N	M
PAK/22/2014		N	N	N	M
TAI/4/2014		N	M	N	N

Type Asia 1:**Vaccine Matching Studies for Serotype Asia-1 FMDV by VNT**

	Asia1 IND/8/79	Asia1 Shamir
PAK/19/2014	N	N
PAK/20/2014	N	N

Type SAT 2:**Vaccine Matching Studies for Serotype SAT 2 FMDV by VNT**

	SAT 2 ERI 3218	SAT 2 ZIM/7/83
NIG/17/2011	N	N
NIG/3/2012	N	M

Results Descriptor:

M : = Vaccine Match- $r_1 = \geq 0.3$. 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.

N : = No Vaccine Match - $r_1 = < 0.3$. Suggests that the field isolate is so different from the vaccine strain that the vaccine is unlikely to protect

Borderline = Any r_1 values between 0.28 to 0.32

□ = Not tested against this vaccine

Annex 2. Recent FMD Publications (July-September 2014) cited by PubMed (Pirbright Institute papers and authors are highlighted in **BOLD**)

- **Fowler VL, Bankowski BM, Armson B, Di Nardo A, Valdazo-Gonzalez B, Reid SM, Barnett PV, Wadsworth J, Ferris NP, Mioulet V, King DP.** Recovery of Viral RNA and Infectious Foot-and-Mouth Disease Virus from Positive Lateral-Flow Devices. *PLoS One*. 2014 14;9(10):e109322. doi: 10.1371/journal.pone.0109322. eCollection.
- **Logan G, Freimanis GL, King DJ, Valdazo-González B, Bachanek-Bankowska K, Sanderson ND, Knowles NJ, King DP, Cottam EM.** A universal protocol to generate consensus level genome sequences for foot-and-mouth disease virus and other positive-sense polyadenylated RNA viruses using the Illumina MiSeq. *BMC Genomics*. 2014 Sep 30;15(1):828. [Epub ahead of print] PubMed PMID: 25269623.
- **Gonzales JL, Barrientos MA, Quiroga JL, Ardaya D, Daza O, Martinez C, Orozco C, Crowther J, Paton DJ.** Within herd transmission and evaluation of the performance of clinical and serological diagnosis of foot-and-mouth disease in partially immune cattle herds. *Vaccine*. 2014 Sep 26. pii: S0264-410X(14)01288-2. doi: 10.1016/j.vaccine.2014.09.029. [Epub ahead of print] PubMed PMID: 25261377.
- **Di Nardo A, Knowles NJ, Wadsworth J, Haydon DT, King DP.** Phylodynamic reconstruction of O CATHAY topotype foot-and-mouth disease virus epidemics in the Philippines. *Vet Res*. 2014 Aug 24;45(1):90. [Epub ahead of print] PubMed PMID: 25209700; PubMed Central PMCID: PMC4177241.
- **Bari FD, Parida S, Teklehiorghis T, Dekker A, Sangula A, Reeve R, Haydon DT, Paton DJ, Mahapatra M.** Genetic and antigenic characterisation of serotype A FMD viruses from East Africa to select new vaccine strains. *Vaccine*. 2014 Oct 7;32(44):5794-800. doi: 10.1016/j.vaccine.2014.08.033. Epub 2014 Aug 26. PubMed PMID: 25171846; PubMed Central PMCID: PMC4194315.
- **Waters RA, Fowler VL, Armson B, Nelson N, Gloster J, Paton DJ, King DP.** Preliminary validation of direct detection of foot-and-mouth disease virus within clinical samples using reverse transcription loop-mediated isothermal amplification coupled with a simple lateral flow device for detection. *PLoS One*. 2014 Aug 28;9(8):e105630. doi: 10.1371/journal.pone.0105630. eCollection 2014. PubMed PMID: 25165973; PubMed Central PMCID: PMC4148330.
- **Panjwani A, Strauss M, Gold S, Wenham H, Jackson T, Chou JJ, Rowlands DJ, Stonehouse NJ, Hogle JM, Tuthill TJ.** Capsid protein VP4 of human rhinovirus induces membrane permeability by the formation of a size-selective multimeric pore. *PLoS Pathog*. 2014 Aug 7;10(8):e1004294. doi: 10.1371/journal.ppat.1004294. eCollection 2014 Aug. PubMed PMID: 25102288; PubMed Central PMCID: PMC4125281.
- **Reid SM, Mioulet V, Knowles NJ, Shirazi N, Belsham GJ, King DP.** Development of tailored real-time RT-PCR assays for the detection and differentiation of serotype O, A and Asia-1 foot-and-mouth disease virus lineages circulating in the Middle East. *J Virol Methods*. 2014 Oct;207:146-53. doi: 10.1016/j.jviromet.2014.07.002. Epub 2014 Jul 9. PubMed PMID: 25016065.
- **Xin A, Zhu M, Hu Q, Miao H, Peng Z, He Y, Gao L, Li H.** Effect of amino acid mutation at position 127 in 3A of a rabbit-attenuated foot-and-mouth disease virus serotype Asia1 on viral replication and infection. *Virol Sin*. 2014 Oct 14. [Epub ahead of print] PubMed PMID: 25326348.
- **Fukai K, Yamada M, Morioka K, Ohashi S, Yoshida K, Kitano R, Yamazoe R, Kanno T.** Dose-dependent responses of pigs infected with foot-and-mouth disease virus O/JPN/2010 by the intranasal and intraoral routes. *Arch Virol*. 2014 Oct 4. [Epub ahead of print] PubMed PMID: 25281431.
- **González-Magaldi M, Martín-Acebes MA, Kremer L, Sobrino F.** Membrane Topology and Cellular Dynamics of Foot-and-Mouth Disease Virus 3A Protein. *PLoS One*. 2014 Oct 2;9(9):e106685. doi: 10.1371/journal.pone.0106685. eCollection 2014. PubMed PMID: 25275544; PubMed Central PMCID: PMC4183487.
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Annex 3. RECOMMENDATIONS FROM WRLFMD® ON FMD VIRUS STRAINS TO BE INCLUDED IN FMDV ANTIGEN BANKS –September 2014

High Priority

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*)

(not in order of importance)

Medium Priority

A Eritrea
SAT 2 Zimbabwe
SAT 1 South Africa
A Malaysia 97 (*or Thai equivalent such as A/NPT/TAI/86*)
A Argentina 2001
O Taiwan 97 (*pig-adapted strain or Philippine equivalent*)

(not in order of importance)

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

