



WRLFMD Quarterly Report January-March 2013

Reference Laboratory Contract Report

4/26/2013
WRLFMD



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Reference Laboratory Contract Report^{1,2} January-March 2013

Foot-and-Mouth Disease

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² Copies of all the individual reports cited herein can be obtained from Dr. Jef Hammond, The Pirbright Institute, jef.hammond@pirbright.ac.uk.

Summary

Bhutan

Eight samples were received. One sample from cattle in Sakteng, Trashigang, RLDC Kanglung, typed as **FMDV O** and genotyped as ME-SA/Ind-2001d being most closely related to a virus from Tamil Nadu, India collected in 2011.

PR China

The following outbreaks of FMD have been reported during the reporting period:

04/01/2013 - **FMD type O** in pigs in the Economic development zone, Guangyuan, SICHUAN.

18/02/2013 - **FMD type A** in pigs in Shange town, Maoming, GUANGDONG.

19/02/2013 - **FMD type O** in cattle in Deji Village, Qushui, Lasha, TIBET.

15/03/2013 - **FMD type A** in cattle in Chengbei district, Xining, QINGHAI.

Genotyping of the **FMD type A** viruses by the LVRI revealed the viruses to belong to the ASIA topotype, Sea-97 lineage. This lineage is endemic in Southeast Asia. These were closely related to the type A virus from the Russian Federation (see below).

Iran

Twenty-three viruses were isolated from a batch of 27 samples. Five **FMD type O** viruses belonged to the ME-SA topotype, PanAsia-2 lineage (with one belonging to the FAR-09 sub-lineage and four to ANT-10). Eighteen **FMD type A** viruses all belonged to the ASIA topotype, Iran-05 lineage (with 1, 11 and 6 belonging to the AFG-07, SIS-10 and SIS-12 sub-lineages, respectively).

Pakistan

Thirty-three samples were received in December 2012. Thirty-one FMD viruses were isolated and genotyped with the following results:

4 - O/ME-SA/PanAsia-2^{ANT-10}

2 - O/ME-SA/PanAsia-2^(unnamed)

8 - A/ASIA/Iran-05^{HER-10}

2 - A/ASIA/Iran-05^{SIS-12}

15 - Asia1/ASIA/Sindh-08

Russian Federation

FMD type A outbreaks have been reported in four villages in the ZABAJKAL`SKIY KRAY region:

08/03/2013 - Molodezhny, Priargounsky raion (cattle & pigs).

25/03/2013 - Village Srednyaya-Borsya, Kalgansky raion (cattle).

28/03/2013 - Village Duroi, Priargounsky raion (cattle).

28/03/2013 - Village Priargounsk, Priargounsky raion (cattle).

Genotyping of the **FMD type A** viruses by the FGI-ARRIAH revealed the viruses to belong to the ASIA topotype, Sea-97 lineage. These were closely related to the type A viruses from P.R. China (see below).

United Arab Emirates

Two virus isolates were received from an outbreak of FMD in Scimitar-horned oryx (*Oryx dammah*) in Abu Dhabi, collected on 29th January 2013. These were typed as FMDV O and genotyped as ME-SA/PanAsia-2^{ANT-10} being most closely related to viruses from Iran collected in 2012-2013 (see below).

AFRICA

Tanzania

Thirty-two samples were received and 18 FMD viruses isolated with the following genotyping results:

15 - A/AFRICA/G-I

2 - SAT1/I

1 - SAT2/IV

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/2013.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 January and March 2013 is shown in Annex 1 Table A. A record of all samples received to The Pirbright Institute (January to March 2013) is shown in Annex 1 Table B.

Table 1: Status of sequencing of samples received by the WRLFMD® from January to March 2013.

Batch	Date Recd.	Country	Serotype	No. of samples	No. of sequences	Status
WRLFMD/2012/00037*	13/12/2012	Pakistan	O	6	6	Completed
			A	10	10	Completed
			Asia 1	15	15	Completed
WRLFMD/2013/00001	11/01/2013	Bhutan	O	1	1	Completed
WRLFMD/2013/00002	11/01/2013	Iran	O	5	5	Completed
			A	18	18	Completed
WRLFMD/2013/00004	07/03/2013	United Arab Emirates	O	2	2	Completed
WRLFMD/2013/00005	13/03/2013	Tanzania	A	15	15	Completed
			SAT 1	2	2	Completed
			SAT 2	1	1	Completed
Total				75	75	

*, pending from last Quarterly Report

Detailed Analysis:

ASIA

Bhutan

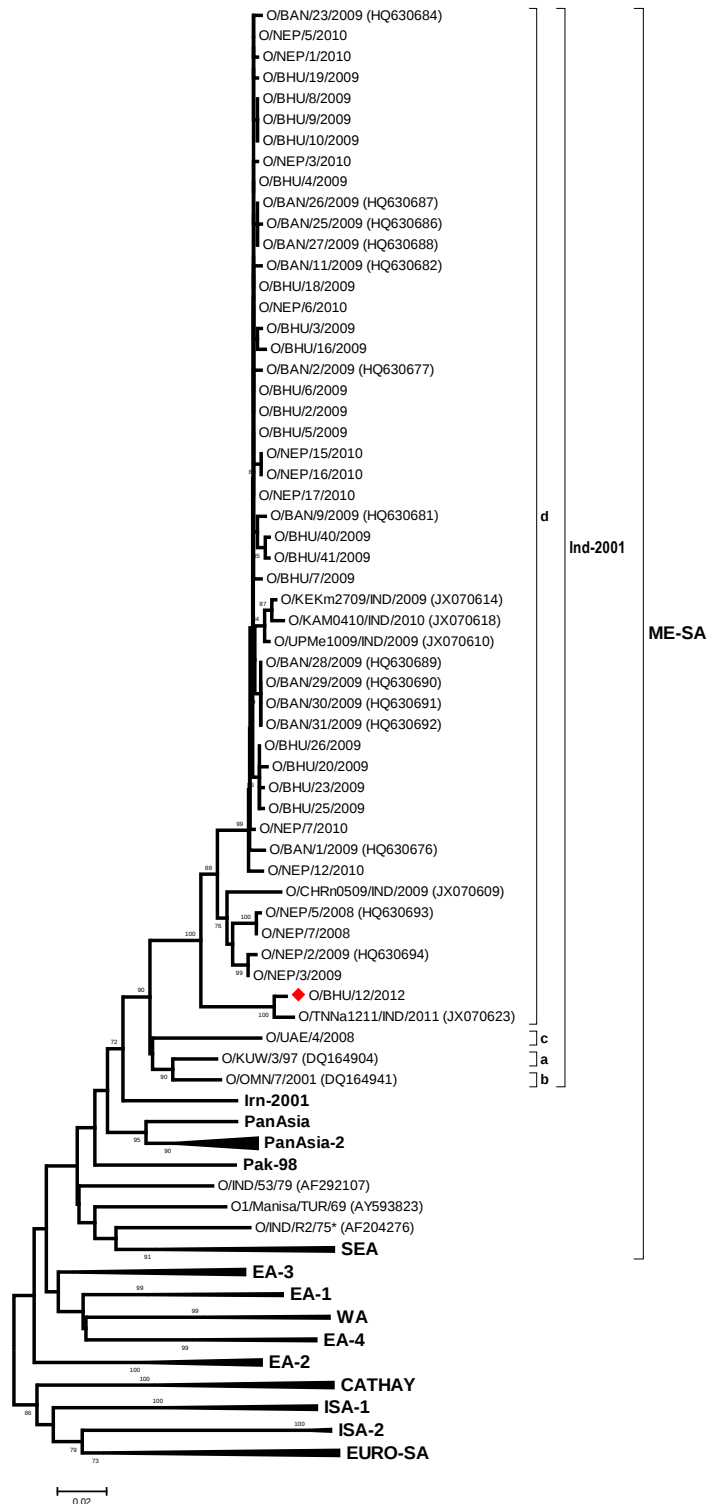
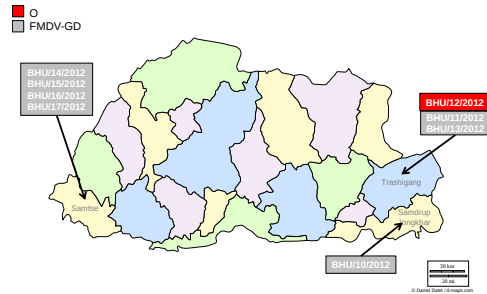
WRLFMD/2013/00001

Date received: 11/01/2013

No. of samples: 8

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

FMDV-GD: 7



Iran

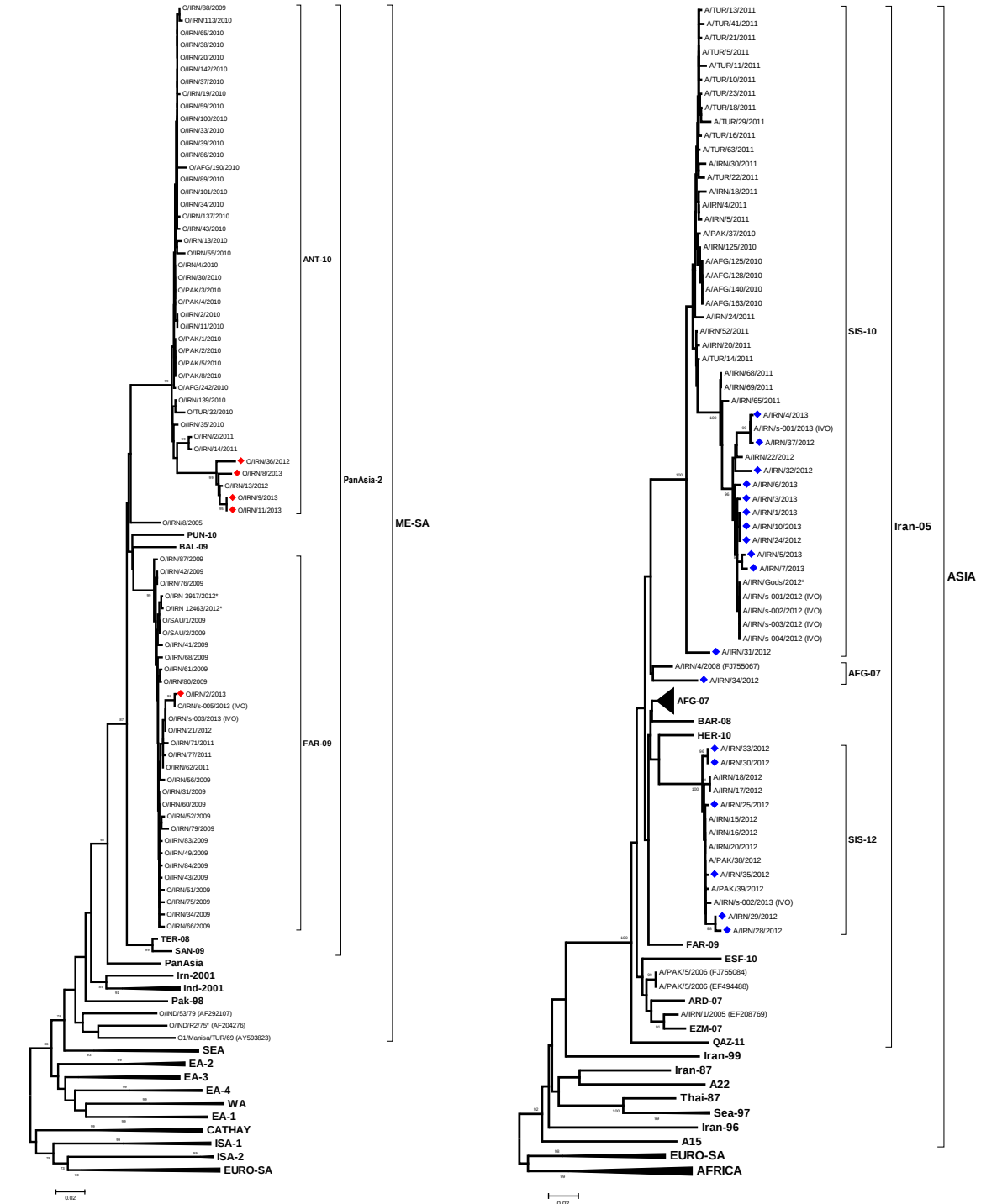
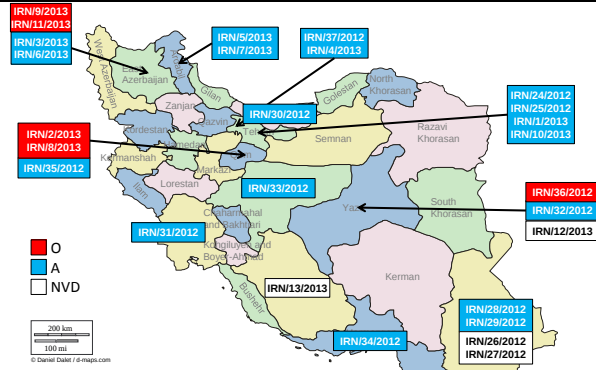
WRLFMD/2013/00002

Date received: 11/01/2013

No. of samples: 27

O/ME-SA/: PanAsia-2^{ANT-10}: 4O/ME-SA/: PanAsia-2^{FAR-09}: 1A/ASIA/Iran-05^{AFG-07}: 1A/ASIA/Iran-05^{SIS-10}: 11A/ASIA/Iran-05^{SIS-12}: 6

NVD: 4



Pakistan

WRLFMD/2012/00037

Date received: 13/12/2012

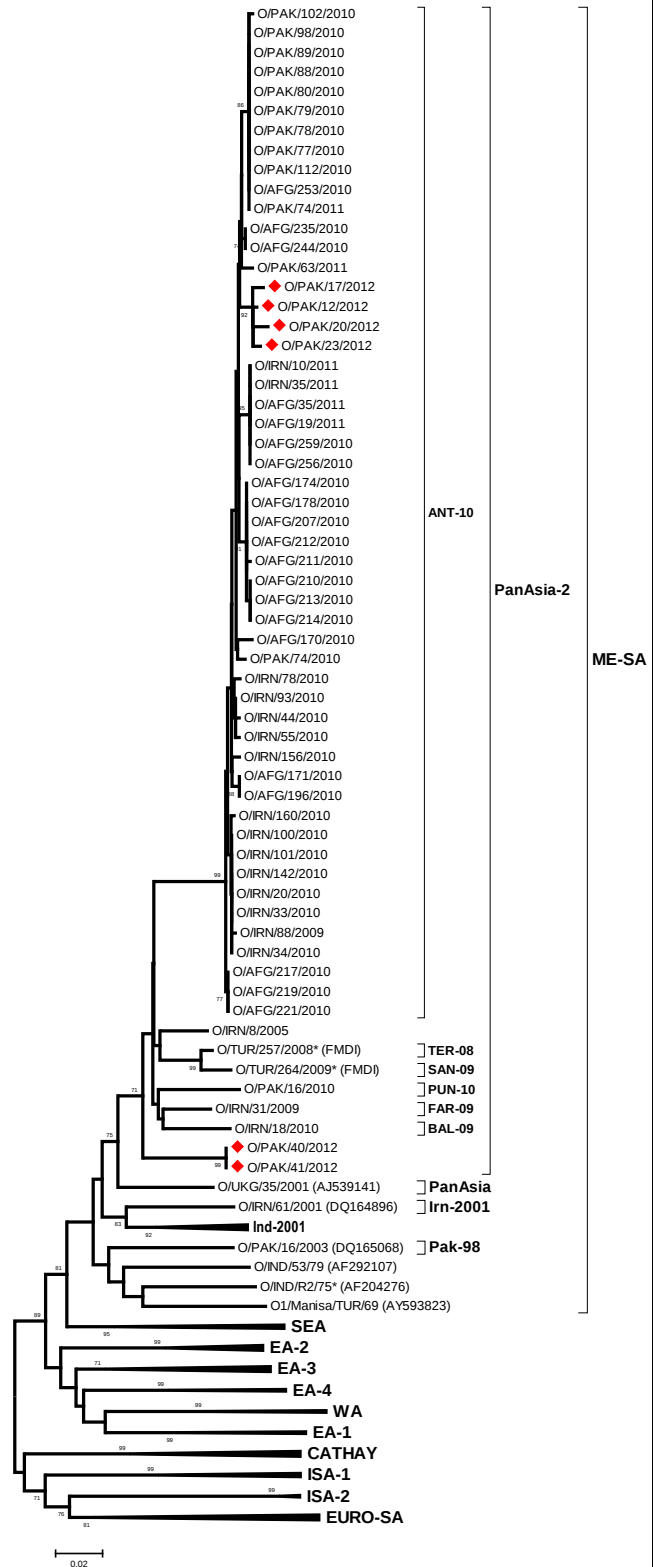
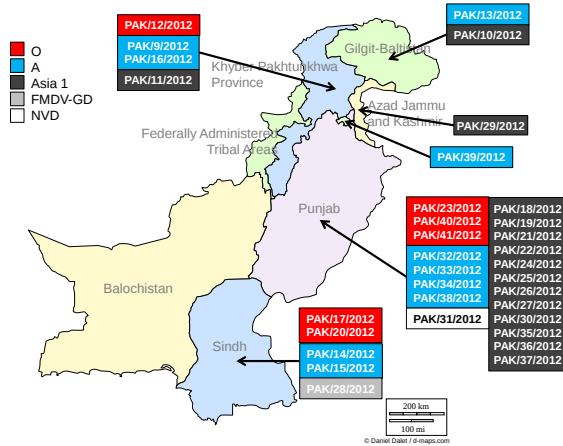
No. of samples: 33

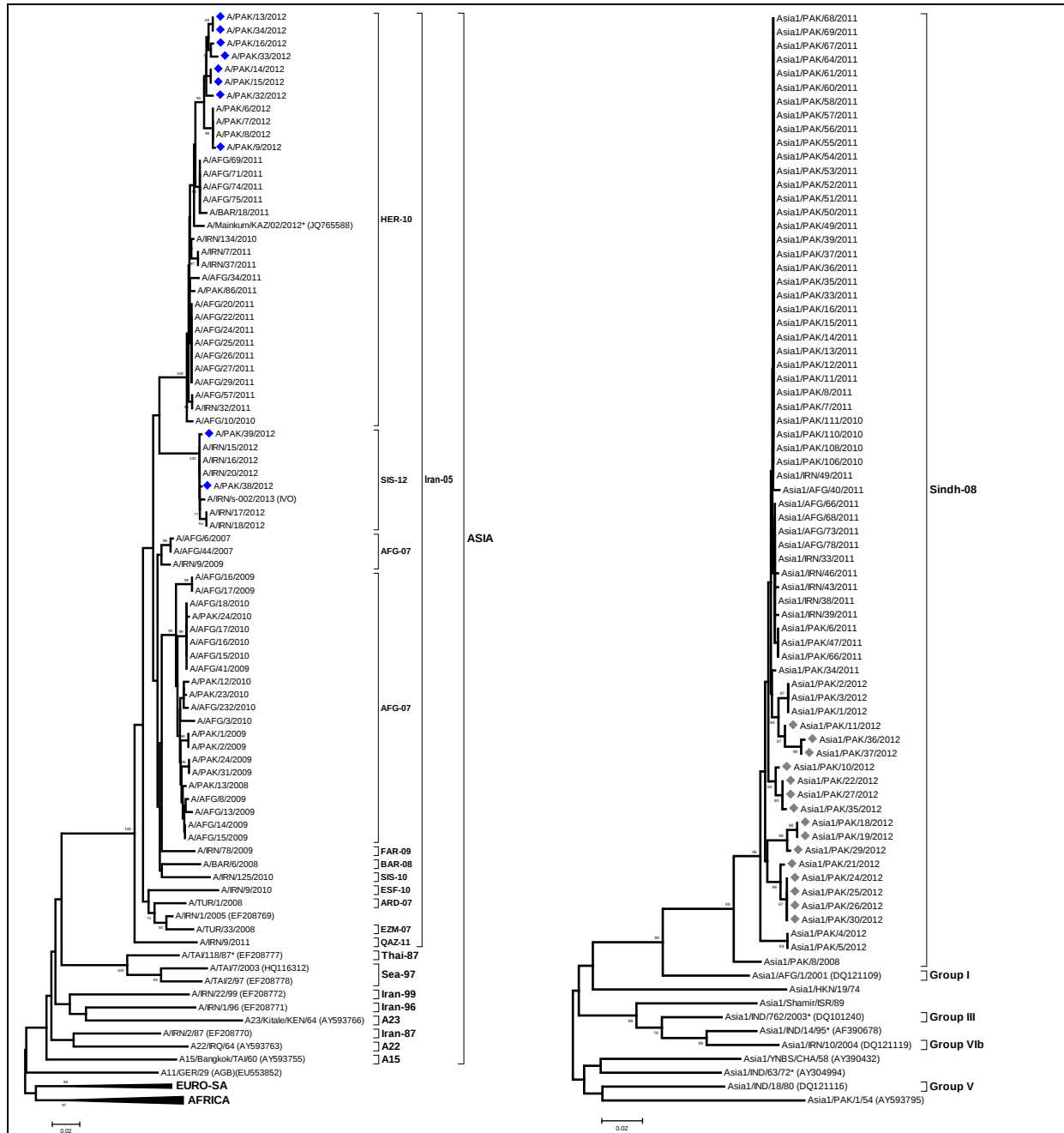
O/ME-SA/PanAsia-2^{ANT-10}: 4O/ME-SA/PanAsia-2^(unnamed): 2A/ASIA/Iran-05^{HER-10}: 8A/ASIA/Iran-05^{SIS-12}: 2

Asia1/ASIA/Sindh-08: 15

FMDV-GD: 1

NVD: 1



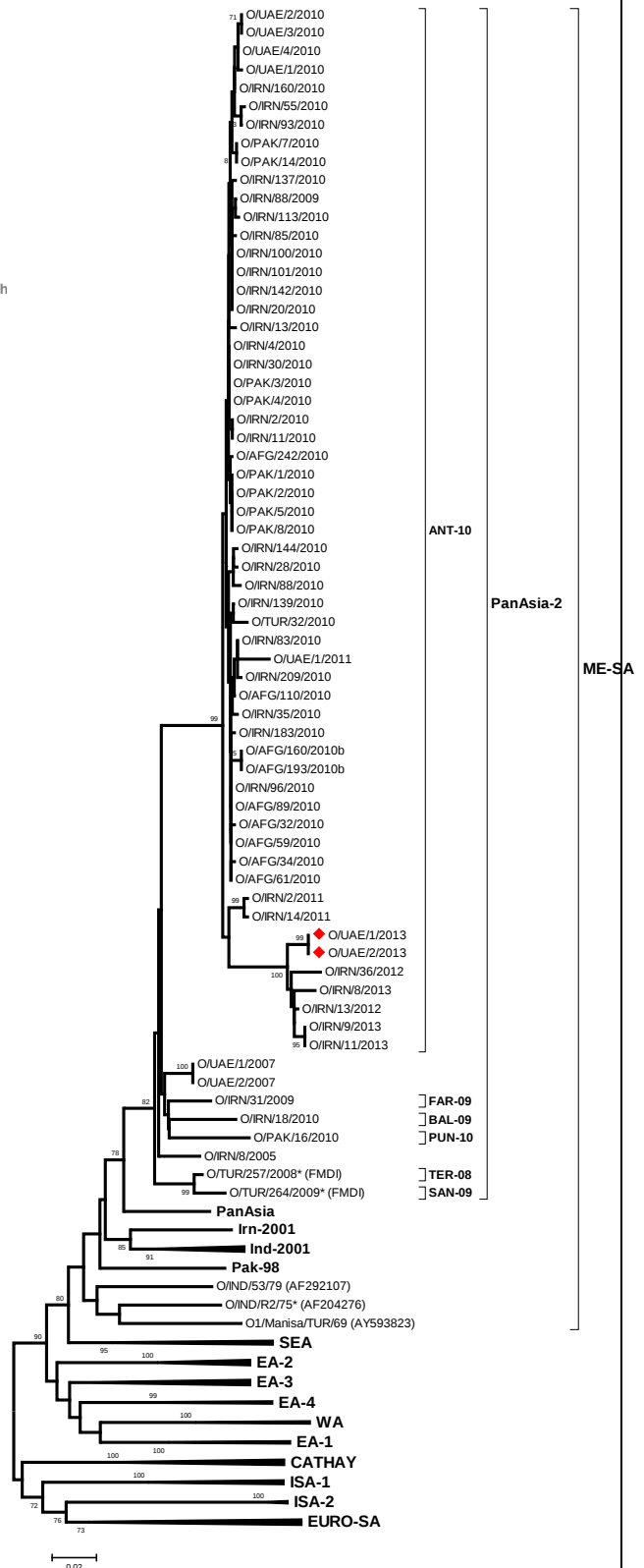
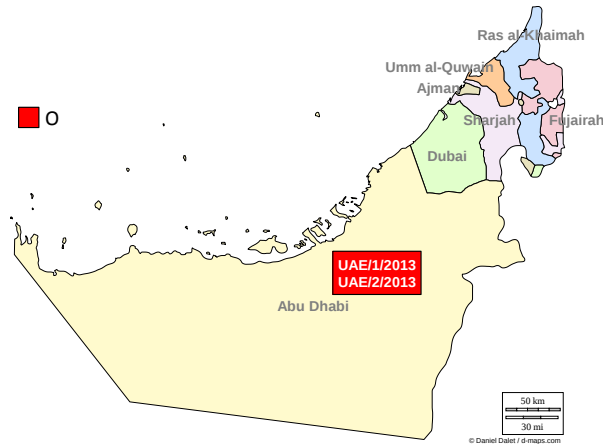


United Arab Emirates

WRLFMD/2013/00004

Date received: 07/03/2013

No. of samples: 2

O/ME-SA/PanAsia-2^{ANT-10}; 2

VP1 sequences received

P.R. China**(LVRI)**

Date received: 07/03/2013

A/GDMM-China-2013-S

Date received: 09/04/2013

A/QHXN-CHA-2013-B

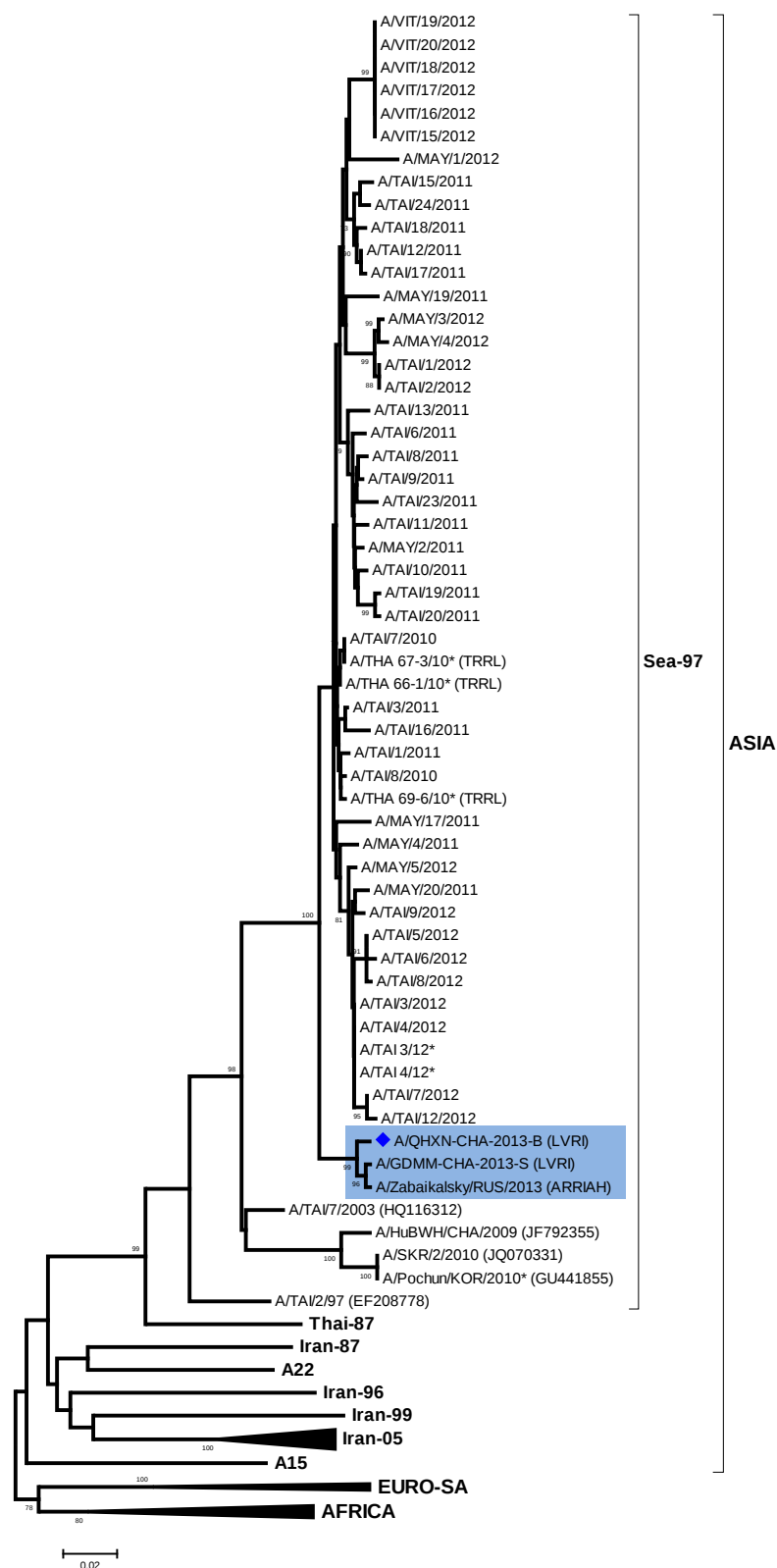
Russian Federation**(FGI-ARRIAH)**

Date received: 21/03/2013

A/Zabaikalsky/RUS/2013

Topotype: ASIA

Lineage: Sea-97



AFRICA

Tanzania

WRLFMD/2013/00005

Date received: 13/03/2013

No. of samples: 32

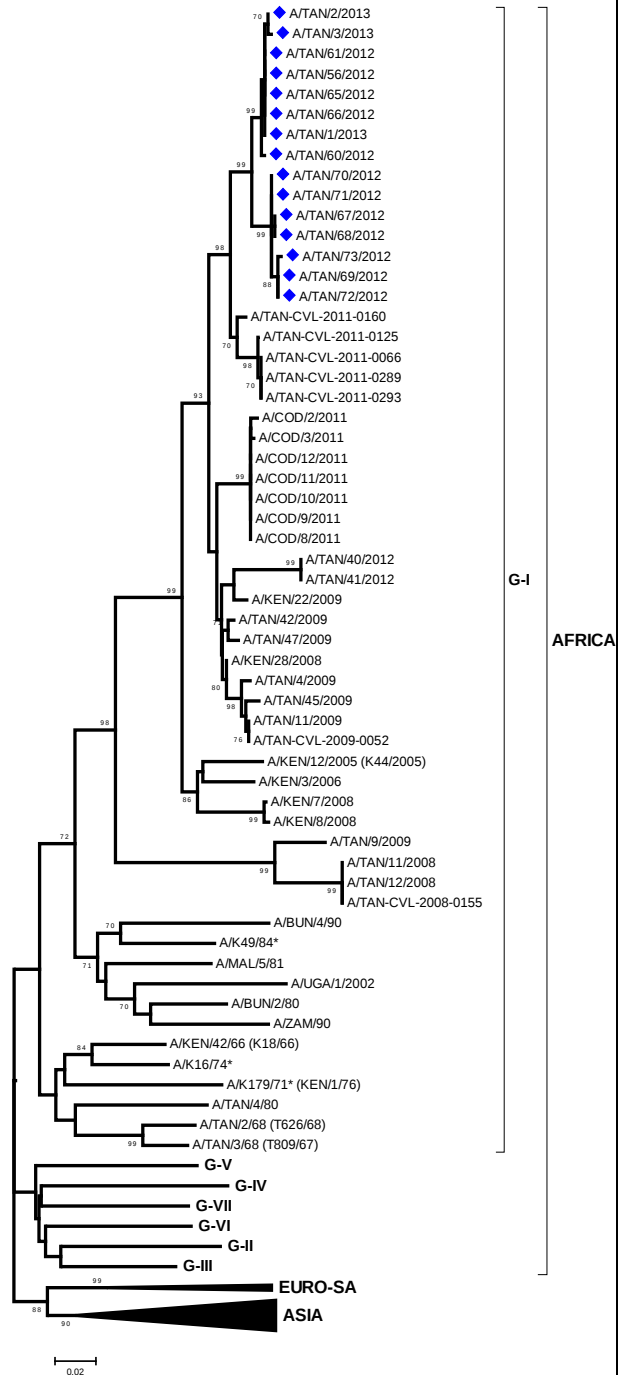
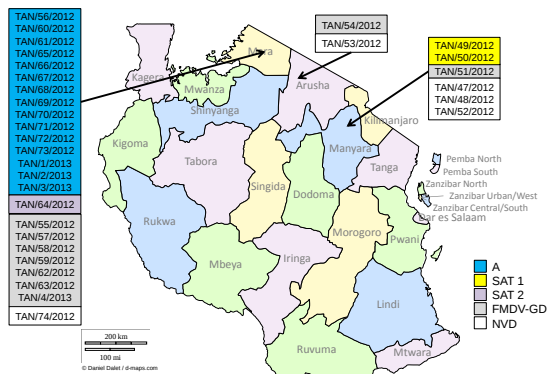
A/AFRICA/G-I: 15

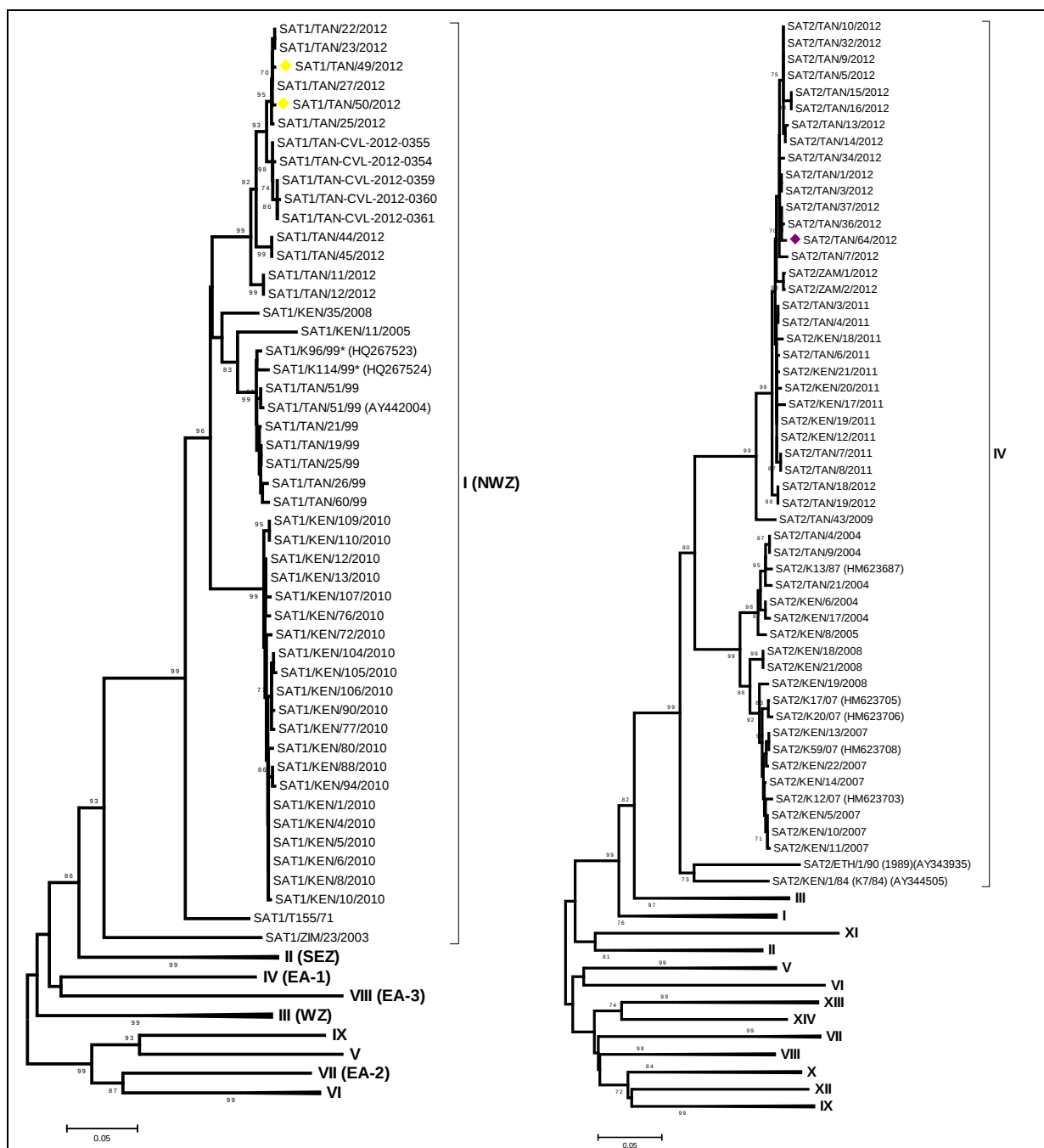
SAT1/I: 2

SAT2/IV: 1

FMDV-GD: 9

NVD: 5





Vaccine matching

Three FMDV type O isolates (See Table C, Type O for details) from Sri Lanka collected in 2009, 2010 and 2012 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). All isolates showed antigenic matching with O 4625, and O TUR 5/09 and 2 isolates showed matching with O Manisa (Table C).

Six FMDV type A viruses (See Table C, Type A for details) from Pakistan, Tanzania and Vietnam collected during 2012 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT).

Three isolates from Pakistan showed variable antigenic matching with A IRN 2005, A TUR 06 and A₂₂ IRQ vaccine strains.

The virus from Tanzania showed close antigenic match with A IRN 2005, A TUR 06 and A₂₂ IRQ. The two isolates from Vietnam showed no match to any of the vaccine strains tested (Table C).

One FMDV type SAT 2 virus (see table C, Type SAT 2 for details) from Egypt 2012 was antigenically matched with both SAT 2 Eritrea and SAT 2 ZIM vaccine strains, however, the SAT 2 virus collected from Tanzania in 2012 showed no match with either of the tested vaccine strains (Table C).

Annex 1. TABLE A: Clinical sample diagnostics made by the WRLFMD® between January-March 2013

Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results		
				VI/ELISA	RT-PCR	Final report
BHUTAN	BHU 10/2012	BOVINE	13-Sep-12	NEG	POS	FMDV GD
	BHU 11/2012	BOVINE	24-Oct-12	NEG	POS	FMDV GD
	BHU 12/2012	BOVINE	24-Oct-12	O	POS	O
	BHU 13/2012	BOVINE	24-Oct-12	NEG	POS	FMDV GD
	BHU 14/2012	BOVINE	18-Nov-12	NT	POS	FMDV GD
	BHU 15/2012	BOVINE	18-Nov-12	NT	POS	FMDV GD
	BHU 16/2012	BOVINE	18-Nov-12	NT	POS	FMDV GD
	BHU 17/2012	BOVINE	18-Nov-12	NT	POS	FMDV GD
IRAN	IRN 24/2012	CATTLE	09-Oct-12	A	POS	A
	IRN 25/2012	CATTLE	25-Oct-12	A	POS	A
	IRN 26/2012	SHEEP	30-Oct-12	NEG	NEG	NVD
	IRN 27/2012	SHEEP	30-Oct-12	NEG	NEG	NVD
	IRN 28/2012	CATTLE	04-Nov-12	A	POS	A
	IRN 29/2012	CATTLE	04-Nov-12	A	POS	A
	IRN 30/2012	CATTLE	05-Nov-12	A	POS	A
	IRN 31/2012	CATTLE	06-Nov-12	A	POS	A
	IRN 32/2012	CATTLE	08-Nov-12	A	POS	A
	IRN 33/2012	CATTLE	17-Nov-12	A	POS	A
	IRN 34/2012	CATTLE	17-Nov-12	A	POS	A
	IRN 35/2012	CATTLE	18-Dec-12	A	POS	A
	IRN 36/2012	CATTLE	20-Dec-12	O	POS	O
	IRN 37/2012	CATTLE	24-Dec-12	A	POS	A
	IRN 1/2013	CATTLE	01-Jan-13	A	POS	A
	IRN 2/2013	CATTLE	01-Jan-13	O	POS	O
	IRN 3/2013	CATTLE	01-Jan-13	A	POS	A
	IRN 4/2013	CATTLE	01-Jan-13	A	POS	A
	IRN 5/2013	CATTLE	01-Jan-13	A	POS	A
	IRN 6/2013	CATTLE	01-Jan-13	A	POS	A
	IRN 7/2013	CATTLE	01-Jan-13	A	POS	A

	IRN 8/2013	CATTLE	01-Jan-13	O	POS	O
	IRN 9/2013	CATTLE	01-Jan-13	O	POS	O
	IRN 10/2013	CATTLE	01-Jan-13	A	POS	A
	IRN 11/2013	CATTLE	01-Jan-13	O	POS	O
	IRN 12/2013	SHEEP	01-Jan-13	NEG	NEG	NVD
	IRN 13/2013	SHEEP	01-Jan-13	NEG	NEG	NVD
MAURITANIA	MAU 1/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 2/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 3/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 4/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 5/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 6/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 7/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 8/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 9/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 10/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 11/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 12/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 13/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 14/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 15/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 16/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 17/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 18/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 19/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 20/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 21/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 22/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 23/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 24/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 25/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 26/2012	CATTLE	09-Dec-12	NT	NEG	NVD
	MAU 27/2012	CATTLE	09-Dec-12	NT	NEG	NVD
PAKISTAN*	PAK 9/2012	CATTLE	16-Jan-12	A	POS	A
	PAK 10/2012	CATTLE	07-Feb-12	ASIA-1	POS	ASIA-1
	PAK 11/2012	CATTLE	09-Feb-12	ASIA-1	POS	ASIA-1
	PAK 12/2012	CATTLE	21-Feb-12	O	POS	O
	PAK 13/2012	CATTLE	24-Feb-12	A	POS	A
	PAK 14/2012	CATTLE	20-Mar-12	A	POS	A
	PAK 15/2012	CATTLE	20-Mar-12	A	POS	A
	PAK 16/2012	BUFFALO	06-Apr-12	A	POS	A
	PAK 17/2012	CATTLE	07-Apr-12	O	POS	O
	PAK 18/2012	BUFFALO	08-Apr-12	ASIA-1	POS	ASIA-1
	PAK 19/2012	BUFFALO	08-Apr-12	ASIA-1	POS	ASIA-1
	PAK 20/2012	CATTLE	11-Apr-12	O	POS	O
	PAK 21/2012	CATTLE	12-Apr-12	ASIA-1	POS	ASIA-1
	PAK 22/2012	CATTLE	26-Apr-12	ASIA-1	POS	ASIA-1
	PAK 23/2012	CATTLE	27-Apr-12	O	POS	O
	PAK 24/2012	CATTLE	27-Apr-12	ASIA-1	POS	ASIA-1
	PAK 25/2012	CATTLE	27-Apr-12	ASIA-1	POS	ASIA-1
	PAK 26/2012	CATTLE	27-Apr-12	ASIA-1	POS	ASIA-1
	PAK 27/2012	CATTLE	08-May-12	ASIA-1	POS	ASIA-1
	PAK 28/2012	CATTLE	09-May-12	NEG	POS	FMDV GD

	PAK 29/2012	BUFFALO	14-May-12	ASIA-1	POS	ASIA-1
	PAK 30/2012	CATTLE	14-May-12	ASIA-1	POS	ASIA-1
	PAK 31/2012	CATTLE	30-May-12	NEG	NEG	NVD
	PAK 32/2012	CATTLE	20-Jun-12	A	POS	A
	PAK 33/2012	CATTLE	20-Jun-12	A	POS	A
	PAK 34/2012	BUFFALO	21-Jun-12	A	POS	A
	PAK 35/2012	BUFFALO	21-Jun-12	ASIA-1	POS	ASIA-1
	PAK 36/2012	BUFFALO	30-Jun-12	ASIA-1	POS	ASIA-1
	PAK 37/2012	BUFFALO	30-Jun-12	ASIA-1	POS	ASIA-1
	PAK 38/2012	CATTLE	28-Sep-12	A	POS	A
	PAK 39/2012	CATTLE	05-Nov-12	A	POS	A
	PAK 40/2012	CATTLE	23-Nov-12	O	POS	O
	PAK 41/2012	CATTLE	23-Nov-12	O	POS	O
UNITED ARAB EMIRATES	UAE 1/2013	SCIMITAR HORNED ORYX	29-Jan-13	O	POS	O
	UAE 2/2013	SCIMITAR HORNED ORYX	29-Jan-13	O	POS	O
TOTAL :		129				

*Pakistan samples pending from previous report

FMD(V)	Foot-and-mouth disease (virus)
FMDV GD	Genome detected
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 (January-March 2013)

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
BHUTAN	8	1	-	-	-	-	-	-	7	8	-
IRAN	27	5	18	-	-	-	-	-	4	23	4
MAURITANIA	27	-	-	-	-	-	-	-	27	-	27
PAKISTAN	33	6	10	-	-	-	-	15	2	32	1
TANZANIA	32	-	15	-	2	1	-	-	14	21	5
UNITED ARAB EMIRATES	2	2	-	-	-	-	-	-	-	2	-
TOTAL	129	14	43	-	2	1	-	15	54	86	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

TABLE C: Antigenic characterisation of FMD field isolates by matching with vaccine strains by 2dmVNT from 1st January to 31st March 2012

Type O:

Vaccine Matching studies for serotype O FMDV by VNT-WRLFMD®				
SAMPLE REF	SEROTYPE	O Manisa	O Tur 5/09	O 4625
O Srl 2/12	O	N	M	M
O Srl 3/09	O	M	M	M
O Srl 9/10	O	M	M	M

Type A:

Vaccine matching studies for serotype A FMDV by VNT-WRLFMD®							
SAMPLE REF	SEROTYPE	A IND 17/82	A IRN 2005	A MAY 97	A TUR 06	A22 IRQ	A ERI 98
PAK 13/2012	A	N	M	N	M	M	
PAK 32/2012	A	M	N	N	M	N	
PAK 39/2012	A	N	N	M	N	N	
TAN 40/2012	A		M	N	M	M	N
VIT 15/2012	A		N	N	N	N	
VIT 16/2012	A		N	N	N	N	

TYPE SAT 2:

Vaccine Matching studies for serotype SAT2 FMDV by VNT-WRLFMD®			
SAMPLE REF	SEROTYPE	SAT2 Eritrea	SAT2 ZIM
TAN 36/2012	SAT2	N	N
EGY 31/2012	SAT2	M	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

□ = Not tested against this vaccine

Annex 2. Recent FMD Publications cited by PubMed

1. Gowane GR, Sharma AK, Sankar M, Narayanan K, Das B, Subramaniam S, Pattnaik B. Association of BoLA DRB3 alleles with variability in immune response among the crossbred cattle vaccinated for foot-and-mouth disease (FMD). *Res Vet Sci.* 2013 Mar 28. doi:pii: S0034-5288(13)00078-7. 10.1016/j.rvsc.2013.03.001. [Epub ahead of print] PubMed PMID: 23541924.
2. Wanczyk H, Barker T, Rood D, Zapata DI, Howell AR, Richardson SK, Zinckgraf J, Marusov GP, Lynes MA, Silbart LK. Cloning and Characterization of a Hybridoma Secreting a 4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)-Specific Monoclonal Antibody and Recombinant F(ab). *Toxins (Basel).* 2013 Mar 19;5(3):568-89. doi: 10.3390/toxins5030568. PubMed PMID: 23518474.
3. Larocco M, Krug PW, Kramer E, Ahmed Z, Pacheco JM, Duque H, Baxt B, Rodriguez LL. A Continuous Bovine Kidney Cell Line Constitutively Expressing Bovine α Vss6 Integrin Has Increased Susceptibility To Foot and Mouth Disease Virus. *J Clin Microbiol.* 2013 Mar 20. [Epub ahead of print] PubMed PMID: 23515553.
4. Belsham GJ. Influence of the Leader protein coding region of foot-and-mouth disease virus on virus replication. *J Gen Virol.* 2013 Mar 20. [Epub ahead of print] PubMed PMID: 23515027.
5. Zhou JH, You YN, Chen HT, Zhang J, Ma LN, Ding YZ, Pejsak Z, Liu YS. The effects of the synonymous codon usage and tRNA abundance on protein folding of the 3C protease of foot-and-mouth disease virus. *Infect Genet Evol.* 2013 Mar 14;16C:270-274. doi: 10.1016/j.meegid.2013.02.017. [Epub ahead of print] PubMed PMID: 23499709.
6. Alejo DM, Moraes MP, Liao X, Dias CC, Tulman ER, Segundo FD, Rood D, Grubman MJ, Silbart LK. An adenovirus vectored mucosal adjuvant augments protection of mice immunized intranasally with an adenovirus-vectored foot-and-mouth disease virus subunit vaccine. *Vaccine.* 2013 Apr 26;31(18):2302-9. doi:10.1016/j.vaccine.2013.02.060. Epub 2013 Mar 13. PubMed PMID: 23499593.
7. Chang H, Ma Y, Lin T, Cong G, Du J, Ma J. Foot-and-mouth disease virus carrier status in *Bos grunniens* yaks. *Virol J.* 2013 Mar 11;10:81. doi: 10.1186/1743-422X-10-81. PubMed PMID: 23497369; PubMed Central PMCID: PMC3602197.
8. Gülçe İz S, Döşkaya M, Borrego B, Rodriguez F, Gürüz Y, Gürhan ID. Co-expression of the Bcl-xL antiapoptotic protein enhances the induction of Th1-like immune responses in mice immunized with DNA vaccines encoding FMDV B and T cell epitopes. *Vet Res Commun.* 2013 Mar 13. [Epub ahead of print] PubMed PMID:23483312.
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Annex 3. RECOMMENDATIONS FROM WRLFMD® ON FMD VIRUS STRAINS TO BE INCLUDED IN FMDV ANTIGEN BANKS – March 2013

High Priority

O Manisa
 O PanAsia-2
 O BFS or Campos
 A24 Cruzeiro
 Asia 1 Shamir
 A Iran-05
 A22 Iraq
 SAT 2 Saudi Arabia (*or equivalent i.e. SAT 2 Eritrea*)

(not in order of importance)

Medium Priority

A Eritrea
 A Iran '96
 SAT 2 Zimbabwe
 A Iran 87 or A Saudi Arabia 23/86 (*or equivalent*)
 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*)
 A Iran '99

(not in order of importance)

Low Priority

A15 Bangkok related strain
 A87 Argentina related strain
 C Noville
 SAT 2 Kenya
 SAT 1 Kenya
 SAT 3 Zimbabwe
 A Kenya

(not in order of importance)

