



WRLFMD Quarterly Report

April-June 2012

Reference Laboratory Contract Report

7/31/2012

WRLFMD

This page deliberately blank

**OIE/FAO Reference Laboratory Contract Report^{1,2}
April-June 2012**

Foot-and-Mouth Disease

¹N.B. The content of this report is the property of WRLFMD®, IAH-Pirbright. For presentation, publication or any other public use, please contact Dr. Jef Hammond, IAH-Pirbright, jef.hammond@iah.ac.uk.

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

Summary

ASIA

Bahrain

A further FMDV **type SAT2** IV/Ken-09 was detected in imported cattle sampled on 05/04/2012 on a quarantine farm in the Northern Governorate of Bahrain.

Hong Kong SAR (PR China)

Three samples were received from pigs in Hong Kong on 25th April 2012. FMDV genome was detected in two of the samples and the third was identified as FMDV **type O** by ELISA; however, no FMD virus was isolated in cell cultures and VP1 RT-PCR assays were negative.

Kazakhstan & Kyrgyzstan

A further outbreak of FMDV **type O** occurred at Borovoe, Dmitriy, Borodulihinsky, East Kazakhstan on 30/05/2012. No genotyping information is available.

Six FMDV **type O** and two **type A** VP1 sequences were submitted to the public sequence databases on 12/03/2012 by the Ministry of Education and Science, Research Institute for Biological Safety Problems, Gvardeyskiy, Zhambyl oblast 080409, Kazakhstan.

Phylogenetic analyses showed that the **type O** viruses belonged to two virus lineages:

- i) Zhambyl province, close to the Kyrgyzstan border. These viruses from Korday (May 2010), Tynali (May 2011), Akterek (February 2012) and Korday (February 2012) belonged to the O/ME-SA/PanAsia-2 lineage and formed a distinct sub-lineage.
- ii) East Kazakhstan province, close to where the borders of Russia, Mongolia and China meet. These viruses from Kurchum (August 2011), Urdzhar (December 2011) belonged to the O/ME-SA/PanAsia lineage and were closely related to viruses from Southeast Asia.

The two **type A** sequences were from an unknown location in Kyrgyzstan (November 2011) and Mainkum, Almaty province, Kazakhstan (Feb 2012). Both sequences were closely related to each other and belonged to the Iran-05^{HER-10} lineage, being most closely related to viruses from Afghanistan collected in 2011.

Malaysia

Six FMD **type O** and three **type A** viruses were isolated from a batch of 18 samples received from Malaysia. FMDV genome was detected by real time RT-PCR in a further eight samples and VP1 RT-PCRs were able to amplify **type O** and **type A** sequences from three and two of these sample, respectively. All nine **type O** VP1 sequences belonged to the SEA/Mya-98 lineage, while all five **type A** sequences belonged to the ASIA/Sea-97 lineage.

Palestinian Autonomous Territories

An outbreak due to FMD **type SAT 2** was reported in cattle in Rafah, Gaza Strip (09/04/2012). Phylogenetic analysis showed this virus to belong to the SAT2/VII/Ghb-12 lineage and to be most closely related to viruses from Egypt in 2012.

Taiwan POC

An outbreak of FMD type O was reported in pigs in Wandan Township, P'ing-Tung on 01/05/2012. This was detected by serology and no virus was isolated or detected by RT-PCR.

An FMD **type O** virus isolate, collected from a pig on 30/01/2012 in Jinning Township, Kinmen was received from Taiwan and shown to belong to the SEA/Mya-98 lineage. Kinmen consists of a small

archipelago of several islands which lie very close to mainland China. This is the first report of this toptype/lineage in Taiwan.

Thailand

Four FMD **type O** and 19 **type A** viruses were isolated from a batch of 24 samples received from Thailand (collected in 2011 and 2012). Two **type O** viruses belonged to the ME-SA/PanAsia lineage while the other two belonged to the SEA/Mya-98 lineage. All 19 **type A** viruses belonged to the ASIA/Sea-97 lineage.

AFRICA

Botswana

A new FMD **type SAT 2** outbreak was reported in cattle at Matsebe Crush, Ngami, Ngamiland, Maun on 23/05/2012. Partial VP1 sequence data received from the Botswana Vaccine Institute showed this outbreak to be due to toptype III (data not shown).

Egypt

During April and May 2012, six additional outbreaks of FMD **type SAT 2** were reported in four Egyptian governorates: Damietta (2), Matrouh (2), Sohag (1) and Suez (1). No genotyping information is available.

Kenya

Six FMD **type O**, one **type SAT 1** and six **type SAT 2** viruses were isolated from a batch of samples received from Kenya. All additional samples typed as SAT 2, but no virus was isolated in cell culture and the VP1 RT-PCR was negative. All six type O viruses belonged to the EA-2 toptype, the SAT 1 virus belonged to toptype I and all six SAT 2 viruses belonged to toptype IV. All these toptypes are endemic in Kenya.

Libya

In April, three outbreaks of FMD **type O** were reported:

- i) 18/04/2012: Alnjela (Enjela), Tarabulus (Tripoli) in cattle.
- ii) 17/04/2012: Alhwari (Al Hawari), Benghazi in sheep/goats.
- iii) 30/04/2012: Althalia, Benghazi in cattle.

The Enjela (Tripoli) outbreak was caused by O/ME-SA/PanAsia-2^{ANT-10} and was closely related to viruses which had occurred in Libya between 2010 and 2011. The Al Hawari (Benghazi) outbreak was caused by O/EA-3 and was closely related to viruses from the Tigray Region of northern Ethiopia (sampled in November 2011). This is the first record of the EA-3 toptype in Libya.

South Africa

Five outbreaks of FMD **type SAT 2** were reported in cattle between the 4th and the 30th April at Bushbuckridge, Mpumalanga. These were within the surveillance zone of South Africa's FMD control zone. Cattle in this zone are vaccinated against FMD. No genotyping information is available.

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/2012.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 2012 is shown in Annex 1 Table A. A record of all samples received to IAH-Pirbright (April to June 2012) is shown in Annex 1 Table B.

Table 1: Status of sequencing of samples received by the WRLFMD from April to June 2012.

Batch	Date received	Country	Serotype	No. of positive samples	No. of VP1 sequences	Status
WRLFMD/2012/00017	21/04/2012	Palestinian AT	SAT 2	1	1	Completed
WRLFMD/2012/00018	25/04/2012	Hong Kong SAR, PRC	O	1*	0	Completed
WRLFMD/2012/00019	11/05/2012	Malaysia	O	9	9	Completed
WRLFMD/2012/00019	11/05/2012	Malaysia	A	5	5	Completed
WRLFMD/2012/00020	16/05/2012	Taiwan POC	O	1	1	Completed
WRLFMD/2012/00021	22/05/2012	Libya	O	3*	2	Completed
WRLFMD/2012/00022	12/06/2012	Bahrain	SAT 2	1	1	Completed
WRLFMD/2012/00023	22/06/2012	Thailand	O	4	4	Completed
WRLFMD/2012/00023	22/06/2012	Thailand	A	19	19	Completed
WRLFMD/2012/00024	29/06/2012	Kenya	O	6	6	Completed
WRLFMD/2012/00024	29/06/2012	Kenya	SAT 1	1	1	Completed
WRLFMD/2012/00024	29/06/2012	Kenya	SAT 2	6	6	Completed
Total				57	55	

*, one sample was VP1 RT-PCR negative

Detailed Analysis:

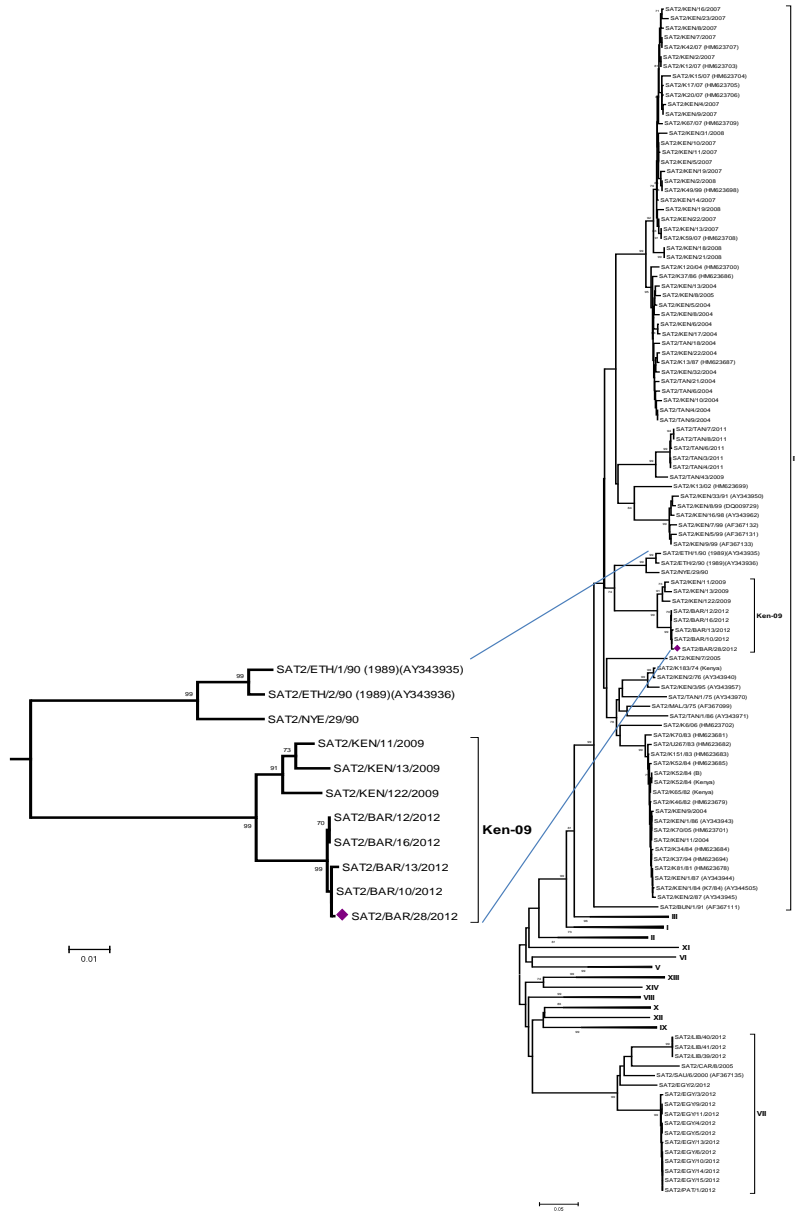
ASIA

Bahrain

WRLFMD/2012/00022
 Date received: 12/06/2012
 No. of samples: 113
 SAT2/IV/Ken-09: 1
 FMDV-GD: 2
 FMDV-NGD*: 38
 Not tested: 11
 NVD: 61

Samples from animals held in quarantine in the Northern Governorate.

NGD, no genome detected.



Kazakhstan & Kyrgyzstan*

WRLMEG/2012/00009

Date received:

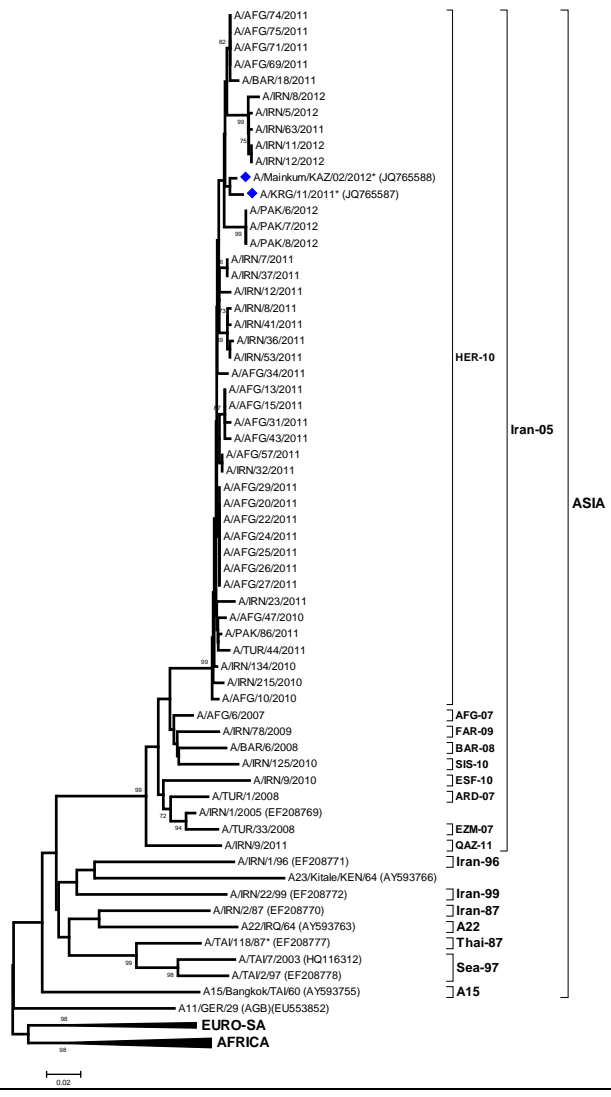
No. of sequences:

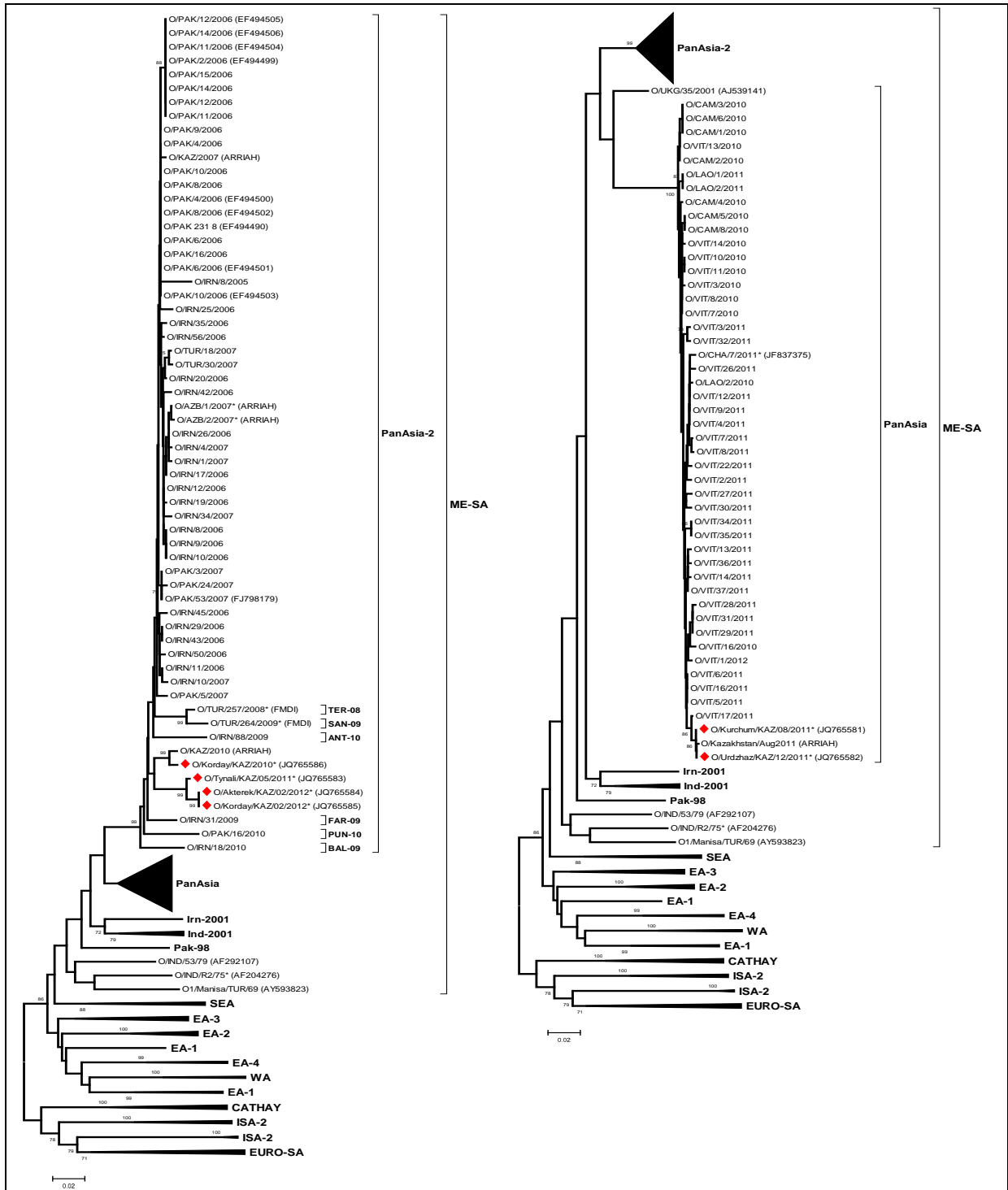
O/ME-SA/PanAsia: 2

O/ME-SA/PanAsia-2: 4

A/ASIA/Iran-05^{HER-10}: 2

*, No location was given for the Kyrgyzstan type A virus





Malaysia

WRLFMD/2012/00019

Date received: 11/05/2012

No. of samples: 18

O/SEA/Mya-98: 9*

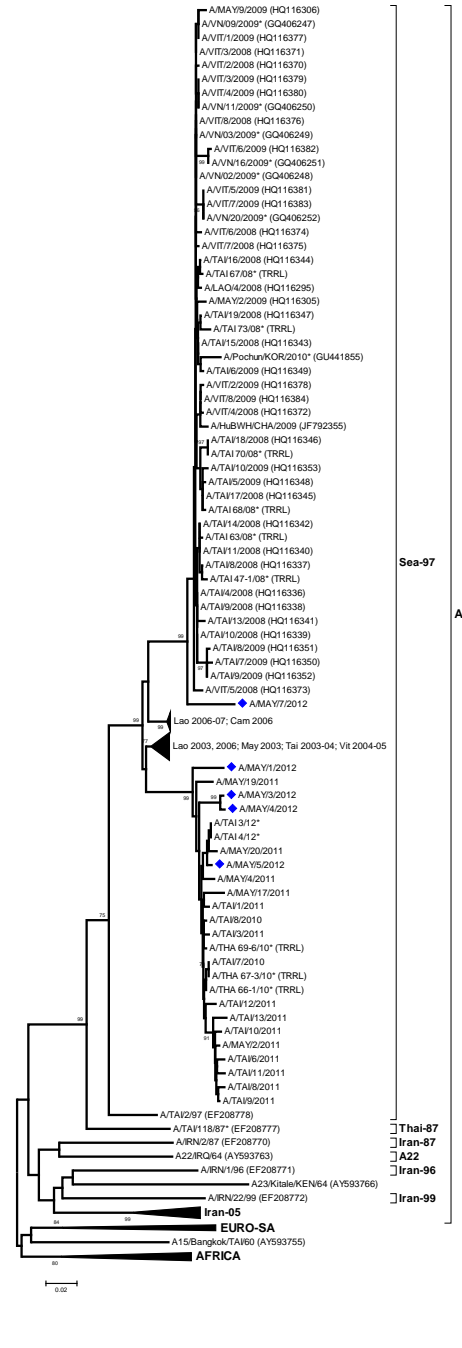
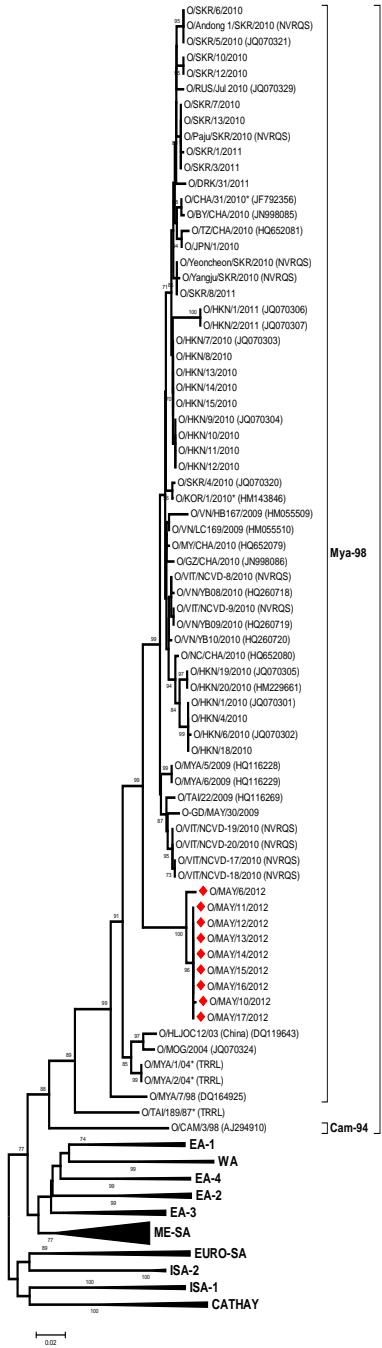
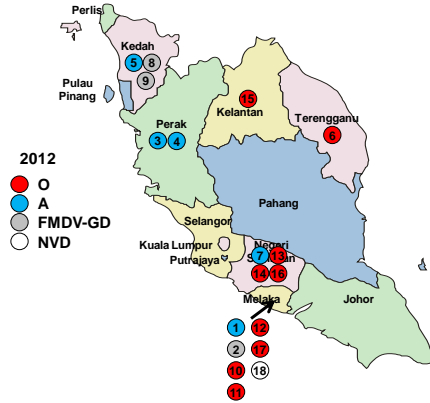
A/ASIA/Sea-97: 5†

FMDV-GD: 3

NVD: 1

*, three were originally reported as FMDV-GD

†, two were originally reported as FMDV-GD



Palestinian Autonomous Territories

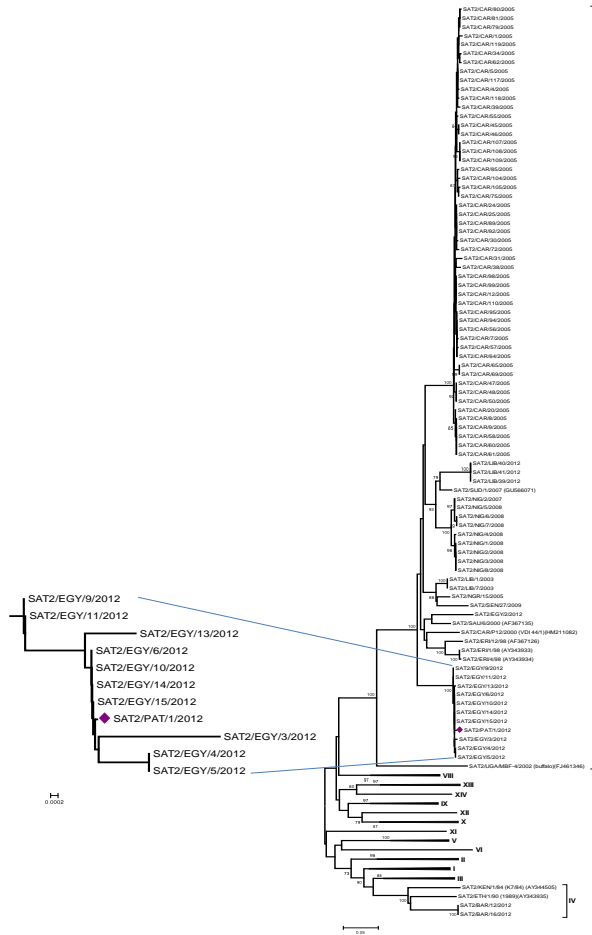
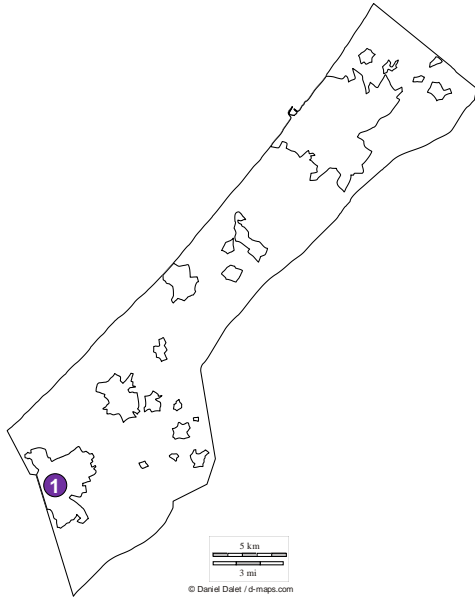
WRLFMD/2012/00017

Date received: 21/04/2012

No. of samples: 2

SAT2/VII/Gbh-12: 1

FMDV-GD: 1



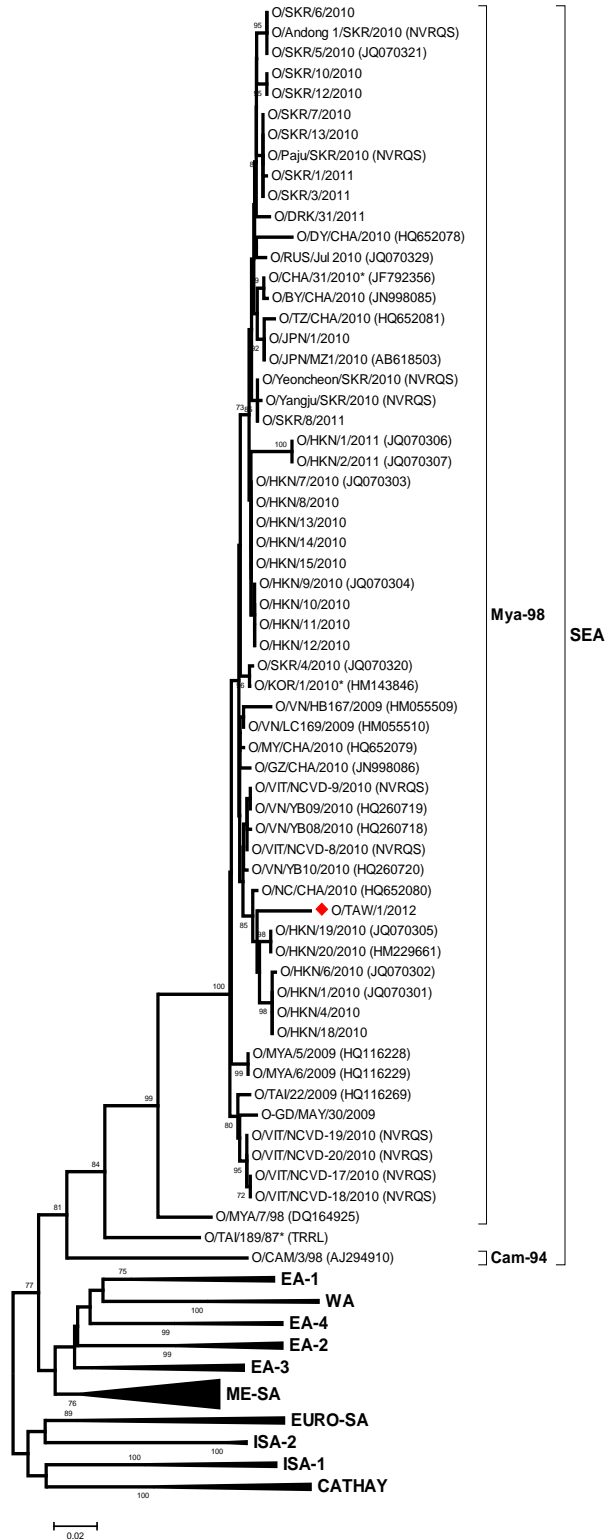
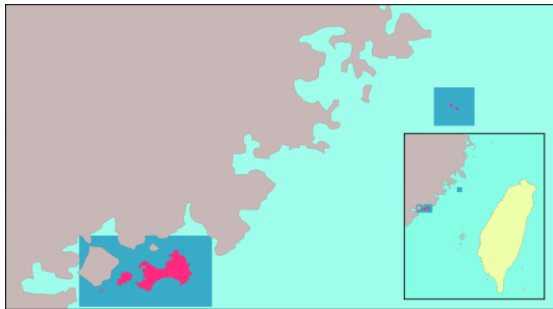
Taiwan POC

WRLFMD/2012/00020

Date received: 16/05/2012

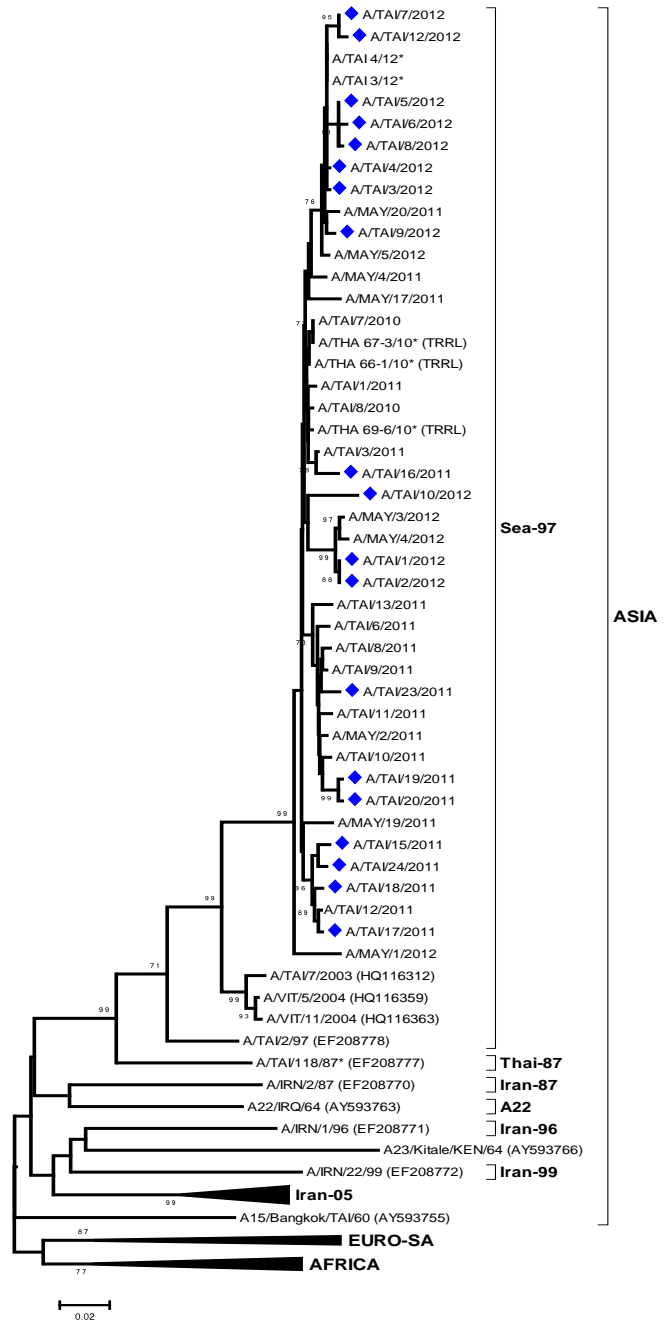
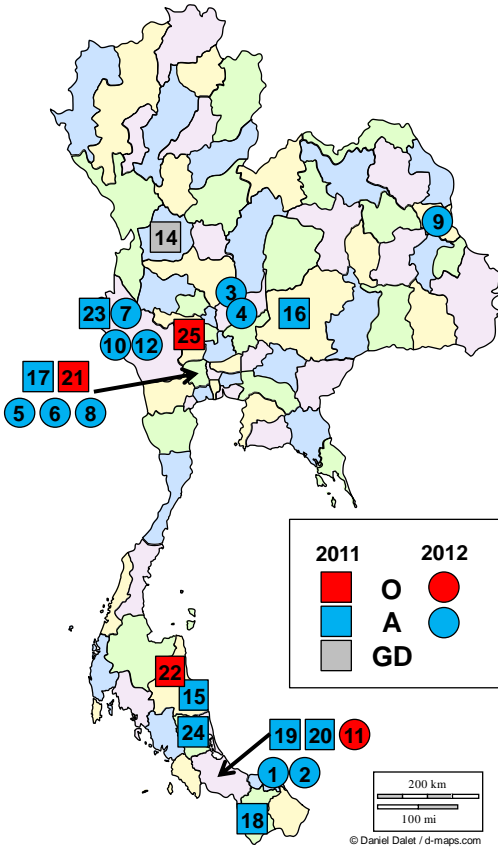
No. of samples: 1

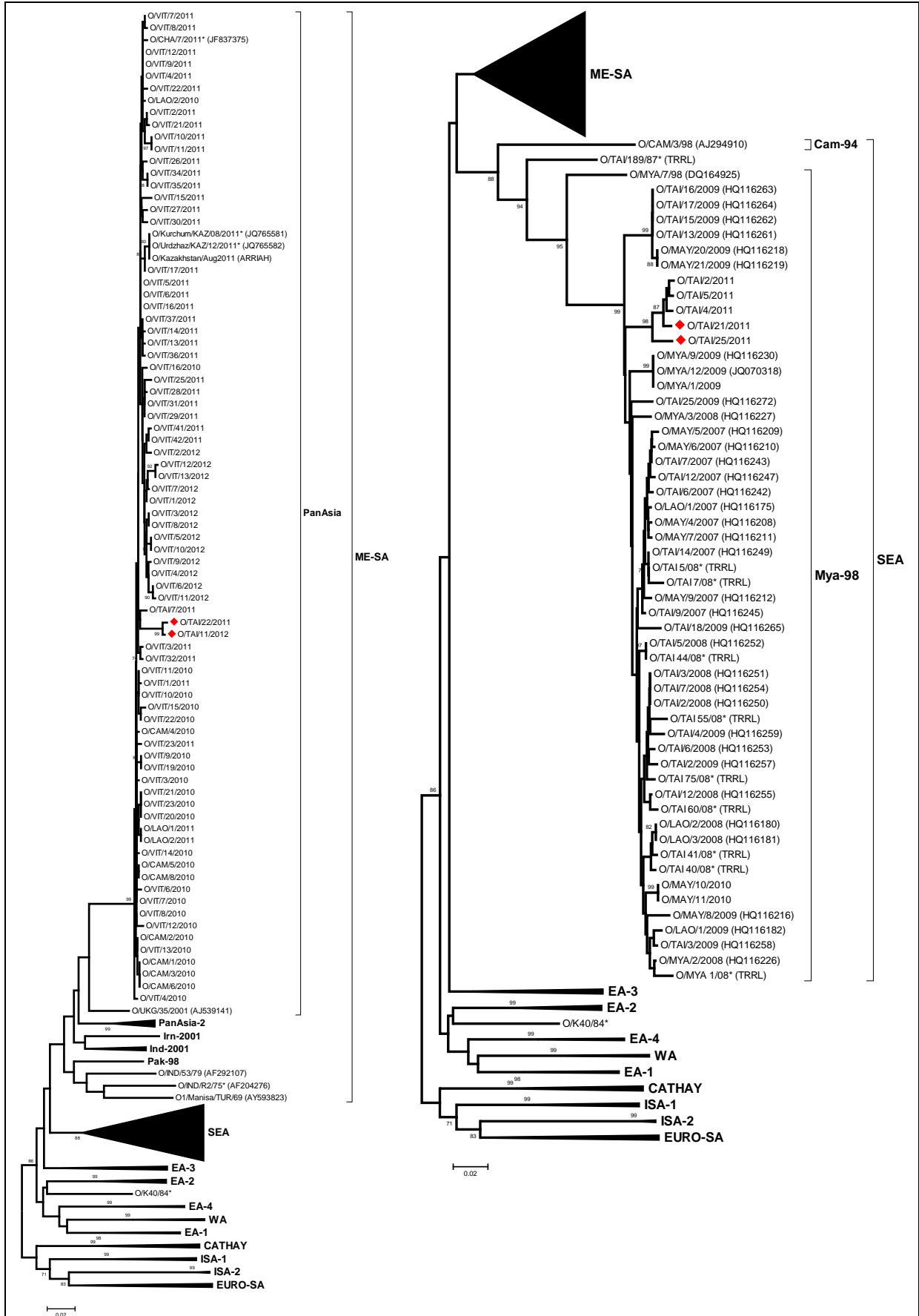
O/SEA/Mya-98: 1



Thailand

WRLMEG/2012/00023
 Date received: 22/06/2012
 No. of samples: 24
 O/ME-SA/PanAsia: 2
 O/SEA/Mya-98: 2
 A/ASIA/Sea-97: 19
 FMDV-GD: 1





AFRICA

Libya

WRLFMD/2012/00021

Date received: 22/05/2012

No. of samples: 51

O/ME-SA/PanAsia-2^{ANT-10}: 1

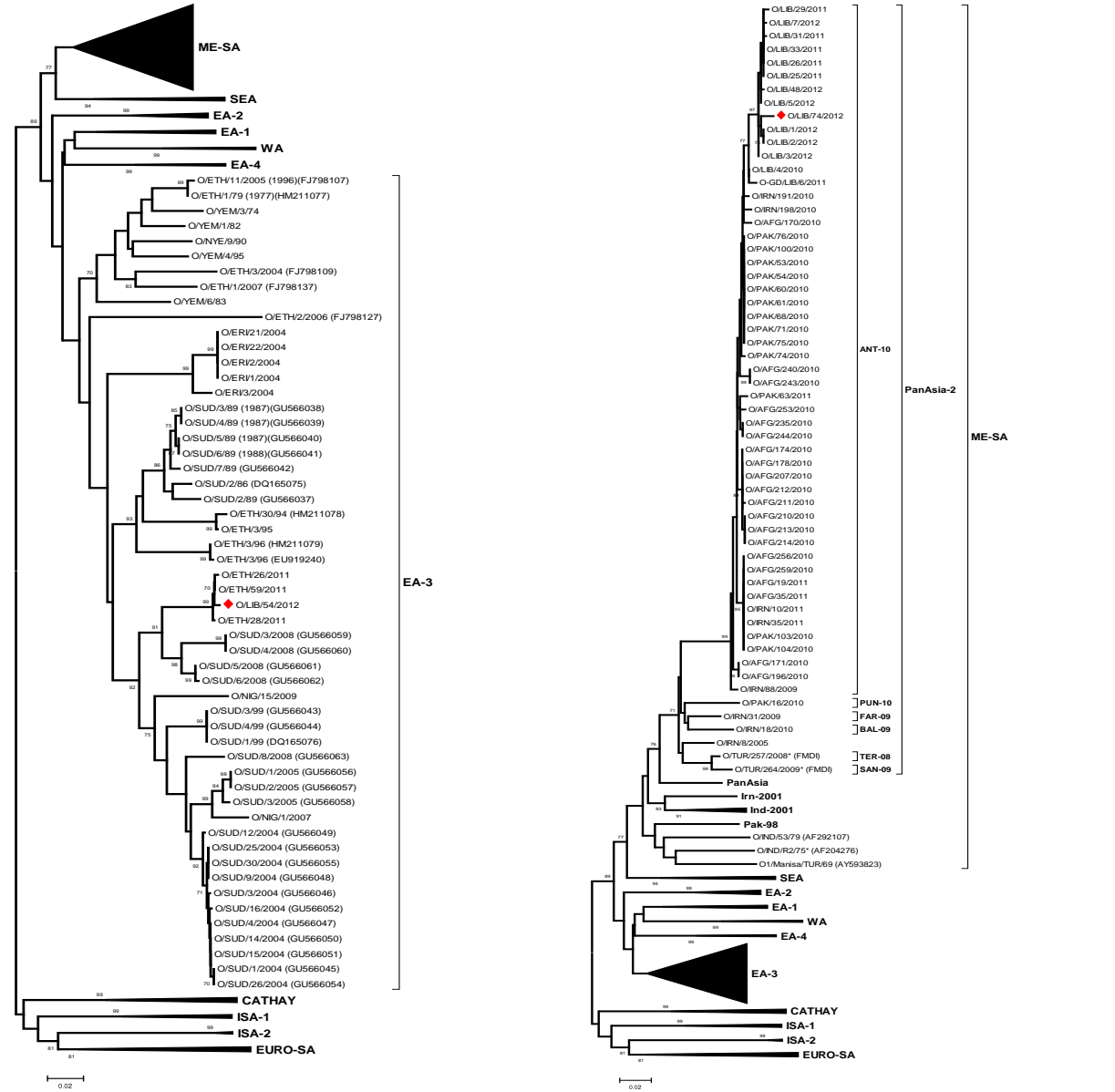
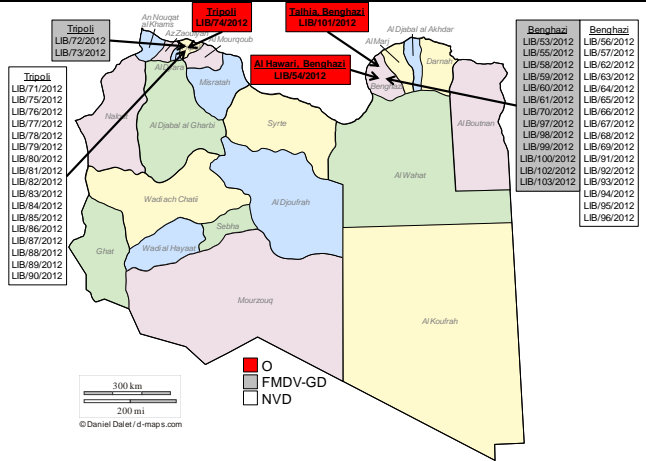
O/EA-3: 1

O (NVI)*: 1

FMDV-GD: 15

NVD: 33

*, no virus isolated in cell culture/VP1 RT-PCR negative



Kenya

WRLFMD/2012/00024

Date received: 29/06/2012

No. of samples: 20

O/EA-2: 6

SAT 1/I: 1

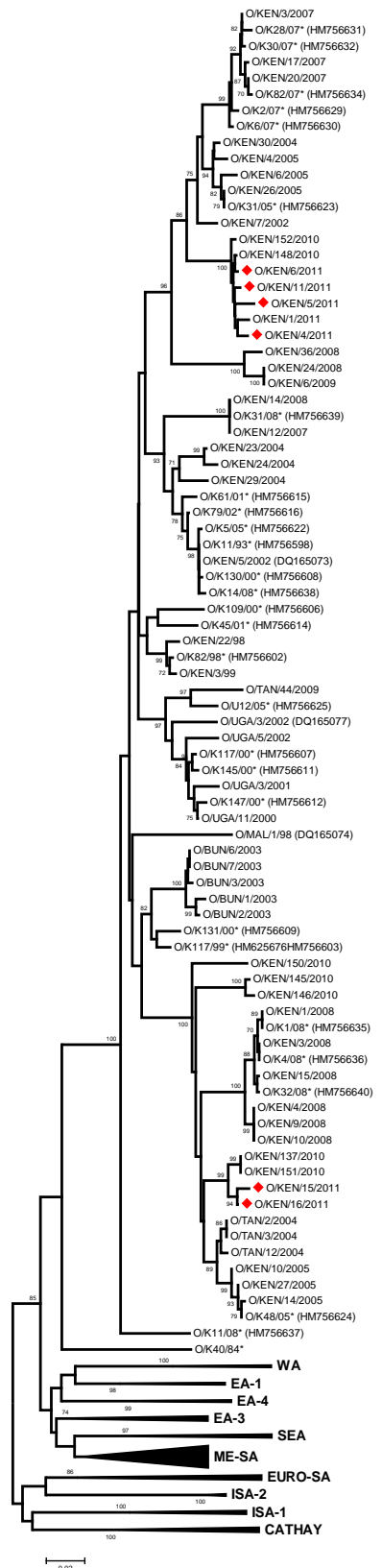
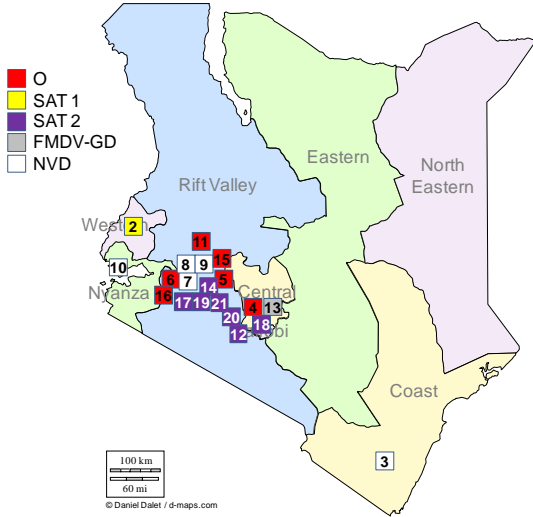
SAT 2/IV: 6

SAT 2 (NVI)*: 1

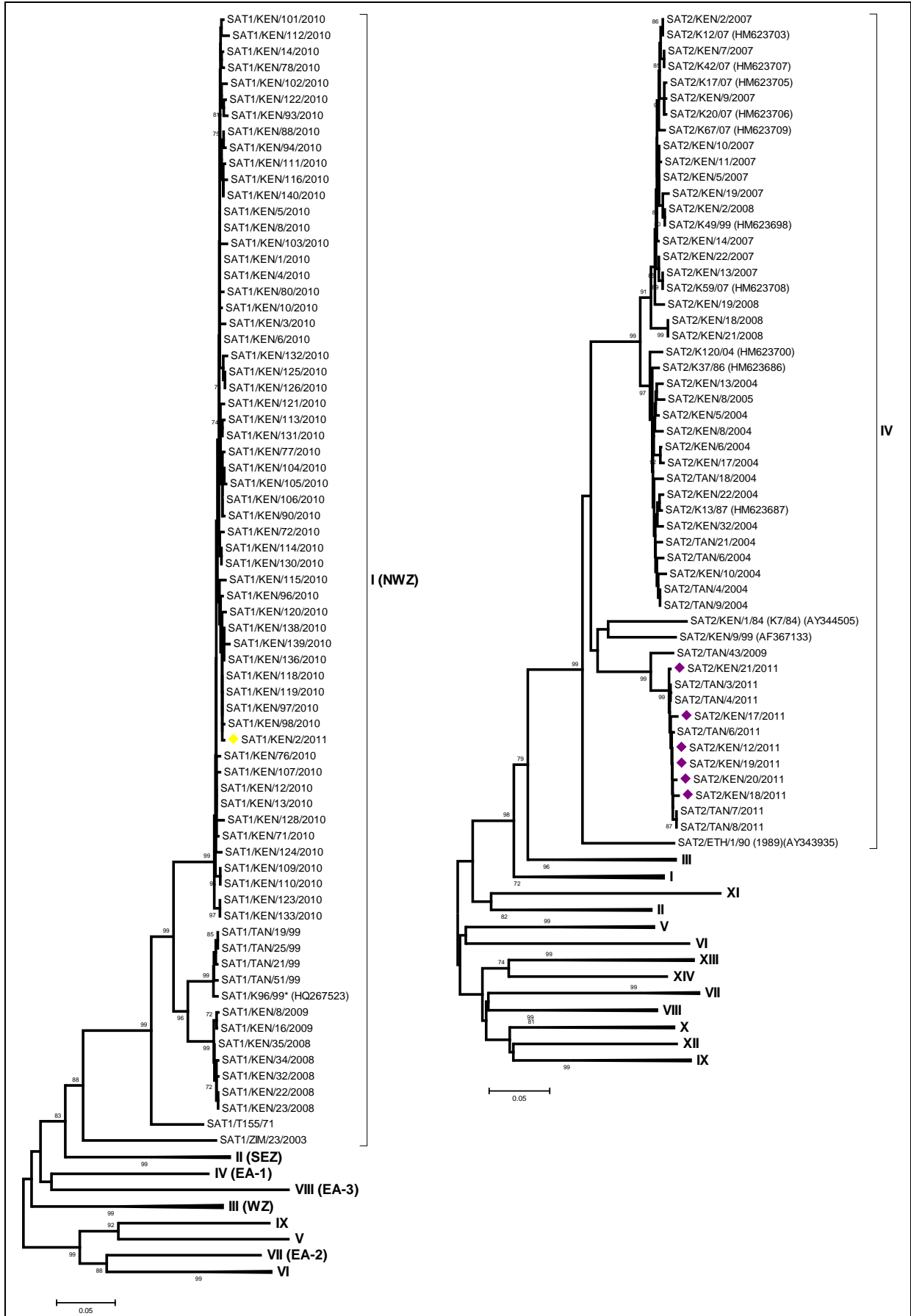
FMDV-GD: 1

NVD: 5

*. no virus isolated in cell culture/VP1 RT-PCR negative



EA-2



Vaccine matching

Eight FMDV type O isolates (See Table C, Type O for details) from United Arab Emirates, Libya, Egypt, Israel, Kuwait and Vietnam collected in 2011 and 2012 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). All isolates were antigenically matched with O TUR 5/09 and O4625 vaccine strains except the virus from Vietnam which showed no matching with any vaccine strain examined. One virus from Egypt and Israel also showed close matching with O Manisa. (Table C).

Seven FMDV type A viruses (see table C, Type A for details) from Turkey, Egypt, Pakistan, Thailand, Vietnam and Bahrain collected in 2010, 2011 and 2012 were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). All isolates showed antigenic match with the A TUR 06 vaccine strain except one virus from Thailand. One virus from Turkey, Pakistan, Thailand and Vietnam were also antigenically close to A₂₂ IRAQ vaccine virus. (Table C).

Six FMDV type Asia 1 viruses (see table C, Type Asia 1 for details) from Pakistan, Iran and Turkey collected in 2011 and 2012 all showed no antigenic match with ASIA 1 IND 8/79 vaccine strain by the two dimensional virus neutralisation test (2dmVNT). One virus from Pakistan and Turkey gave a good match with Asia 1 Shamir vaccine virus antigenically. Two viruses from Turkey showed a close match with Asia 1 TUR 11 vaccine virus (Table C).

Eight FMDV type SAT 2 viruses (see table C, Type SAT 2 for details) from Libya, Bahrain, Egypt, Tanzania and Palestinian Autonomous Territories were analysed antigenically by the two dimensional virus neutralisation test (2dmVNT). All viruses except two from Libya showed antigenic matching with SAT 2 Eritrea vaccine strains. The two SAT2 viruses from Libya showed no match with either SAT 2 Eritrea or SAT 2 Zim vaccine strains (Table C).

Annex 1.

TABLE A: Clinical sample diagnostics made by the WRLFMD between April-June 2012

Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results		
				VI/ELISA	RT-PCR	Final report
BAHRAIN	BAR 17/2012	CATTLE	05-Mar-12	NOT TESTED	NEG	NVD
	BAR 18/2012	CATTLE	05-Mar-12	NOT TESTED	NEG	NVD
	BAR 19/2012	CATTLE	05-Mar-12	NOT TESTED	NEG	NVD
	BAR 20/2012	CATTLE	28-Mar-12	NOT TESTED	NEG	NVD
	BAR 21/2012	CATTLE	28-Mar-12	NOT TESTED	NEG	NVD
	BAR 22/2012	CATTLE	28-Mar-12	NOT TESTED	NEG	NVD
	BAR 23/2012	SHEEP	28-Mar-12	NOT TESTED	NEG	NVD
	BAR 24/2012	SHEEP	28-Mar-12	NOT TESTED	NEG	NVD
	BAR 25/2012	SHEEP	28-Mar-12	NOT TESTED	NEG	NVD
	BAR 26/2012	SHEEP	28-Mar-12	NOT TESTED	NEG	NVD
	BAR 27/2012	SHEEP	28-Mar-12	NOT TESTED	NEG	NVD
	BAR 28/2012	CATTLE	05-Apr-12	SAT 2	POS	SAT 2
	BAR 29/2012	CATTLE	08-Apr-12	NOT TESTED	NEG	NVD
	BAR 30/2012	CATTLE	18-Apr-12	NOT TESTED	NEG	NVD
	BAR 31/2012	CATTLE	19-Apr-12	NOT TESTED	NEG	NVD
	BAR 32/2012	CATTLE	19-Apr-12	NOT TESTED	NEG	NVD
	BAR 33/2012	CATTLE	19-Apr-12	NOT TESTED	POS	FMDV GD
	BAR 34/2012	CATTLE	22-Apr-12	NOT TESTED	NEG	NVD
	BAR 35/2012	CATTLE	24-Apr-12	NOT TESTED	NEG	NVD
	BAR 36/2012	CATTLE	24-Apr-12	NOT TESTED	NEG	NVD
BAR 37/2012	CATTLE	25-Apr-12	NOT TESTED	NEG	NVD	

BAR 38/2012	CATTLE	25-Apr-12	NOT TESTED	NOT TESTED	NOT TESTED
BAR 39/2012	CATTLE	25-Apr-12	NOT TESTED	NOT TESTED	NOT TESTED
BAR 40/2012	CATTLE	25-Apr-12	NOT TESTED	NEG	NVD
BAR 41/2012	CATTLE	25-Apr-12	NOT TESTED	NOT TESTED	NOT TESTED
BAR 42/2012	CATTLE	25-Apr-12	NOT TESTED	NEG	NVD
BAR 43/2012	CATTLE	25-Apr-12	NOT TESTED	NEG	NVD
BAR 44/2012	CATTLE	25-Apr-12	NOT TESTED	NEG	NVD
BAR 45/2012	CATTLE	25-Apr-12	NOT TESTED	NEG	NVD
BAR 46/2012	CATTLE	25-Apr-12	NOT TESTED	NEG	NVD
BAR 47/2012	CATTLE	25-Apr-12	NOT TESTED	NEG	NVD
BAR 48/2012	CATTLE	25-Apr-12	NOT TESTED	NEG	NVD
BAR 49/2012	CATTLE	26-Apr-12	NOT TESTED	NEG	NVD
BAR 50/2012	CATTLE	26-Apr-12	NOT TESTED	NEG	NVD
BAR 51/2012	CATTLE	26-Apr-12	NOT TESTED	NEG	NVD
BAR 52/2012	CATTLE	26-Apr-12	NOT TESTED	NOT TESTED	NOT TESTED
BAR 53/2012	CATTLE	26-Apr-12	NOT TESTED	NOT TESTED	NOT TESTED
BAR 54/2012	CATTLE	26-Apr-12	NOT TESTED	NEG	NVD
BAR 55/2012	CATTLE	26-Apr-12	NOT TESTED	NEG	NVD
BAR 56/2012	CATTLE	26-Apr-12	NOT TESTED	NEG	NVD
BAR 57/2012	CATTLE	26-Apr-12	NOT TESTED	NEG	NVD
BAR 58/2012	CATTLE	26-Apr-12	NOT TESTED	NOT TESTED	NOT TESTED
BAR 59/2012	CATTLE	26-Apr-12	NOT TESTED	NEG	NVD
BAR 60/2012	CATTLE	26-Apr-12	NOT TESTED	NEG	NVD
BAR 61/2012	CATTLE	26-Apr-12	NOT TESTED	NOT TESTED	NOT TESTED
BAR 62/2012	SHEEP	26-Apr-12	NOT TESTED	NEG	NVD
BAR 63/2012	SHEEP	26-Apr-12	NOT TESTED	NOT TESTED	NOT TESTED
BAR 64/2012	SHEEP	26-Apr-12	NOT TESTED	NEG	NVD
BAR 65/2012	SHEEP	26-Apr-12	NOT TESTED	NEG	NVD
BAR 66/2012	SHEEP	26-Apr-12	NOT TESTED	NEG	NVD
BAR 67/2012	SHEEP	26-Apr-12	NOT TESTED	NEG	NVD
BAR 68/2012	SHEEP	26-Apr-12	NOT TESTED	NEG	NVD
BAR 69/2012	CATTLE	29-Apr-12	NOT TESTED	NEG	NVD
BAR 70/2012	CATTLE	29-Apr-12	NOT TESTED	NEG	NVD
BAR 71/2012	CATTLE	29-Apr-12	NOT TESTED	NOT TESTED	NOT TESTED
BAR 72/2012	CATTLE	29-Apr-12	NOT TESTED	NOT TESTED	NOT TESTED
BAR 73/2012	CATTLE	29-Apr-12	NOT TESTED	NEG	NVD
BAR 74/2012	CATTLE	29-Apr-12	NOT TESTED	NEG	NVD
BAR 75/2012	CATTLE	29-Apr-12	NOT TESTED	NEG	NVD
BAR 76/2012	CATTLE	29-Apr-12	NOT TESTED	NEG	NVD
BAR 77/2012	CATTLE	29-Apr-12	NOT TESTED	NEG	NVD
BAR 78/2012	CATTLE	29-Apr-12	NOT TESTED	NEG	NVD
BAR 79/2012	CATTLE	29-Apr-12	NOT TESTED	NEG	NVD
BAR 80/2012	CATTLE	29-Apr-12	NOT TESTED	NEG	NVD
BAR 81/2012	CATTLE	30-Apr-12	NOT TESTED	NEG	NVD
BAR 82/2012	CATTLE	30-Apr-12	NOT TESTED	NEG	NVD
BAR 83/2012	SHEEP	30-Apr-12	NOT TESTED	NEG	NVD
BAR 84/2012	CATTLE	30-Apr-12	NOT TESTED	NEG	NVD
BAR 85/2012	CATTLE	30-Apr-12	NOT TESTED	NEG	NVD
BAR 86/2012	SHEEP	30-Apr-12	NOT TESTED	NEG	FMDV NGD
BAR 87/2012	SHEEP	30-Apr-12	NOT TESTED	NEG	FMDV NGD
BAR 88/2012	SHEEP	30-Apr-12	NOT TESTED	NEG	FMDV NGD
BAR 89/2012	SHEEP	30-Apr-12	NOT TESTED	NEG	FMDV NGD
BAR 90/2012	SHEEP	30-Apr-12	NOT TESTED	NEG	FMDV NGD
BAR 91/2012	SHEEP	30-Apr-12	NOT TESTED	NOT TESTED	NOT TESTED
BAR 92/2012	SHEEP	30-Apr-12	NOT TESTED	NEG	FMDV NGD

	BAR 93/2012	CATTLE	30-Apr-12	NOT TESTED	NEG	NVD
	BAR 94/2012	CATTLE	07-May-12	NOT TESTED	NEG	NVD
	BAR 95/2012	CATTLE	07-May-12	NOT TESTED	NEG	NVD
	BAR 96/2012	CATTLE	07-May-12	NOT TESTED	NEG	NVD
	BAR 97/2012	CATTLE	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 98/2012	CATTLE	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 99/2012	CATTLE	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 100/2012	CATTLE	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 101/2012	CATTLE	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 102/2012	SHEEP	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 103/2012	SHEEP	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 104/2012	SHEEP	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 105/2012	CATTLE	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 106/2012	CATTLE	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 107/2012	CATTLE	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 108/2012	CATTLE	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 109/2012	CATTLE	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 110/2012	CATTLE	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 111/2012	CATTLE	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 112/2012	CATTLE	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 113/2012	CATTLE	08-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 114/2012	CATTLE	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 115/2012	CATTLE	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 116/2012	CATTLE	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 117/2012	CATTLE	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 118/2012	CATTLE	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 119/2012	CATTLE	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 120/2012	CATTLE	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 121/2012	CATTLE	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 122/2012	CATTLE	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 123/2012	CATTLE	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 124/2012	SHEEP	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 125/2012	SHEEP	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 126/2012	SHEEP	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 127/2012	SHEEP	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 128/2012	SHEEP	09-May-12	NOT TESTED	NEG	FMDV NGD
	BAR 129/2012	CATTLE	24-May-12	NEG	POS	FMDV GD
HONG KONG, SAR OF PRC	HKN 1/2012	PIG	28-Mar-12	NEG	POS	FMDV GD
	HKN 2/2012	PIG	28-Mar-12	O	POS	O
	HKN 3/2012	PIG	28-Mar-12	NEG	POS	FMDV GD
ISRAEL	ISR 1/2012	SHEEP	20-Mar-12	O	POS	O
	ISR 2/2012	SHEEP	21-Mar-12	O	POS	O
KENYA	KEN 2/2011	CATTLE	17-Jan-11	SAT 1	POS	SAT 1
	KEN 3/2011	CATTLE	30-Jan-11	NEG	NEG	NVD
	KEN 4/2011	CATTLE	02-Feb-11	O	POS	O
	KEN 5/2011	CATTLE	15-Feb-11	O	POS	O
	KEN 6/2011	CATTLE	19-Feb-11	O	POS	O
	KEN 7/2011	CATTLE	19-Feb-11	NEG	NEG	NVD
	KEN 8/2011	CATTLE	01-Mar-11	NEG	NEG	NVD
	KEN 9/2011	CATTLE	01-Mar-11	NEG	NEG	NVD
	KEN 10/2011	CATTLE	13-Mar-11	NEG	NEG	NVD
	KEN 11/2011	CATTLE	Apr-11	O	POS	O

	KEN 12/2011	CATTLE	06-Jul-11	SAT 2	POS	SAT 2
	KEN 13/2011	CATTLE	05-Sep-11	NEG	POS	FMDV GD
	KEN 14/2011	CATTLE	05-Sep-11	SAT 2	POS	SAT 2
	KEN 15/2011	CATTLE	18-Sep-11	O	POS	O
	KEN 16/2011	CATTLE	22-Sep-11	O	POS	O
	KEN 17/2011	CATTLE	23-Sep-11	SAT 2	POS	SAT 2
	KEN 18/2011	CATTLE	23-Sep-11	SAT 2	POS	SAT 2
	KEN 19/2011	CATTLE	23-Sep-11	SAT 2	POS	SAT 2
	KEN 20/2011	CATTLE	27-Oct-11	SAT 2	POS	SAT 2
	KEN 21/2011	CATTLE	27-Oct-11	SAT 2	POS	SAT 2
	KEN 1/2012	BUFFALO	Mar-2011	SAT 2, O	POS	SAT 2, O
	KEN 2/2012	BUFFALO	Mar-2011	SAT 2, O	POS	SAT 2, O
	KEN 3/2012	BUFFALO	Mar-2011	SAT 2, O	POS	SAT 2, O
LIBYA	LIB 53/2012	SHEEP/GOAT	19-Apr-12	NOT TESTED	POS	FMDV GD
	LIB 54/2012	SHEEP/GOAT	19-Apr-12	O	POS	O
	LIB 55/2012	SHEEP/GOAT	19-Apr-12	NOT TESTED	POS	FMDV GD
	LIB 56/2012	SHEEP/GOAT	19-Apr-12	NOT TESTED	NEG	NVD
	LIB 57/2012	SHEEP/GOAT	19-Apr-12	NOT TESTED	NEG	NVD
	LIB 58/2012	SHEEP/GOAT	19-Apr-12	NOT TESTED	POS	FMDV GD
	LIB 59/2012	SHEEP/GOAT	19-Apr-12	NOT TESTED	POS	FMDV GD
	LIB 60/2012	SHEEP/GOAT	19-Apr-12	NOT TESTED	POS	FMDV GD
	LIB 61/2012	SHEEP/GOAT	19-Apr-12	NOT TESTED	POS	FMDV GD
	LIB 62/2012	CATTLE	19-Apr-12	NOT TESTED	NEG	NVD
	LIB 63/2012	CATTLE	19-Apr-12	NOT TESTED	NEG	NVD
	LIB 64/2012	CATTLE	19-Apr-12	NOT TESTED	NEG	NVD
	LIB 65/2012	CATTLE	19-Apr-12	NOT TESTED	NEG	NVD
	LIB 66/2012	CATTLE	19-Apr-12	NOT TESTED	NEG	NVD
	LIB 67/2012	CATTLE	19-Apr-12	NOT TESTED	NEG	NVD
	LIB 68/2012	CATTLE	19-Apr-12	NOT TESTED	NEG	NVD
	LIB 69/2012	CATTLE	19-Apr-12	NOT TESTED	NEG	NVD
	LIB 70/2012	CATTLE	19-Apr-12	NOT TESTED	POS	FMDV GD
	LIB 71/2012	CATTLE	22-Apr-12	NOT TESTED	NEG	NVD
	LIB 72/2012	CATTLE	22-Apr-12	NEG	POS	FMDV GD
	LIB 73/2012	CATTLE	23-Apr-12	NEG	POS	FMDV GD
	LIB 74/2012	CATTLE	23-Apr-12	O	POS	O
	LIB 75/2012	CATTLE	23-Apr-12	NOT TESTED	NEG	NVD
	LIB 76/2012	SHEEP	02-May-12	NOT TESTED	NEG	NVD
	LIB 77/2012	SHEEP	02-May-12	NOT TESTED	NEG	NVD
	LIB 78/2012	SHEEP	02-May-12	NOT TESTED	NEG	NVD
	LIB 79/2012	SHEEP	02-May-12	NOT TESTED	NEG	NVD
	LIB 80/2012	SHEEP	02-May-12	NOT TESTED	NEG	NVD
	LIB 81/2012	SHEEP	02-May-12	NOT TESTED	NEG	NVD
	LIB 82/2012	SHEEP	02-May-12	NOT TESTED	NEG	NVD
	LIB 83/2012	SHEEP	02-May-12	NOT TESTED	NEG	NVD
	LIB 84/2012	CATTLE	02-May-12	NOT TESTED	NEG	NVD
	LIB 85/2012	CATTLE	02-May-12	NOT TESTED	NEG	NVD
	LIB 86/2012	CATTLE	02-May-12	NEG	NEG	NVD
	LIB 87/2012	CATTLE	02-May-12	NOT TESTED	NEG	NVD
	LIB 88/2012	CATTLE	02-May-12	NOT TESTED	NEG	NVD
	LIB 89/2012	CATTLE	02-May-12	NOT TESTED	NEG	NVD
	LIB 90/2012	CATTLE	02-May-12	NOT TESTED	NEG	NVD
	LIB 91/2012	CATTLE	03-May-12	NOT TESTED	NEG	NVD
	LIB 92/2012	CATTLE	03-May-12	NOT TESTED	NEG	NVD
	LIB 93/2012	CATTLE	03-May-12	NOT TESTED	NEG	NVD

	LIB 94/2012	CATTLE	03-May-12	NOT TESTED	NEG	NVD
	LIB 95/2012	CATTLE	03-May-12	NOT TESTED	NEG	NVD
	LIB 96/2012	CATTLE	03-May-12	NOT TESTED	NEG	NVD
	LIB 97/2012	CATTLE	03-May-12	NEG	POS	FMDV GD
	LIB 98/2012	CATTLE	03-May-12	NOT TESTED	POS	FMDV GD
	LIB 99/2012	CATTLE	03-May-12	NEG	POS	FMDV GD
	LIB 100/2012	CATTLE	03-May-12	NOT TESTED	POS	FMDV GD
	LIB 101/2012	CATTLE	03-May-12	O	POS	O
	LIB 102/2012	CATTLE	03-May-12	NEG	POS	FMDV GD
	LIB 103/2012	CATTLE	03-May-12	NEG	POS	FMDV GD
MALAYSIA	MAY 1/2012	CATTLE	31-Jan-12	A	POS	A
	MAY 2/2012	CATTLE	31-Jan-12	NOT TESTED	POS	FMDV GD
	MAY 3/2012	BUFFALO	31-Jan-12	NOT TESTED	POS	FMDV GD
	MAY 4/2012	CATTLE	05-Feb-12	A	POS	A
	MAY 5/2012	CATTLE	21-Feb-12	NOT TESTED	POS	FMDV GD
	MAY 6/2012	CATTLE	28-Mar-12	O	POS	O
	MAY 7/2012	CATTLE	02-Apr-12	A	POS	A
	MAY 8/2012	CATTLE	03-Apr-12	NOT TESTED	POS	FMDV GD
	MAY 9/2012	CATTLE	03-Apr-12	NOT TESTED	POS	FMDV GD
	MAY 10/2012	CATTLE	12-Apr-12	NOT TESTED	POS	FMDV GD
	MAY 11/2012	CATTLE	13-Apr-12	O	POS	O
	MAY 12/2012	CATTLE	13-Apr-12	O	POS	O
	MAY 13/2012	CATTLE	17-Apr-12	O	POS	O
	MAY 14/2012	CATTLE	17-Apr-12	NOT TESTED	POS	FMDV GD
	MAY 15/2012	CATTLE	18-Apr-12	O	POS	O
	MAY 16/2012	CATTLE	23-Apr-12	O	POS	O
	MAY 17/2012	CATTLE	28-Apr-12	NOT TESTED	POS	FMDV GD
	MAY 18/2012	CATTLE	30-Apr-12	NOT TESTED	NEG	NVD
PALESTINIAN AUTONOMOUS TERRITORIES	PAT 1/2012	CATTLE	16-Apr-12	SAT 2	POS	SAT 2
	PAT 2/2012	CATTLE	16-Apr-12	NEG	POS	FMDV GD
THAILAND	TAI 14/2011	CATTLE	29-Aug-11	NEG	POS	FMDV GD
	TAI 15/2011	CATTLE	21-Oct-11	A	POS	A
	TAI 16/2011	CATTLE	24-Oct-11	A	POS	A
	TAI 17/2011	CATTLE	24-Oct-11	A	POS	A
	TAI 18/2011	CATTLE	24-Oct-11	A	POS	A
	TAI 19/2011	CATTLE	24-Oct-11	A	POS	A
	TAI 20/2011	CATTLE	24-Oct-11	A	POS	A
	TAI 21/2011	CATTLE	12-Nov-11	O	POS	O
	TAI 22/2011	CATTLE	12-Nov-11	O	POS	O
	TAI 23/2011	CATTLE	23-Nov-11	A	POS	A
	TAI 24/2011	CATTLE	23-Nov-11	A	POS	A
	TAI 25/2011	CATTLE	14-Dec-11	O	POS	O
	TAI 1/2012	CATTLE	18-Jan-12	A	POS	A
	TAI 2/2012	CATTLE	18-Jan-12	A	POS	A
	TAI 3/2012	CATTLE	26-Mar-12	A	POS	A
	TAI 4/2012	CATTLE	26-Mar-12	A	POS	A
	TAI 5/2012	CATTLE	26-Mar-12	A	POS	A
	TAI 6/2012	CATTLE	30-Apr-12	A	POS	A
	TAI 7/2012	CATTLE	02-May-12	A	POS	A
	TAI 8/2012	CATTLE	04-May-12	A	POS	A
	TAI 9/2012	CATTLE	08-May-12	A	POS	A
	TAI 10/2012	CATTLE	18-May-12	A	POS	A

	TAI 11/2012	CATTLE	18-Jan-12	O	POS	O
	TAI 12/2012	CATTLE	30-Apr-12	A	POS	A
TAIWAN, PROVINCE OF CHINA	TAW 1/2012	PIG	30-Jan-12	O	POS	O
	TOTAL :	237				

FMD(V)	Foot-and-mouth disease (virus)
GD	Genome detected
NGD	No 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

TABLE B: Summary of samples collected and received to IAH-Pirbright (April-June 2012)

Country	No. of samples	Virus isolation in cell culture/ELISA							RT-PCR for FMD (or SVD) virus (where appropriate)		
		FMD virus serotypes							NVD	Positive	Negative
		O	A	C	SAT 1	SAT 2	SAT 3	Asia 1			
PALESTINIAN AUTONOMOUS TERRITORIES	2	-	-	-	-	1	-	-	1	2	-
ISRAEL	2	2	-	-	-	-	-	-	-	2	-
KENYA	23	9	0	0	1	10	0	0	6	18	5
LIBYA	51	3	-	-	-	-	-	-	7	18	33
BAHRAIN	113	-	-	-	-	1	-	-	1	3	99
HONG KONG, SAR OF PRC	3	1	-	-	-	-	-	-	2	3	-
MALAYSIA	18	6	3	-	-	-	-	-	-	17	1
TAIWAN, PROVINCE OF CHINA	1	1	-	-	-	-	-	-	-	1	-
THAILAND	24	4	19	-	-	-	-	-	1	24	-
TOTAL	237	26	22	0	1	12	0	0	18	88	138

FMD(V)	Foot-and-mouth disease (virus)
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

TABLE C: Antigenic characterisation of FMD field isolates by matching with vaccine strains by VNT from 1st APRIL to 30th JUNE 2012**Type O:**

Vaccine Matching studies for serotype O FMDV by VNT-WRL FMD				
WRL SAMPLE REF	TYPE	O 4625	O Manisa	O Tur 5/09
UAE 1/2011	O	M	N	M
LIB 48/2012	O	M	N	M
EGY 10/2011	O	M	N	M
EGY 6/2011	O	M	M	M
ISR 1/2012	O	M	N	M
ISR 2/2012	O	M	M	M
KUW 3/2012	O	M	N	M
VIT 12/2012	O	N	N	N

Type A:

Vaccine Matching studies for serotype A FMDV by VNT-WRL FMD										
WRL SAMPLE REF	TYPE	A MAY 97	A IND 17/82	A Eri 98	A IRN 87	A Iran 2005	A SAU 41/91	A SAU 95	A TUR 06	A22 IRQ
TUR 78/2011	A					M		N	M	M
EGY 1/2012	A			N	N	N		N	M	N
PAK 6/12	A	N				N			M	M
TAI 1/11	A	N	N			M			N	N
TAI 13/11	A	N	N			M			M	M
VIT 17/10	A	N	M			M			M	M
BAR 18/11	A			M		N	N	M	M	N

Type Asia 1

Vaccine Matching studies for serotype Asia 1 FMDV by VNT-WRL FMD				
WRL SAMPLE REF	TYPE	Asia1 IND 8/79	Asia1 Shamir	Asia1 Tur11
PAK 5/2012	ASIA1	N	N	
PAK 91/2011	ASIA1	N	M	
IRN 10/2012	ASIA1	N	N	
IRN 54/2011	ASIA1	N	N	
TUR 2/2012	ASIA1	N	M	M
TUR 65/2011	ASIA1	N	N	M

Type SAT 2:

Vaccine Matching studies for serotype SAT 2 FMDV by VNT-WRL FMD				
WRL SAMPLE REF	TYPE	SAT2 Eritrea	SAT2 ZIM	SAT2 ZIM 7/83
LIB 40/2012	SAT2	N	N	
LIB 41/2012	SAT2	N	N	
TAN 3/2011	SAT2	M		M
TAN 7/2011	SAT2	M		N
BAR 10/2012	SAT2	M		M
BAR 12/2012	SAT2	M		M
EGY 2/2012	SAT2	M		N
PAT 1/2012	SAT2	M		M

In the case of VNT:

M: $r_1 = \geq 0.3$. 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: $r_1 = < 0.3$. Suggests that the field isolate is so different from the vaccine strain that the vaccine is unlikely to protect

Annex 2. Recent FMD Publications cited by PubMed

- 1: Wang D, Fang L, Li K, Zhong H, Fan J, Ouyang C, Zhang H, Duan E, Luo R, Zhang Z, Liu X, Chen H, Xiao S. Foot-and-mouth disease virus 3C protease cleaves NEMO to impair innate immune signaling. *J Virol*. 2012 Jun 20. [Epub ahead of print] PubMed PMID: 22718831.
- 2: Dar PA, Ganesh K, Nagarajan G, Sarika S, Reddy GR, Suryanaryana VV. Sindbis virus replicase-based DNA vaccine construct containing FMDV specific multivalent-epitope gene: Studies on its immune responses in guinea pigs. *Scand J Immunol*. 2012 Jun 15. doi: 10.1111/j.1365-3083.2012.02733.x. [Epub ahead of print] PubMed PMID: 22702835.
- 3: Nampanya S, Richards J, Khounsy S, Inthavong P, Yang M, Rast L, Windsor PA. Investigation of Foot and Mouth Disease hotspots in northern Lao PDR. *Transbound Emerg Dis*. 2012 Jun 12. doi: 10.1111/j.1865-1682.2012.01350.x. [Epub ahead of print] PubMed PMID: 22690839.
- 4: Howey R, Bankowski B, Juleff N, Savill NJ, Gibson D, Fazakerley J, Charleston B, Woolhouse ME. Modelling the within-host dynamics of the foot-and-mouth disease virus in cattle. *Epidemics*. 2012 Jun;4(2):93-103. Epub 2012 Apr 26. PubMed PMID: 22664068.
- 5: Park JH, Lee KN, Ko YJ, Kim SM, Lee HS, Park JY, Yeh JY, Kim MJ, Lee YH, Sohn HJ, Cho IS, Kim B. Diagnosis and Control Measures of the 2010 Outbreak of Foot-and-Mouth Disease A Type in the Republic of Korea. *Transbound Emerg Dis*. 2012 May 27. doi: 10.1111/j.1865-1682.2012.01333.x. [Epub ahead of print] PubMed PMID: 22630568.
- 6: Lohse L, Jackson T, Bøtner A, Belsham GJ. Capsid coding sequences of foot-and-mouth disease viruses are determinants of pathogenicity in pigs. *Vet Res*. 2012 May 24;43(1):46. [Epub ahead of print] PubMed PMID: 22624592.
- 7: Li P, Bai X, Sun P, Li D, Lu Z, Cao Y, Fu Y, Bao H, Chen Y, Xie B, Liu Z. Evaluation of a genetically modified foot-and-mouth disease virus vaccine candidate generated by reverse genetics. *BMC Vet Res*. 2012 May 16;8(1):57. [Epub ahead of print] PubMed PMID: 22591597.
- 8: Fang M, Li J, Wang H, Yang M, Zhang Y, Zhou L, Wei H, Yang G, Yu Y, Wei X, Yu Y, Wang L, Wan M. Correlation between efficacy and structure of recombinant epitope vaccines against bovine type O foot and mouth disease virus. *Biotechnol Lett*. 2012 May;34(5):839-47. PubMed PMID: 22286179.
- 9: Pandya M, Pacheco JM, Bishop E, Kenney M, Milward F, Doel T, Golde WT. An alternate delivery system improves vaccine performance against foot-and-mouth disease virus (FMDV). *Vaccine*. 2012 Apr 26;30(20):3106-11. Epub 2012 Mar 2. PubMed PMID: 22387223.
- 10: Krug PW, Larson CR, Eslami AC, Rodriguez LL. Disinfection of foot-and-mouth disease and African swine fever viruses with citric acid and sodium hypochlorite on birch wood carriers. *Vet Microbiol*. 2012 Apr 23;156(1-2):96-101. Epub 2011 Nov 6. PubMed PMID: 22115968.
- 11: Moniwa M, Embury-Hyatt C, Zhang Z, Hole K, Clavijo A, Copps J, Alexandersen S. Experimental Foot-and-Mouth Disease Virus Infection in White Tailed Deer. *J Comp Pathol*. 2012 Apr 18. [Epub ahead of print] PubMed PMID: 22520809.
- 12: Guo H, Hao R, Qian H, Sun S, Sun D, Yin H, Liu Z, Liu X. Upconversion nanoparticles modified with aminosilanes as carriers of DNA vaccine for foot-and-mouth disease. *Appl Microbiol Biotechnol*. 2012 Apr 5. [Epub ahead of print] PubMed PMID: 22476264.
- 13: Fowler V, Robinson L, Bankowski B, Cox S, Parida S, Lawlor C, Gibson D, O'Brien F, Ellefsen B, Hannaman D, Takamatsu HH, Barnett PV. A DNA vaccination regime including protein boost and electroporation protects cattle against foot-and-mouth disease. *Antiviral Res*. 2012 Apr;94(1):25-34. Epub 2012 Feb 11. PubMed PMID: 22330893.
- 14: Szczepanek SM, Barrette RW, Rood D, Alejo D, Silbart LK. Xenoepitope substitution avoids deceptive imprinting and broadens the immune response to foot-and-mouth disease virus. *Clin Vaccine Immunol*. 2012 Apr;19(4):461-7. Epub 2012 Feb 8. PubMed PMID: 22323558; PubMed Central PMCID: PMC3318270.

- 15: Perez-Martin E, Weiss M, Diaz-San Segundo F, Pacheco JM, Arzt J, Grubman MJ, de los Santos T. Bovine type III interferon significantly delays and reduces the severity of foot-and-mouth disease in cattle. *J Virol*. 2012 Apr;86(8):4477-87. Epub 2012 Feb 1. PubMed PMID: 22301155; PubMed Central PMCID: PMC3318609.
- 16: Xu YF, Shen HY, Zhao MQ, Chen LJ, Li YG, Liao M, Jia JT, Lv YR, Yi L, Chen JD. Adenovirus-vectored shRNAs targeted to the highly conserved regions of VP1 and 2B in tandem inhibits replication of foot-and-mouth disease virus both in vitro and in vivo. *J Virol Methods*. 2012 Apr;181(1):51-8. Epub 2012 Feb 4. PubMed PMID: 22327142.
- 17: Wang Y, Shen Q, Jiang Y, Song Y, Fang L, Xiao S, Chen H. Immunogenicity of foot-and-mouth disease virus structural polyprotein P1 expressed in transgenic rice. *J Virol Methods*. 2012 Apr;181(1):12-7. Epub 2012 Jan 16. PubMed PMID: 22274594.
- 18: Dukpa K, Robertson ID, Ellis TM. Serological and clinical surveillance studies to validate reported foot-and-mouth disease free status in Tsirang district of Bhutan. *Prev Vet Med*. 2012 Apr 1;104(1-2):23-33. Epub 2011 Dec 14. PubMed PMID: 22172605.

Annex 3. RECOMMENDATIONS FROM WRLFMD ON FMD VIRUS STRAINS TO BE INCLUDED IN FMDV ANTIGEN BANKS – June 2012

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)