WRLFMD Quarterly Report July to September 2017

Foot-and-Mouth Disease

The Pirbright Institute

BBSRC bioscience for the future

Department for Environment Food & Rural Affairs

eufmd

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Copies of all the individual reports cited herein can be obtained from The Pirbright Institute and prior to presentation, publication or any other public use of these data, please contact Dr Donald King, The Pirbright Institute, donald.king@pirbright.ac.uk

1. Summary of samples tested and reported FMD outbreaks

1.1. Asia

Bhutan

Twenty two samples, collected mainly from cattle between March and July 2017, were received on 11/08/2017. FMD viruses were isolated from 16 samples (15 type O and 1 type A), while FMDV genome was detected in a further five samples. The type O viruses all belonged to the ME-SA/Ind-2001d lineage. The single type A virus characterised as belonging to ASIA/G-VII, the first type A detected in Bhutan since 2003. This virus shared a close sequence relationship to type A viruses found in Nepal.

Cambodia

Five samples (cell culture isolates) were received on 23/05/2017 from the OIE Regional Reference Laboratory (RRL) in Pakchong (Thailand). The original samples had been collected during December 2016. Virus isolation and typing results revealed two FMDV type O and two type A viruses. The fifth sample contained both O and A (detected by VP1 RT-PCR and sequencing). The type O viruses belonged to the ME-SA/PanAsia lineage while the type A viruses belonged to the ASIA/Sea-97 lineage.

Mongolia

Between April and September 2017, 13 outbreaks due to FMD type O were reported in cattle, sheep and goats in the Dornogovi, Dundgovi, Khentii and Sükhbaatar provinces. Three FMDV type O VP1 sequences were received from FGBI-ARRIAH. Two, from cattle in Khentii province, belonged to the ME-SA/PanAsia lineage and the third, from cattle in Sukhbaatar province, belonged to the ME-SA/Ind-2001d lineage. This is the first report of the O/ME-SA/Ind-2001d lineage in Mongolia.

Nepal

Twenty six samples, collected from cattle between January and May 2017, were received on 07/07/2017. FMDV type O was isolated from seven samples, type A from three samples, while FMDV genome was detected in a further 11 samples. No virus or genome was detected in the remaining five samples. The type O viruses all

belonged to the ME-SA/Ind-2001d lineage. The three type A viruses (collected on the same day in Chitwan district) belonged to the ASIA/G-VII lineage, the first type A detected in Nepal since 1997. These were very closely related to the type A virus found in Bhutan.

Pakistan

Forty five samples, collected from cattle and water buffalo between January 2016 and September 2017, were received on 15/09/2017. Virus isolation, serotyping and genotyping results are pending.

Turkey

Two VP1 sequences were received from the FMD Institute (Ankara). One FMDV type O, from Tokat province in July 2017, belonged to the ME-SA/PanAsia2QOM-15 lineage, while the other, a FMDV type A from Kars province in June 2017, belonged to the ASIA/G-VII lineage.

1.2. Africa

Botswana

An outbreak of suspected FMD was reported in Namanyane crush, Zone 2d, Ngamiland on 19/09/2017. The serotype was identified as FMD type SAT 2 by the OIE Sub-Saharan Africa Regional Reference laboratory (SSARRL) at the Botswana Vaccine Institute. The VP1 sequence was determined at the SSARRL and sent to the WRLFMD for analysis. It was identified as topotype III and was most closely related to viruses in Botswana collected from cattle in 2015.

Democratic Republic of the Congo

Four outbreaks of suspected FMD were reported on 20/05/2017. They were in cattle in Uvira in the South Kivu Province. No laboratory investigations have been reported.

Malawi

One outbreak of suspected FMD was reported in cattle at Mthumba Dip Tank, Traditional Authority Katunga, Chikwawa. The cattle were in close proximity to African buffalo from the Lengwe National Park. No laboratory investigations have been reported.

Namibia

Between July and September 2017, five outbreaks due to FMD type SAT 2 were reported in cattle at various location near Katima Mulilo situated in the Caprivi strip, Zambezi Region. No genotyping has been reported.

South Africa

Between 30/03/2017 and 15/05/2017, three outbreaks due to FMD type SAT 2 were reported in Bushbuckridge, Mpumalanga.

Between 21st and 31st August 2017, three outbreaks due to FMD SAT 1 were reported at Greater Giyani, Limpopo.

Both outbreaks were within South Africa's FMD protection zone, close to the Kruger National Park and have not affected the status of South Africa's FMD free zone. No genotyping results have been reported.

Uganda

Two VP1 sequence were submitted by the SSARRL (BVI). One was FMDV type O and belonged to the EA-2 topotype and the other was FMDV type SAT 2 and belonged to the VII topotype.

Zimbabwe

Between the 21/07/2017 and 13/09/2017, 46 outbreaks of suspected/untyped FMD were reported in cattle in the provinces of Masvingo, Manicaland and Midlands. No laboratory investigations have been reported.

1.3. South America

Colombia

In July 2017, three further outbreaks of FMD type O were reported in cattle in Norte de Santander Department (which is adjacent to Arauca department where the original outbreak was reported in June 2017). The origin of the disease was identified as being illegal introduction of animals from Venezuela.

Additionally, in June and July, three outbreaks of FMDV type O were reported in the Cundinamarca department. The genetic relationships of these viruses is awaited.

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/2017.htm.

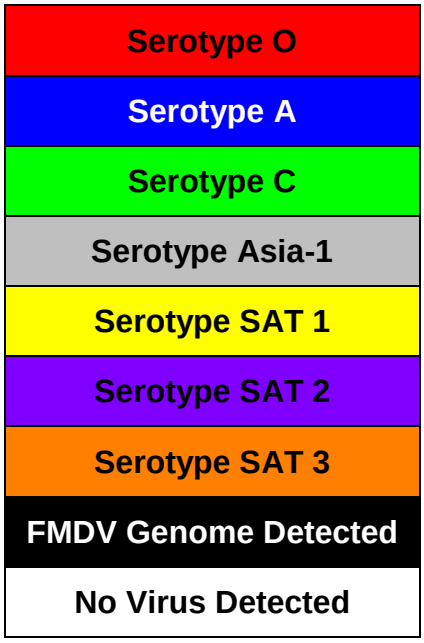
Results from samples or sequences received at WRLFMD (status of samples being tested) are shown in Table 1 and a complete list of clinical sample diagnostics made by the WRLFMD from July to September 2017 is shown in Annex 1 (Summary of Submissions). A record of all samples received by WRLFMD (July to September 2017) is shown in Annex 1 (Clinical Samples).

Table 1: Status of sequencing of samples or sequences received by the WRLFMD from July to September 2017 (* indicates samples carried over from the last quarter and † indicates not included in the totals.)

WRLFMD Batch No.	Date received	Country	Serotype	No. of samples	No. of sequences	Sequencing status
WRLFMD/2017/00014	05/07/2017	Egypt	O	21	21	completed
WRLFMD/2017/00014	05/07/2017	Egypt	A	1	1	completed
WRLFMD/2017/00015	23/05/2017	Cambodia	O	2	2	completed
WRLFMD/2017/00015	23/05/2017	Cambodia	A	2	2	completed
WRLFMD/2017/00015	23/05/2017	Cambodia	O+A	1	2	completed
WRLFMD/2017/00016	07/07/2017	Nepal	O	7	7	completed
WRLFMD/2017/00016	07/07/2017	Nepal	A	3	3	completed
WRLFMD/2017/00018	21/07/2017	Afghanistan	O	5	5	completed
WRLFMD/2017/00018	21/07/2017	Afghanistan	A	9	9	completed
WRLFMD/2017/00018	21/07/2017	Afghanistan	Asia 1	2	2	completed
WRLFMD/2017/00019	11/08/2017	Bhutan	O	15	15	completed
WRLFMD/2017/00019	11/08/2017	Bhutan	A	1	1	completed
WRLFMD/2017/00021	15/09/2017	Pakistan	pending	(n=45)†		pending
			Total	**69**	**70**	

2. Detailed Analysis

Key for maps and trees:



2.1. ASIA

Afghanistan

Batch: WRLFMD/2017/00018

Date received: 21/07/2017

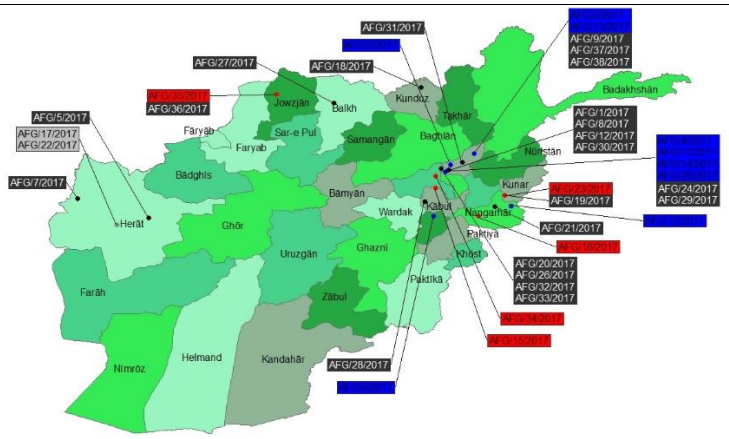
No. of samples: 16

O (ME-SA/PanAsia-2/ANT-10): 5

A (ASIA/Iran-05/FAR-11): 5

A (ASIA/Iran-05/SIS-13): 4

Asia 1 (ASIA/Sindh-08): 2



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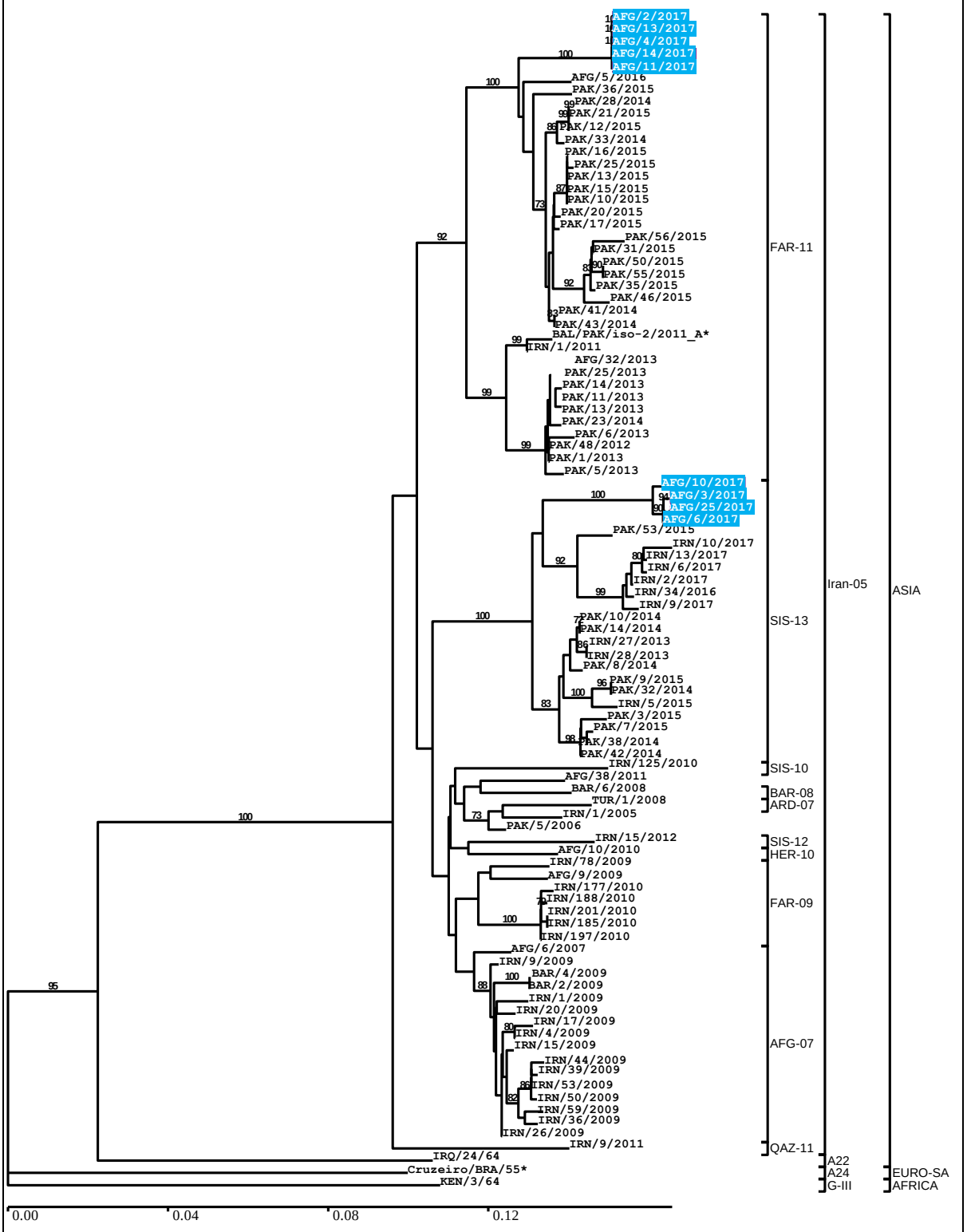

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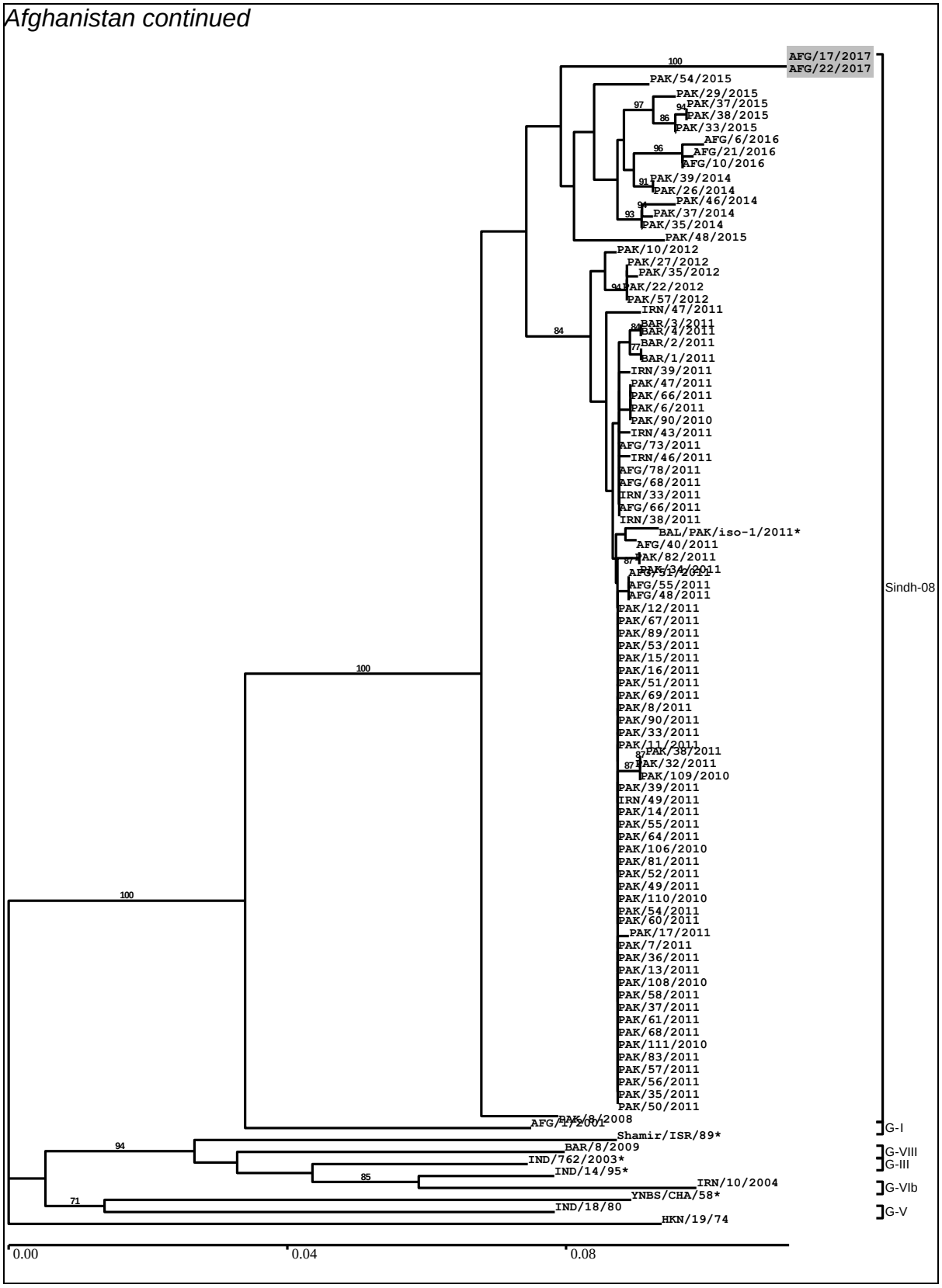


Bhutan

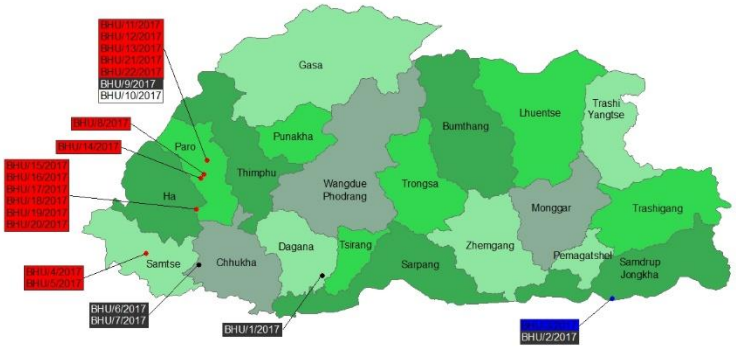
Batch: WRLFMD/2017/00019

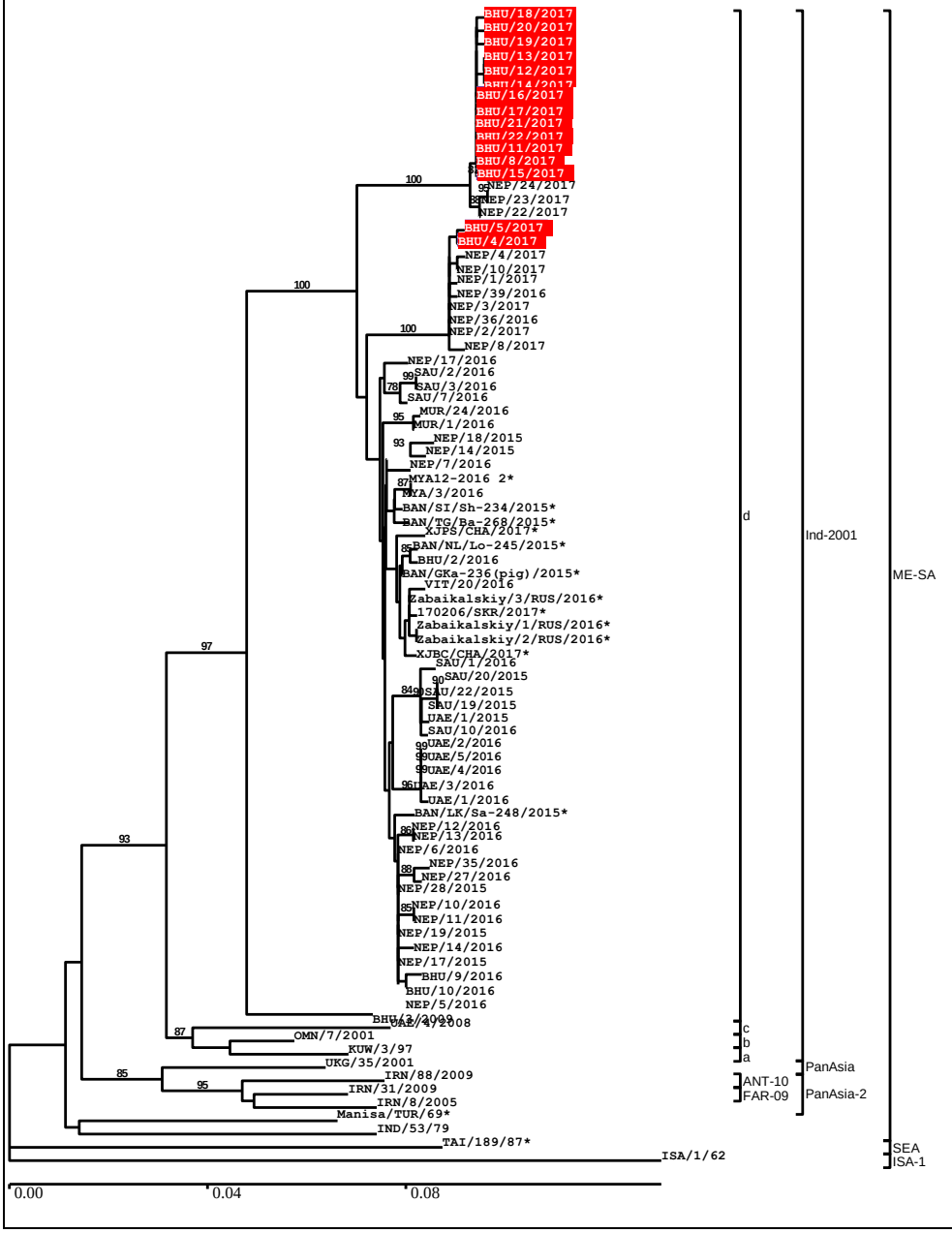
Date received: 11/08/2017

No. of samples: 16

O (ME-SA/Ind-2001d): 15

A (ASIA/G-VII): 1





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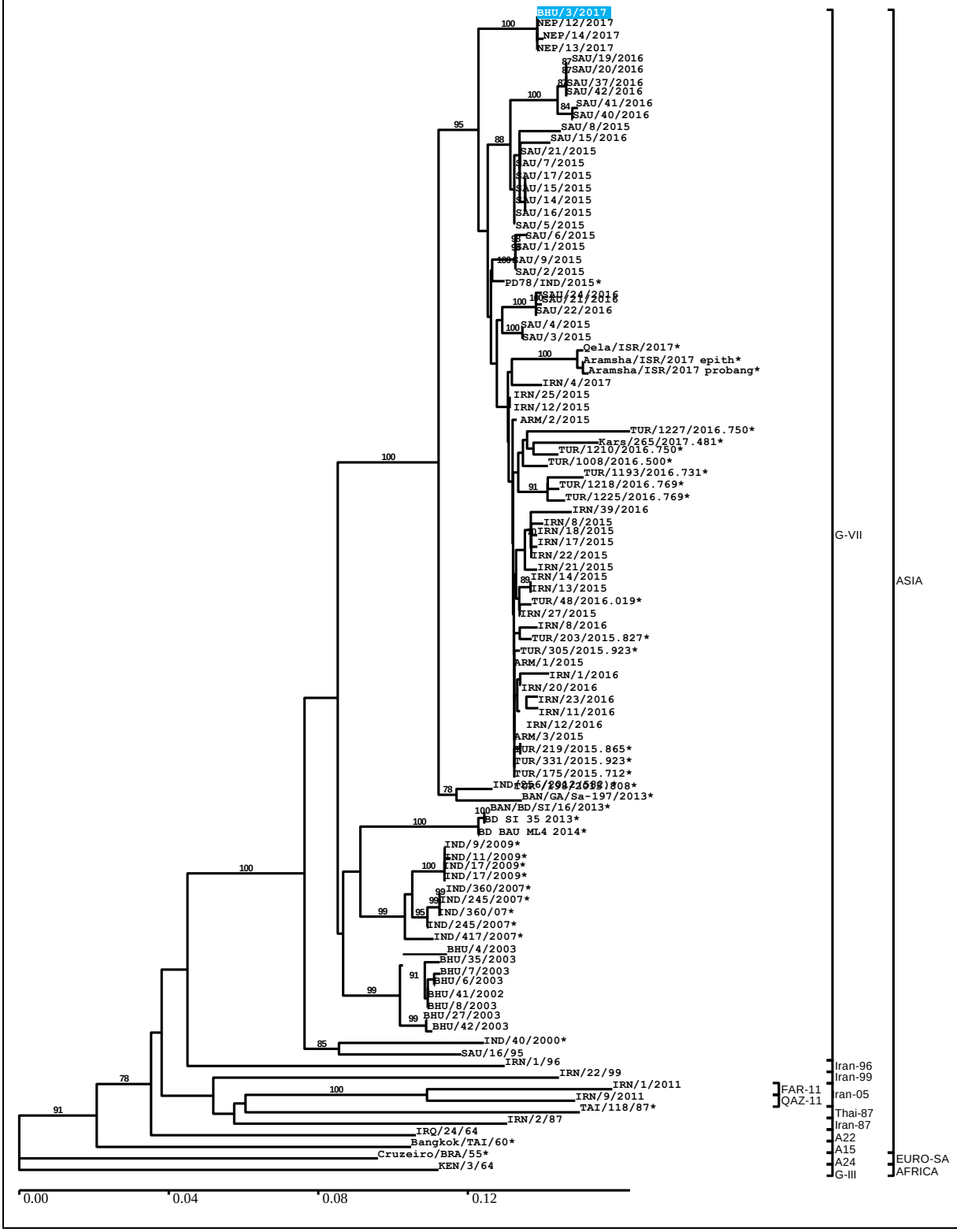


Cambodia

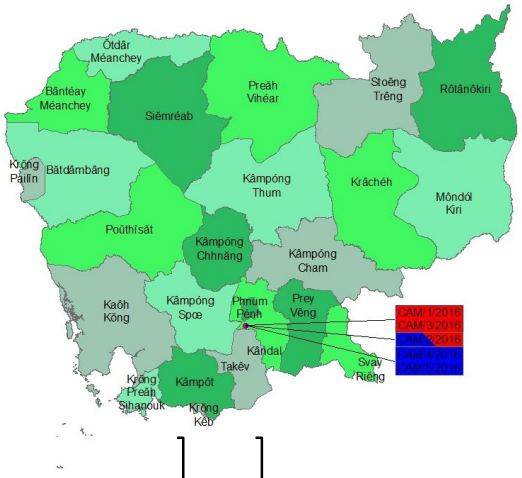
Batch: WRLFMD/2017/00015

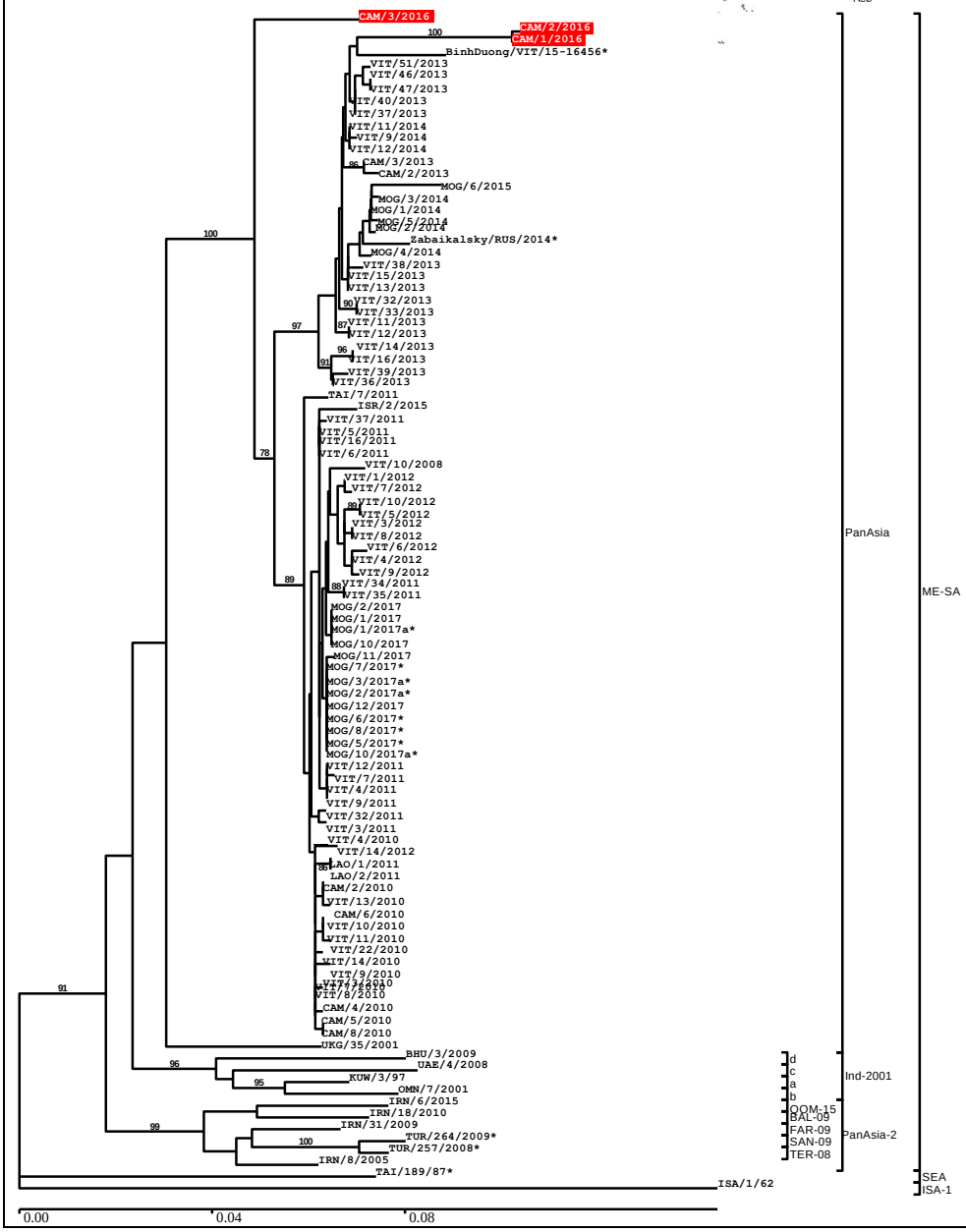
Date received: 23/05/2017

No. of samples: 5

O (ME-SA/PanAsia): 3

A (ASIA/Sea-97): 3





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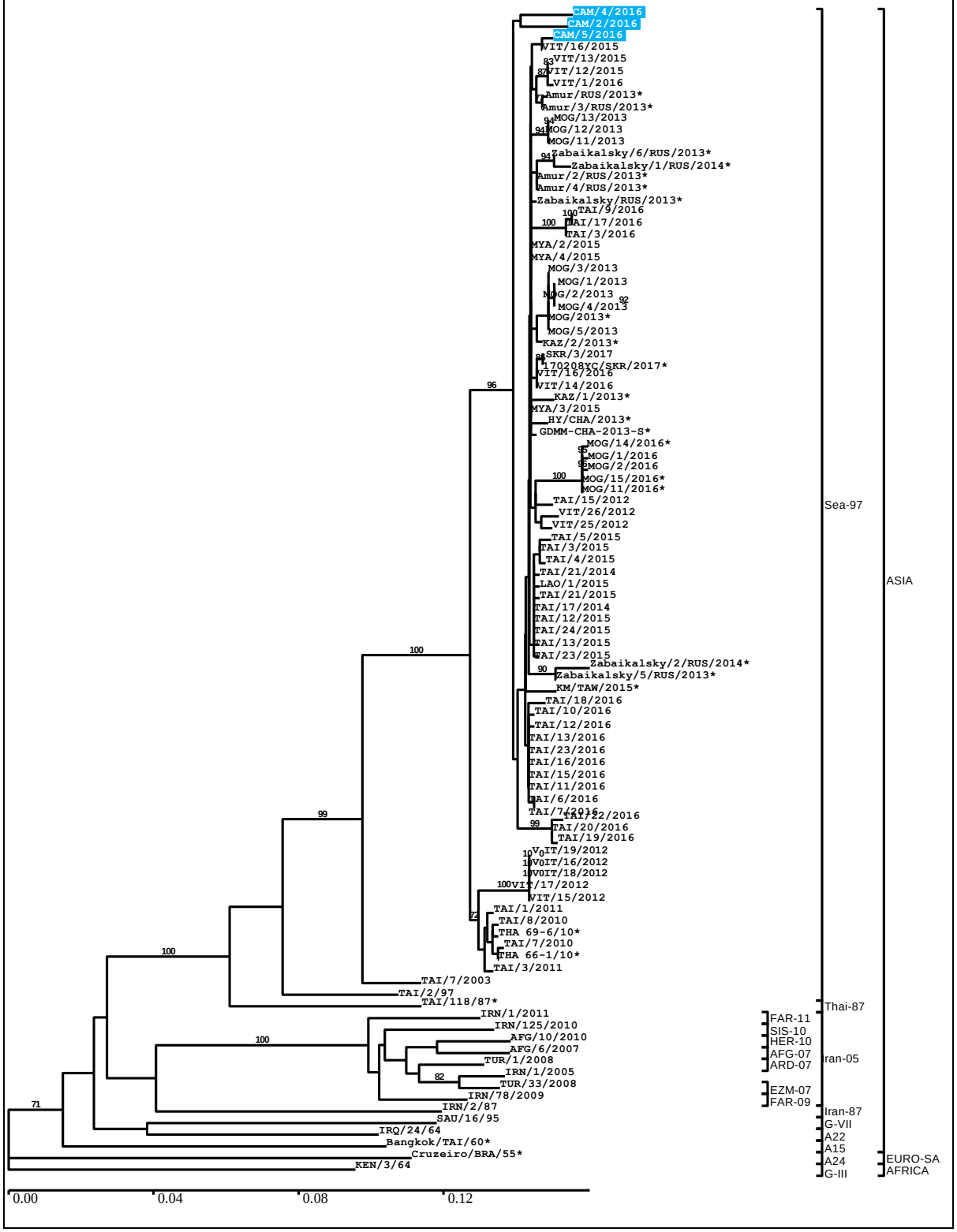


Egypt

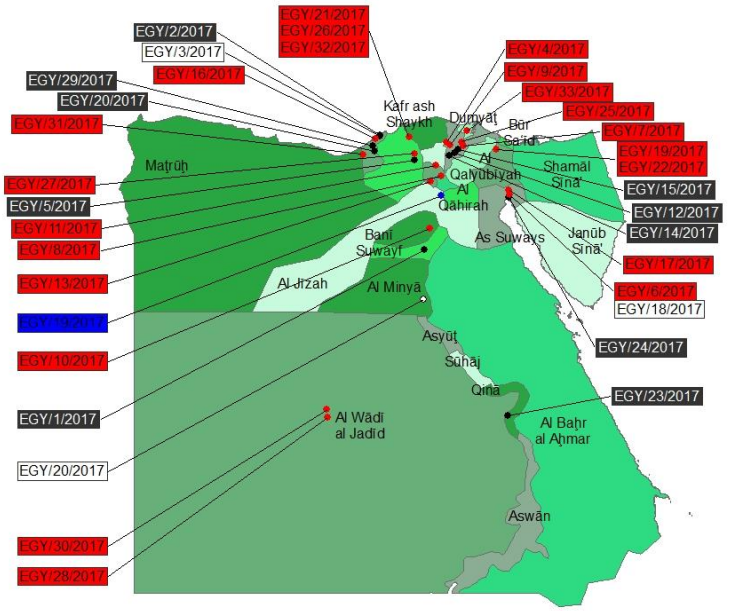
Batch: WRLFMD/2017/00014

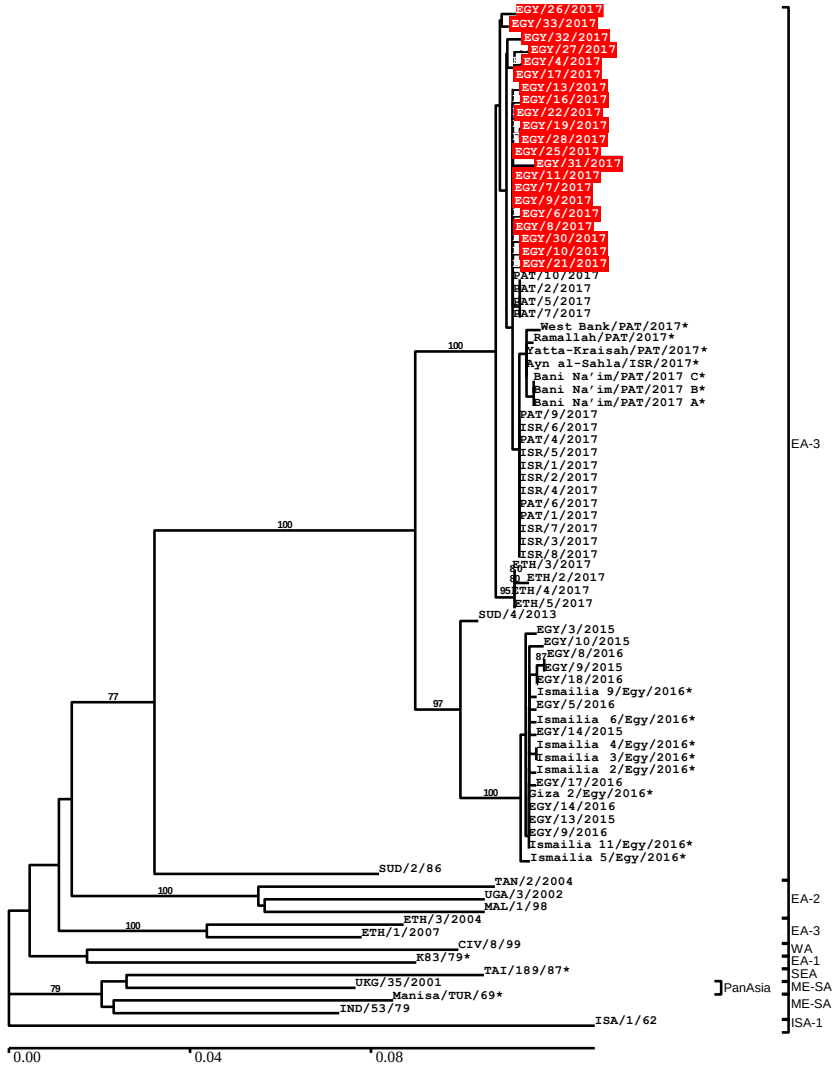
Date received: 05/07/2017

No. of samples: 22

O (EA-3): 21

A (AFRICA/G-IV): 1





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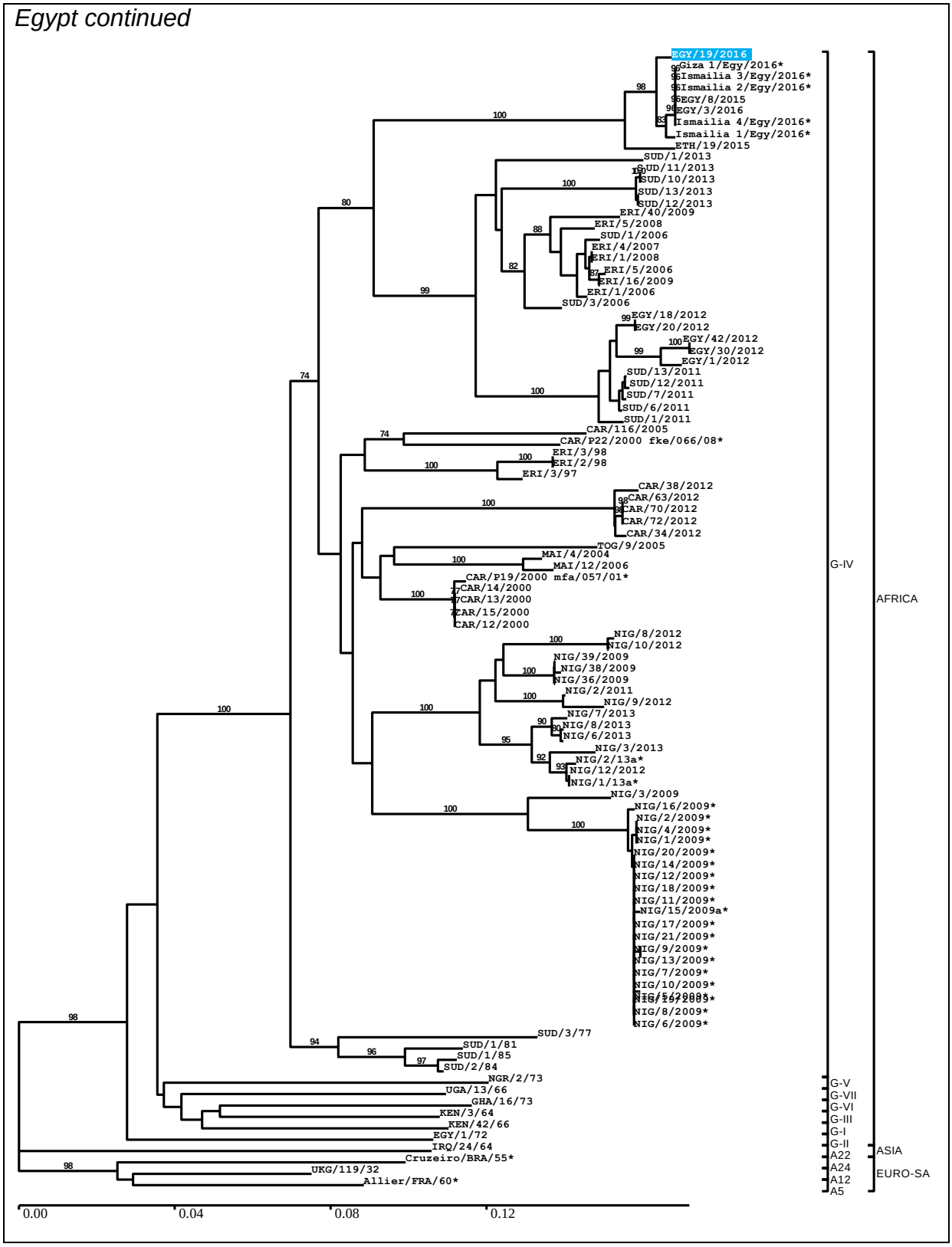


Mongolia

Batch: WRLMEG/2017/00050

Submitted by:

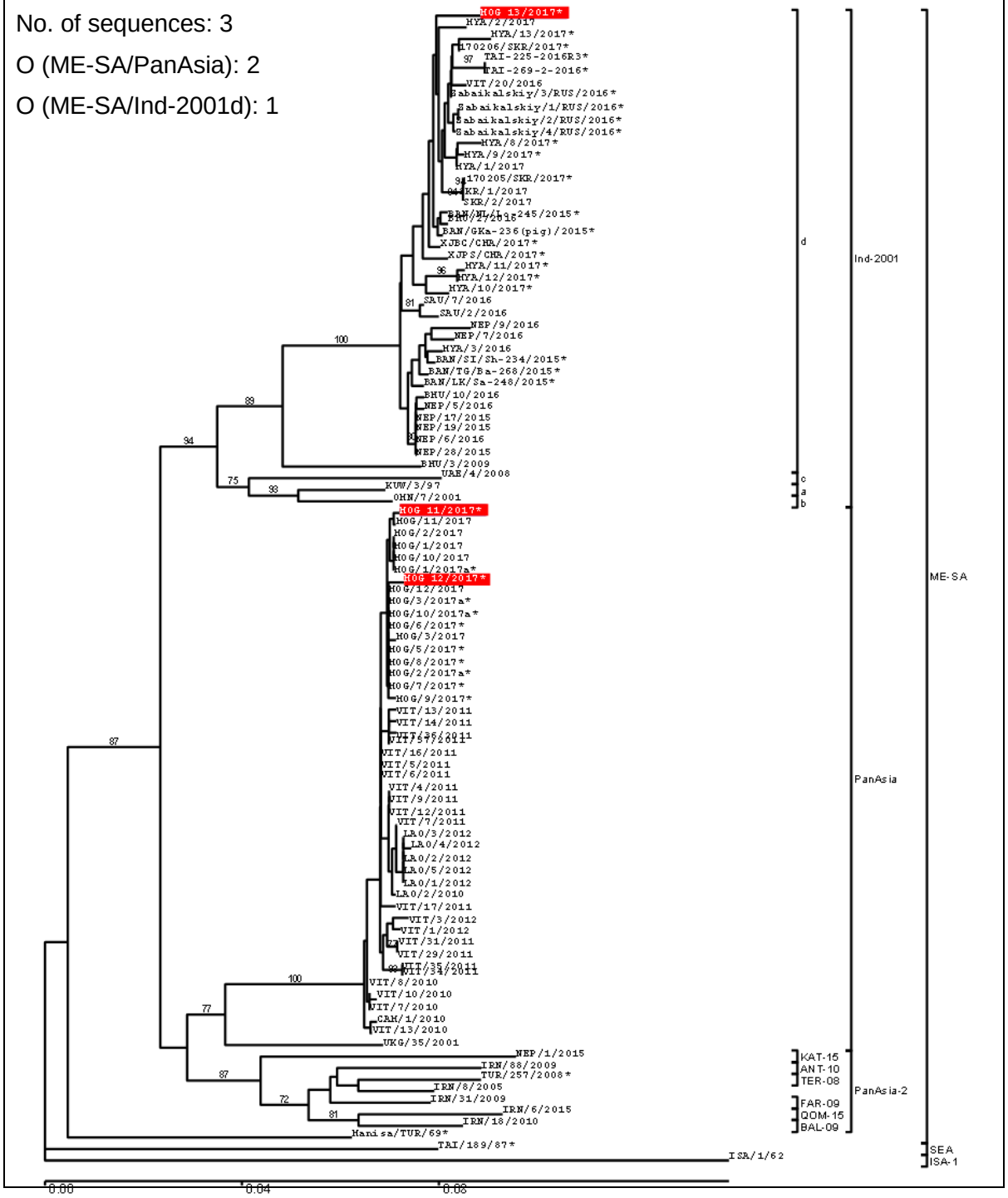
Alexey Mischenko, FGBI-ARRIAH

Date received: 30/09/2017

No. of sequences: 3

O (ME-SA/PanAsia): 2

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



Nepal

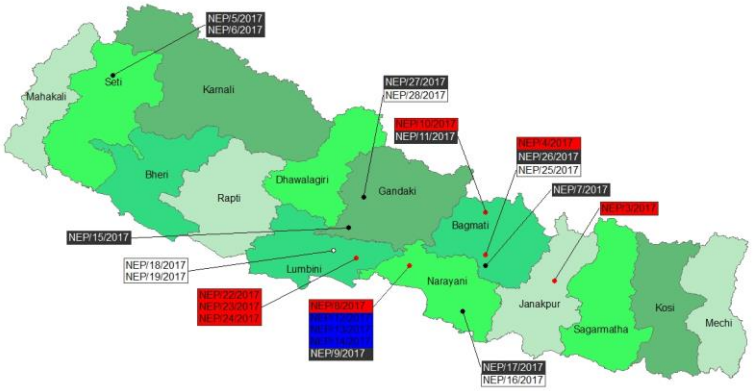
Batch: WRLFMD/2017/00016

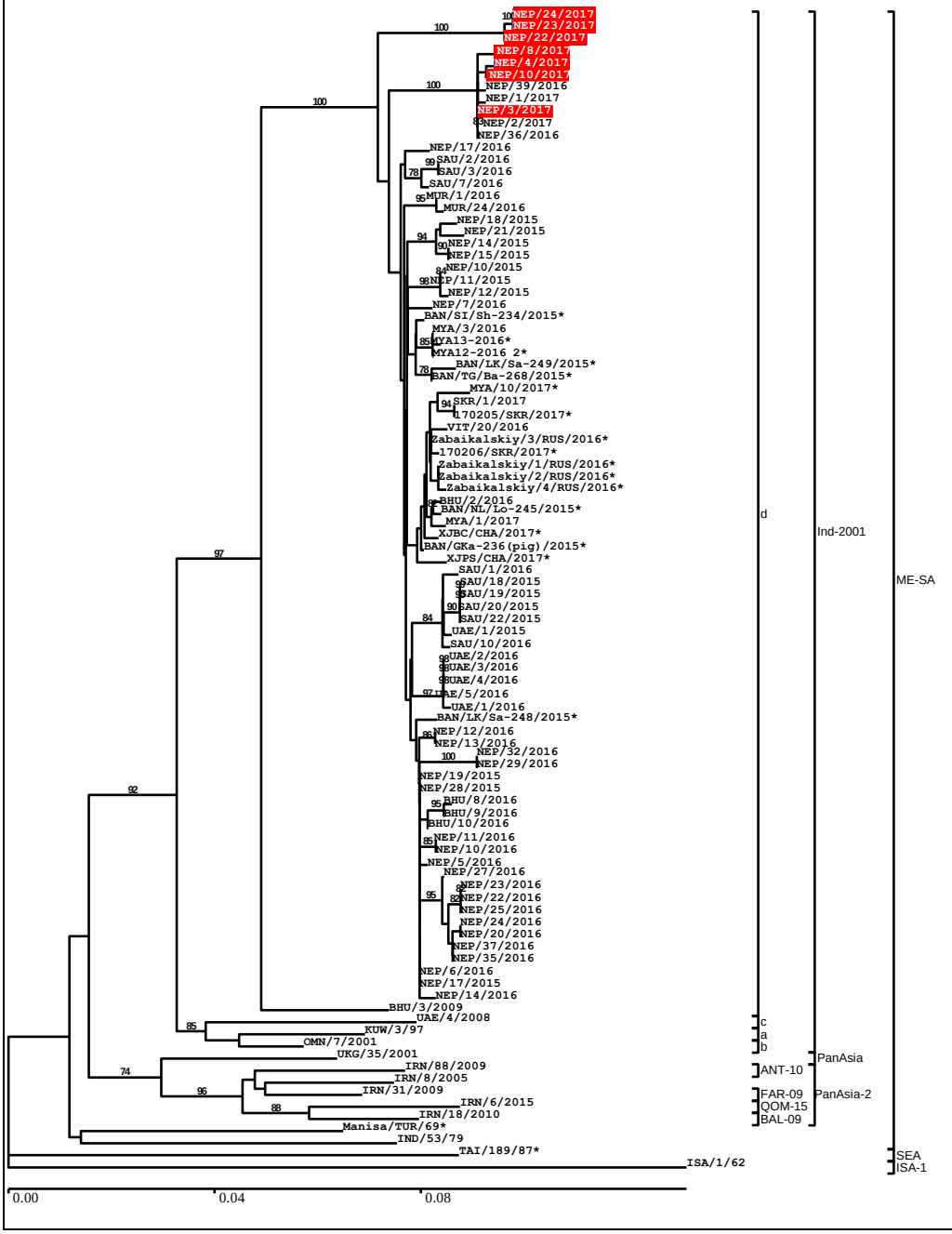
Date received: 07/07/2017

No. of samples: 10

O (ME-SA/Ind-2001d): 7

A (ASIA/G-VII): 3





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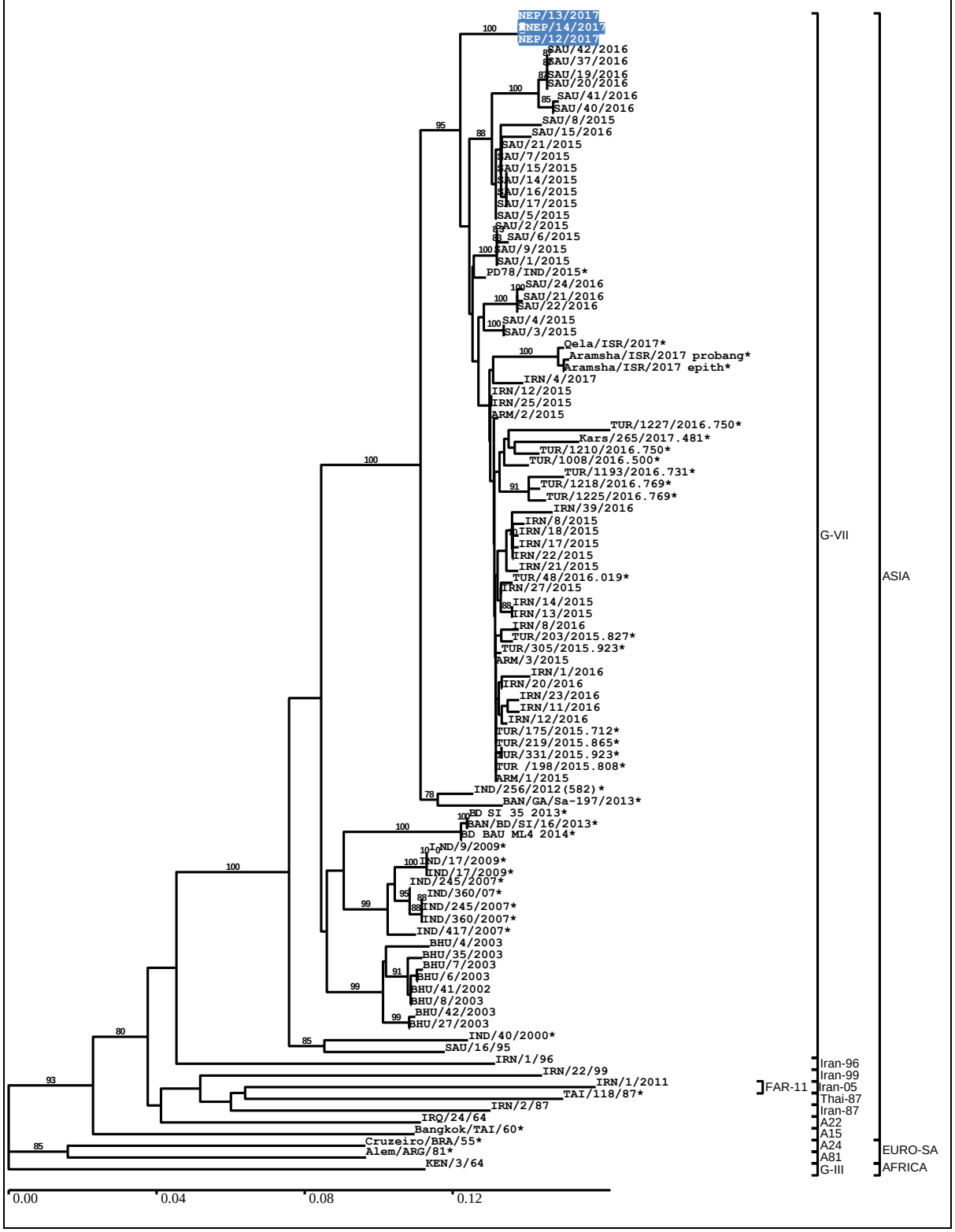


Turkey

Batch: WRLMEG/2017/00045

Submitted by:

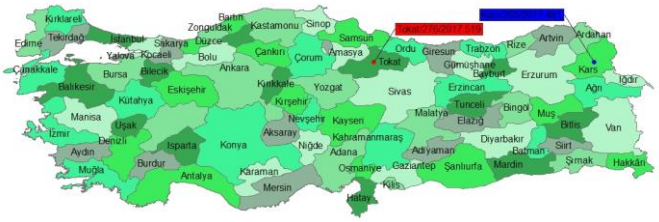
Ünal Parlak, FMD Institute, Ankara

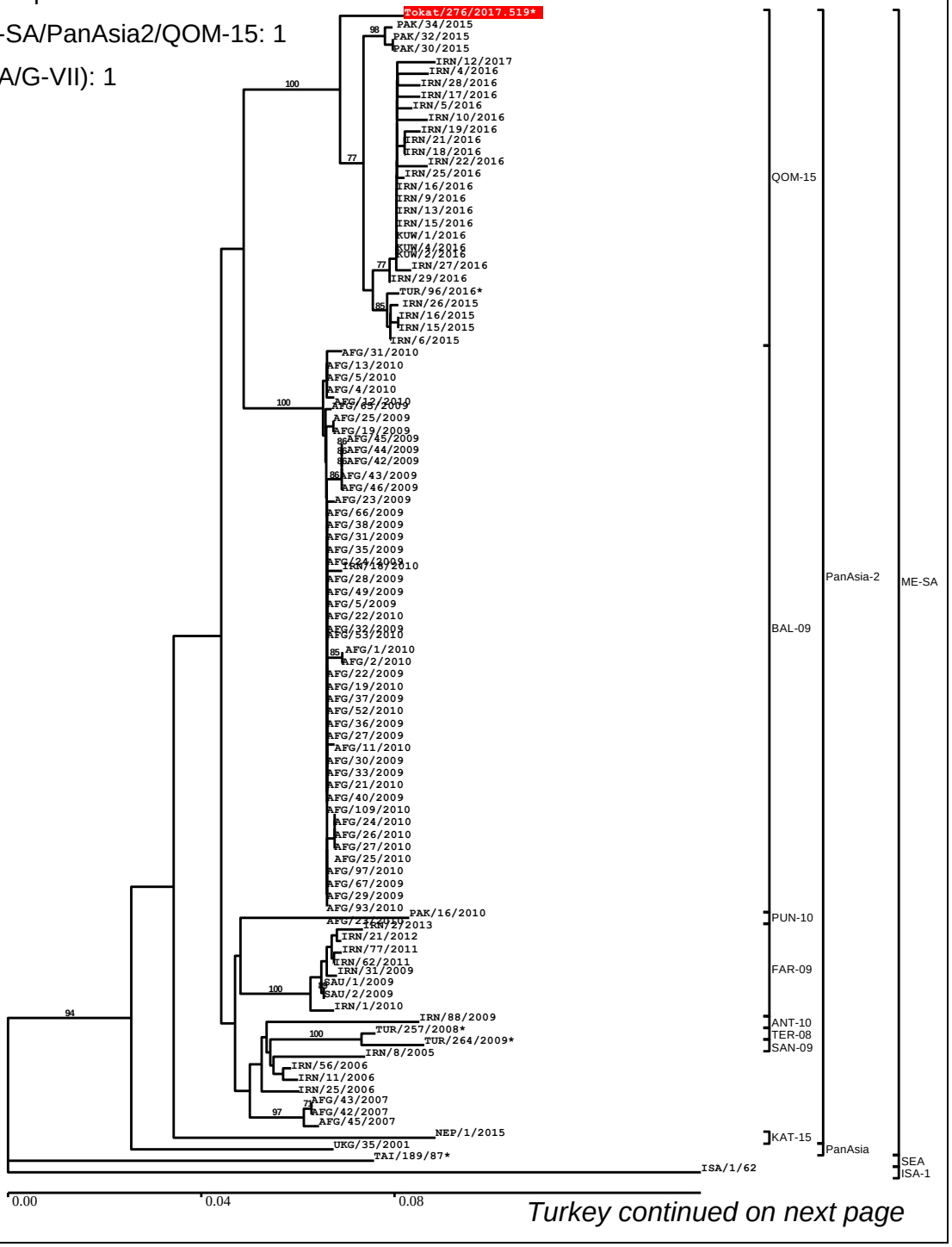
Date received: 13/07/2017

No. of sequences: 2

O (ME-SA/PanAsia2/QOM-15: 1

A (ASIA/G-VII): 1





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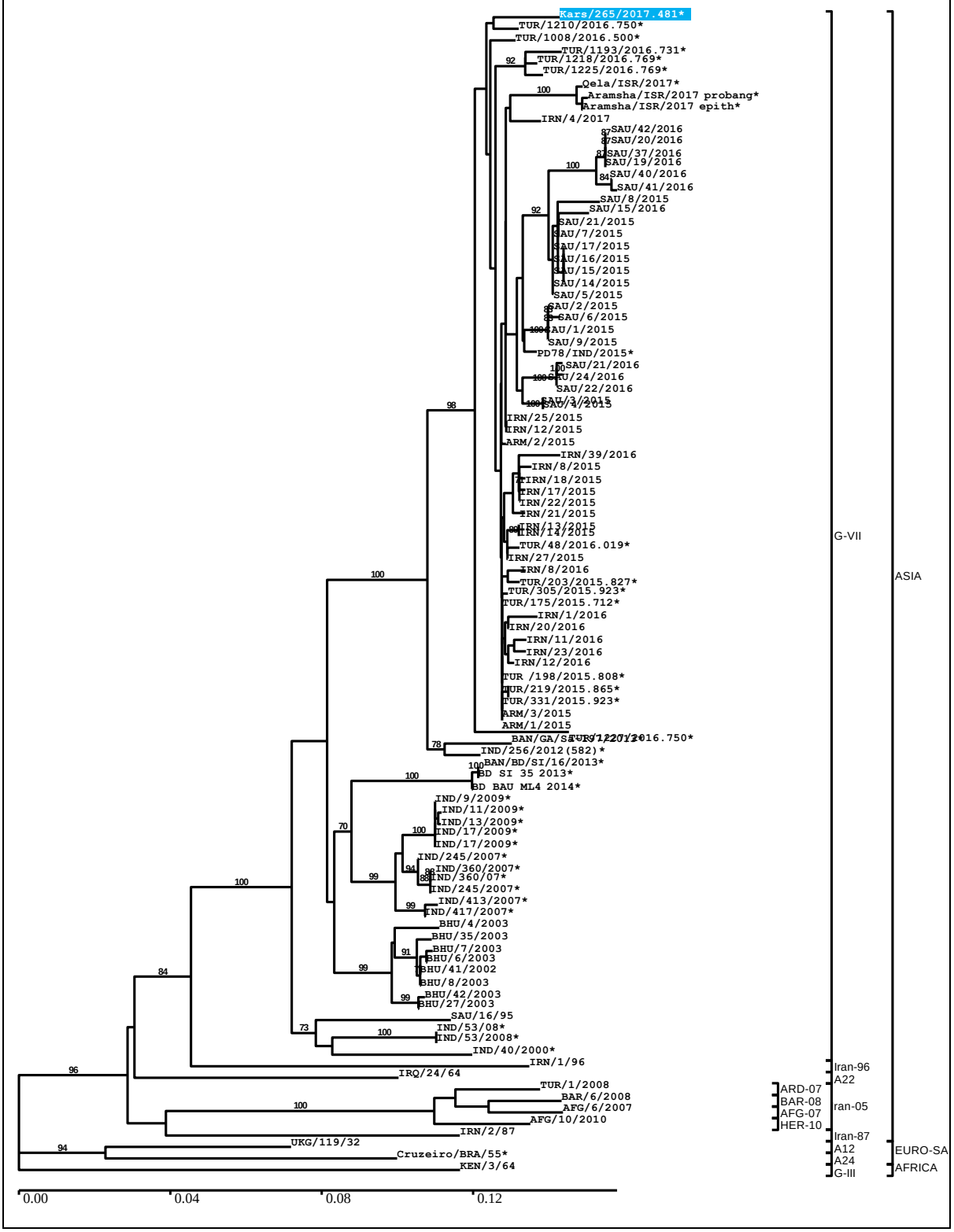


2.2. AFRICA

Botswana

Batch: WRLMEG/2017/00049

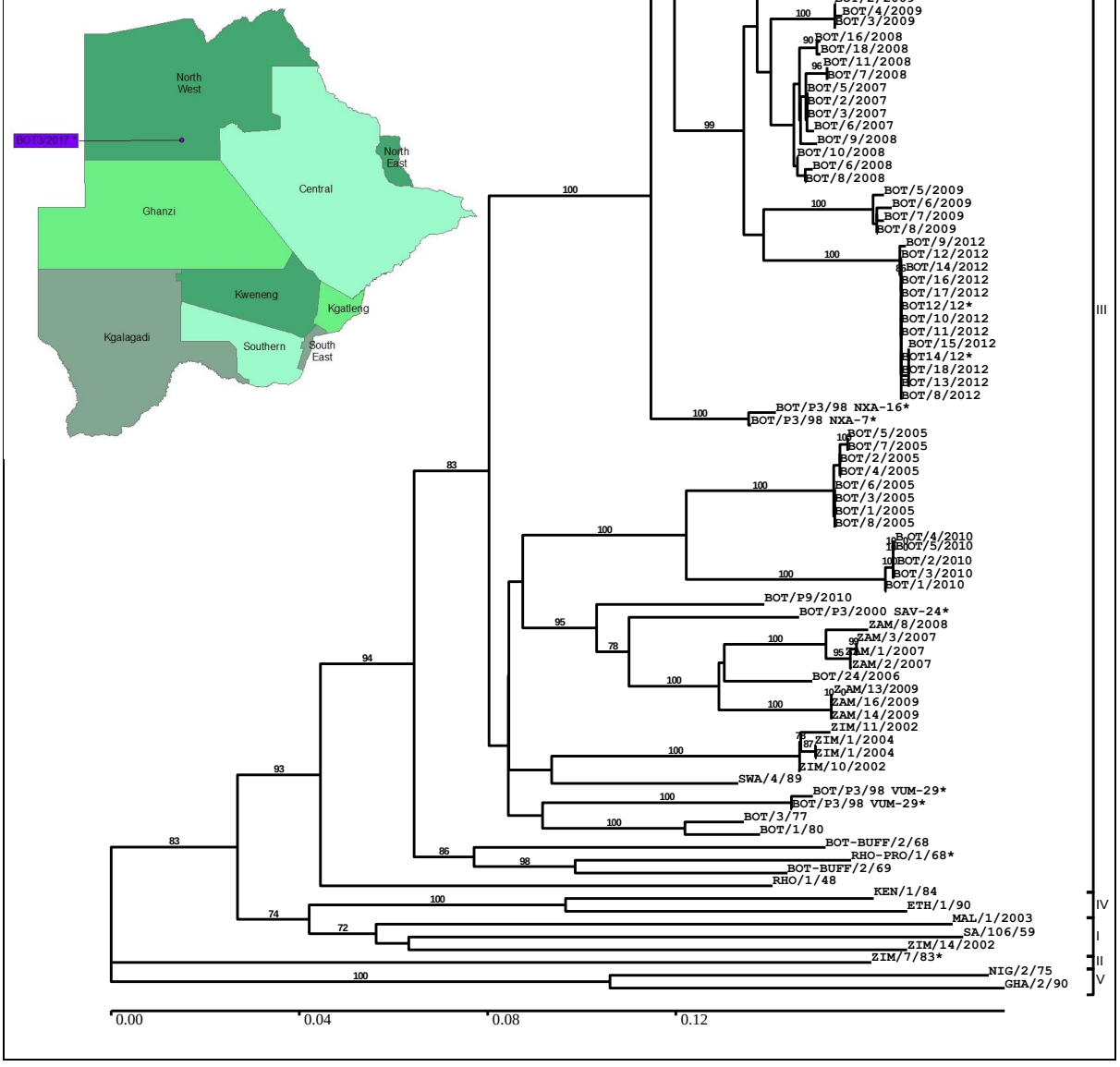
Submitted by:

Elliot Fana, SSARRL, BV

Date sequences received: 25/09/2017

No. of sequences: 1

SAT 2 (III): 1



Uganda

Batch: WRLMEG/2017/00046

Submitted by:

Elliot Fana, SSARRL, BVI

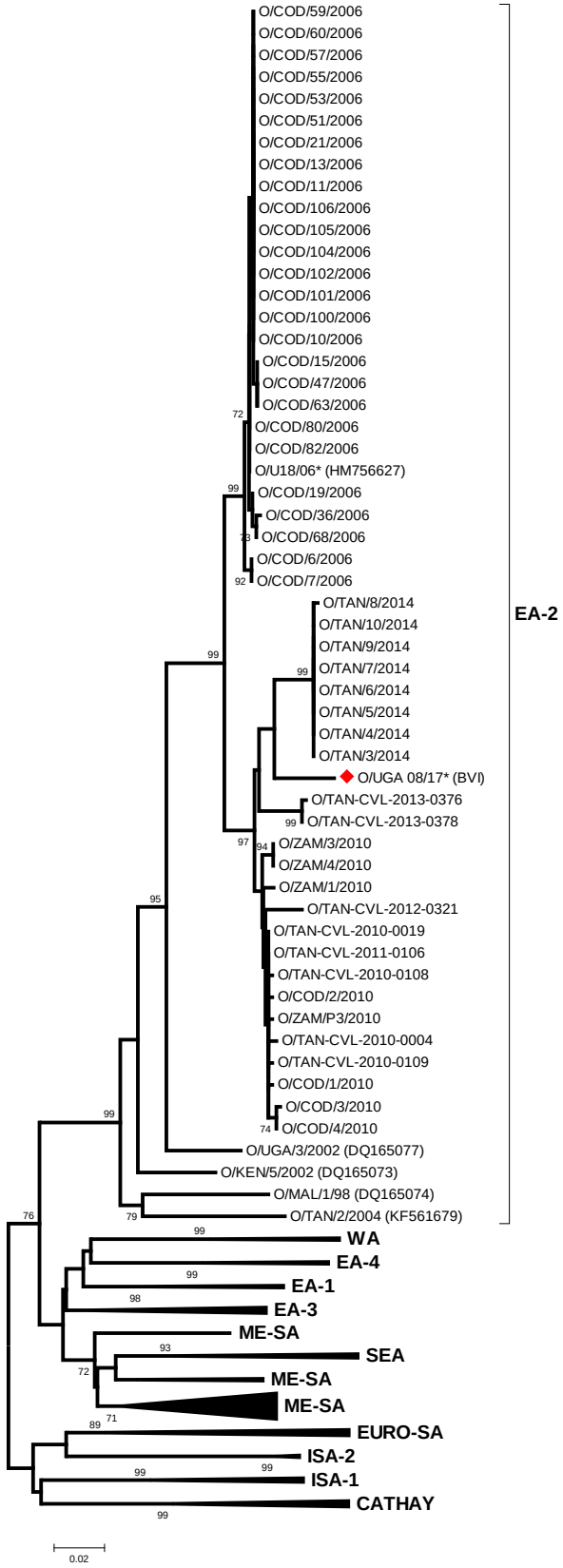
Date sequences received: 20/07/2017

No. of sequences: 2

O (EA-2): 1

SAT 2 (III): 1

Locations not supplied.



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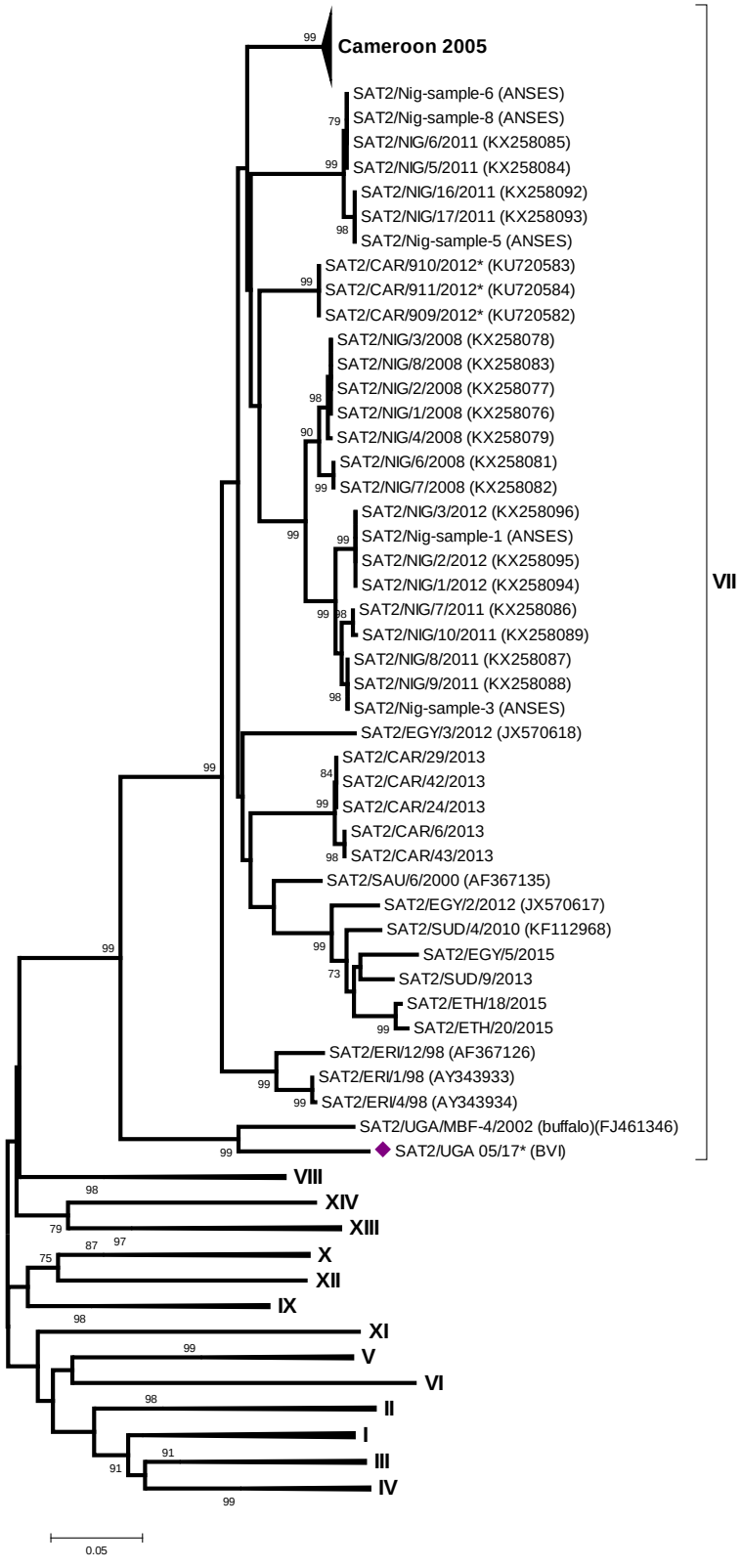

3. Vaccine matching

During this reporting period vaccine matching has been undertaken for 25 FMD virus field strains: serotype O (n=14) and serotype A (n=11). These are samples from Cambodia, Iran (Islamic Republic of), Mongolia, Ethiopia, Lao People's Democratic Republic (the), Myanmar, Nepal and Thailand.

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

4. Annex 1

4.1. Summary of Submissions

Table 2: Summary of samples collected and received to WRLFMD (July to September 2017)

Country	№ of samples	Virus isolation in cell culture/ELISA								RT-PCR for FMD (or SVD) virus (where appropriate)	
		FMD virus serotypes							No Virus Detected		
		O	A	C	SAT 1	SAT 2	SAT 3	ASIA -1		Positive	Negative
AFGHANISTAN	38	5	9	-	-	-	-	2	22	38	-
BHUTAN	22	15	1	-	-	-	-	-	6	21	1
EGYPT	35	21	1	-	-	-	-	-	13	30	5
KAZAKHSTAN	5	-	-	-	-	-	-	-	5	-	5
NEPAL	26	7	3	-	-	-	-	-	16	21	5
PAKISTAN	45	-	-	-	-	-	-	-	-	-	-
Carried over from previous quarterly report:											
CAMBODIA	5	2	3	-	-	-	-	-	-	5	-
TOTAL	**176**	**50**	**17**	**-**	**-**	**-**	**-**	**2**	**62**	**115**	**16**

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
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® July to September 2017

Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results		
				VI/ELISA	RT-PCR	Final report
AFGHANISTAN	AFG 1/2017	CATTLE	04-Jan-17	NEG	POS	FMDV GD
	AFG 2/2017	CATTLE	10-Jan-17	A	POS	A
	AFG 3/2017	CATTLE	13-Jan-17	A	POS	A
	AFG 4/2017	CATTLE	17-Jan-17	A	POS	A
	AFG 5/2107	CATTLE	08-Mar-17	NEG	POS	FMDV GD
	AFG 6/2017	CATTLE	11-Mar-17	A	POS	A
	AFG 7/2017	CATTLE	15-Mar-17	NEG	POS	FMDV GD
	AFG 8/2017	CATTLE	18-Mar-17	NEG	POS	FMDV GD
	AFG 9/2017	CATTLE	20-Mar-17	NEG	POS	FMDV GD
	AFG 10/2017	CATTLE	21-Mar-17	A	POS	A
	AFG 11/2017	CATTLE	21-Mar-17	A	POS	A
	AFG 12/2017	CATTLE	23-Mar-17	NEG	POS	FMDV GD
	AFG 13/2017	CATTLE	25-Mar-17	A	POS	A
	AFG 14/2017	CATTLE	26-Mar-17	A	POS	A
	AFG 15/2017	CATTLE	30-Mar-17	O	POS	O
	AFG 16/2017	CATTLE	04-Apr-17	O	POS	O
	AFG 17/2017	CATTLE	14-Apr-17	ASIA-1	POS	ASIA-1
	AFG 18/2017	CATTLE	15-Apr-17	NEG	POS	FMDV GD
	AFG 19/2017	CATTLE	15-Apr-17	NEG	POS	FMDV GD
	AFG 20/2017	CATTLE	18-Apr-17	NEG	POS	FMDV GD
	AFG 21/2017	CATTLE	18-Apr-17	NEG	POS	FMDV GD
	AFG 22/2017	CATTLE	23-Apr-17	ASIA-1	POS	ASIA-1
	AFG 23/2017	CATTLE	24-Apr-17	O	POS	O
	AFG 24/2017	CATTLE	25-Apr-17	NEG	POS	FMDV GD
	AFG 25/2017	CATTLE	27-Apr-17	A	POS	A
	AFG 26/2017	CATTLE	30-Apr-17	NEG	POS	FMDV GD
	AFG 27/2017	CATTLE	04-May-17	NEG	POS	FMDV GD
	AFG 28/2017	CATTLE	04-May-17	NEG	POS	FMDV GD
	AFG 29/2017	CATTLE	07-May-17	NEG	POS	FMDV GD
	AFG 30/2017	CATTLE	16-May-17	NEG	POS	FMDV GD
	AFG 31/2017	CATTLE	16-May-17	NEG	POS	FMDV GD
	AFG 32/2017	CATTLE	17-May-17	NEG	POS	FMDV GD
	AFG 33/2017	CATTLE	21-May-17	NEG	POS	FMDV GD
	AFG 34/2017	CATTLE	25-May-17	O	POS	O
	AFG 35/2017	CATTLE	26-May-17	O	POS	O
	AFG 36/2017	CATTLE	26-May-17	NEG	POS	FMDV GD
	AFG 37/2017	CATTLE	28-May-17	NEG	POS	FMDV GD

Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results		
				VI/ELISA	RT-PCR	Final report
	AFG 38/2017	CATTLE	28-May-17	NEG	POS	FMDV GD
BHUTAN	BHU 1/2017	PIG	06-Mar-17	NEG	POS	FMDV GD
	BHU 2/2017	CATTLE	01-Apr-17	NEG	POS	FMDV GD
	BHU 3/2017	CATTLE	01-Apr-17	A	POS	A
	BHU 4/2017	CATTLE	08-Apr-17	O	POS	O
	BHU 5/2017	CATTLE	08-Apr-17	O	POS	O
	BHU 6/2017	CATTLE	17-May-17	NEG	POS	FMDV GD
	BHU 7/2017	CATTLE	17-May-17	NEG	POS	FMDV GD
	BHU 8/2017	CATTLE	08-Jun-17	O	POS	O
	BHU 9/2017	CATTLE	25-Jun-17	NEG	POS	FMDV GD
	BHU 10/2017	CATTLE	25-Jun-17	NEG	NEG	NVD
	BHU 11/2017	CATTLE	14-Jul-17	O	POS	O
	BHU 12/2017	CATTLE	19-Jul-17	O	POS	O
	BHU 13/2017	CATTLE	19-Jul-17	O	POS	O
	BHU 14/2017	CATTLE	19-Jul-17	O	POS	O
	BHU 15/2017	CATTLE	21-Jul-17	O	POS	O
	BHU 16/2017	CATTLE	21-Jul-17	O	POS	O
	BHU 17/2017	CATTLE	21-Jul-17	O	POS	O
	BHU 18/2017	CATTLE	21-Jul-17	O	POS	O
	BHU 19/2017	CATTLE	21-Jul-17	O	POS	O
	BHU 20/2017	CATTLE	21-Jul-17	O	POS	O
	BHU 21/2017	CATTLE	22-Jul-17	O	POS	O
	BHU 22/2017	CATTLE	22-Jul-17	O	POS	O
EGYPT	EGY 19/2016	CATTLE	07-Nov-16	A	POS	A
	EGY 20/2016	CATTLE	19-Dec-16	NEG	NEG	NVD
	EGY 1/2017	CATTLE	03-Jan-17	NEG	POS	FMDV GD
	EGY 2/2017	CATTLE	12-Jan-17	NEG	POS	FMDV GD
	EGY 3/2017	CATTLE	18-Jan-17	NEG	NEG	NVD
	EGY 4/2017	BUFFALO	30-Jan-17	O	POS	O
	EGY 5/2017	CATTLE	02-Feb-17	NEG	POS	FMDV GD
	EGY 6/2017	CATTLE	04-Feb-17	O	POS	O
	EGY 7/2017	CATTLE	05-Feb-17	O	POS	O
	EGY 8/2017	CATTLE	06-Feb-17	O	POS	O
	EGY 9/2017	CATTLE	12-Feb-17	O	POS	O
	EGY 10/2017	BUFFALO	13-Feb-17	O	POS	O
	EGY 11/2017	BUFFALO	14-Feb-17	O	NEG	O
	EGY 12/2017	CATTLE	15-Feb-17	NEG	POS	FMDV GD
	EGY 13/2017	CATTLE	15-Feb-17	O	POS	O
	EGY 14/2017	CATTLE	19-Feb-17	NEG	POS	FMDV GD
	EGY 15/2017	CATTLE	20-Feb-17	NEG	POS	FMDV GD
	EGY 16/2017	CATTLE	22-Feb-17	O	POS	O

Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results		
				VI/ELISA	RT-PCR	Final report
	EGY 17/2017	CATTLE	27-Feb-17	O	POS	O
	EGY 18/2017	CATTLE	06-Mar-17	NEG	NEG	NVD
	EGY 19/2017	CATTLE	08-Mar-17	O	POS	O
	EGY 20/2017	BUFFALO	08-Mar-17	NEG	POS	FMDV GD
	EGY 21/2017	CATTLE	13-Mar-17	O	POS	O
	EGY 22/2017	BUFFALO	19-Mar-17	O	NEG	O
	EGY 23/2017	BUFFALO	20-Mar-17	NEG	POS	FMDV GD
	EGY 24/2017	CATTLE	25-Mar-17	NEG	POS	FMDV GD
	EGY 25/2017	CATTLE	30-Mar-17	O	POS	O
	EGY 26/2017	CATTLE	01-Apr-17	O	POS	O
	EGY 27/2017	CATTLE	05-Apr-17	O	POS	O
	EGY 28/2017	CATTLE	11-Apr-17	O	POS	O
	EGY 29/2017	CATTLE	13-Apr-17	NEG	POS	FMDV GD
	EGY 30/2017	CATTLE	15-Apr-17	O	POS	O
	EGY 31/2017	CATTLE	16-Apr-17	O	POS	O
	EGY 32/2017	CATTLE	18-Apr-17	O	POS	O
	EGY 33/2017	CATTLE	23-Apr-17	O	POS	O
KAZAKHSTAN	KAZ 1/2017	CATTLE	04-Jun-17	NEG	NEG	NVD
	KAZ 2/2017	CATTLE	04-Jun-17	NEG	NEG	NVD
	KAZ 3/2017	CATTLE	04-Jun-17	NEG	NEG	NVD
	KAZ 4/2017	CATTLE	04-Jun-17	NEG	NEG	NVD
	KAZ 5/2017	CATTLE	04-Jun-17	NEG	NEG	NVD
NEPAL	NEP 3/2017	CATTLE	20-Jan-17	O	POS	O
	NEP 4/2017	CATTLE	26-Jan-17	O	POS	O
	NEP 5/2017	CATTLE	30-Jan-17	NEG	POS	FMDV GD
	NEP 6/2017	CATTLE	30-Jan-17	NEG	POS	FMDV GD
	NEP 7/2017	CATTLE	08-Feb-17	NEG	POS	FMDV GD
	NEP 8/2017	CATTLE	13-Mar-17	O	POS	O
	NEP 9/2017	CATTLE	13-Mar-17	NEG	POS	FMDV GD
	NEP 10/2017	CATTLE	15-Mar-17	O	POS	O
	NEP 11/2017	CATTLE	15-Mar-17	NEG	POS	FMDV GD
	NEP 12/2017	CATTLE	06-Apr-17	A	POS	A
	NEP 13/2017	CATTLE	06-Apr-17	A	POS	A
	NEP 14/2017	CATTLE	06-Apr-17	A	POS	A
	NEP 15/2017	CATTLE	17-Apr-17	NEG	POS	FMDV GD
	NEP 16/2017	CATTLE	19-Apr-17	NEG	NEG	NVD
	NEP 17/2017	CATTLE	19-Apr-17	NEG	POS	FMDV GD
	NEP 18/2017	CATTLE	19-Apr-17	NEG	NEG	NVD
	NEP 19/2017	CATTLE	19-Apr-17	NEG	NEG	NVD
	NEP 20/2017	CATTLE	03-May-17	NEG	POS	FMDV GD
	NEP 21/2017	CATTLE	03-May-17	NEG	POS	FMDV GD

Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results		
				VI/ELISA	RT-PCR	Final report
	NEP 22/2017	CATTLE	03-May-17	O	POS	O
	NEP 23/2017	CATTLE	03-May-17	O	POS	O
	NEP 24/2017	CATTLE	03-May-17	O	POS	O
	NEP 25/2017	CATTLE	10-May-17	NEG	NEG	NVD
	NEP 26/2017	CATTLE	10-May-17	NEG	POS	FMDV GD
	NEP 27/2017	CATTLE	16-May-17	NEG	POS	FMDV GD
	NEP 28/2017	CATTLE	16-May-17	NEG	NEG	NVD
PAKISTAN	PAK 1/2016	CATTLE	10-Jan-16	Pending	Pending	Pending
	PAK 2/2016	BUFFALO	10-Jan-16	Pending	Pending	Pending
	PAK 3/2016	CATTLE	12-Jan-16	Pending	Pending	Pending
	PAK 4/2016	CATTLE	03-Feb-16	Pending	Pending	Pending
	PAK 5/2016	BUFFALO	12-Feb-16	Pending	Pending	Pending
	PAK 6/2016	BUFFALO	05-Mar-16	Pending	Pending	Pending
	PAK 7/2016	CATTLE	09-Mar-16	Pending	Pending	Pending
	PAK 8/2016	BUFFALO	06-May-16	Pending	Pending	Pending
	PAK 9/2016	CATTLE	08-May-16	Pending	Pending	Pending
	PAK 10/2016	CATTLE	12-May-16	Pending	Pending	Pending
	PAK 11/2016	BUFFALO	06-Jun-16	Pending	Pending	Pending
	PAK 12/2016	CATTLE	09-Jul-16	Pending	Pending	Pending
	PAK 13/2016	BUFFALO	11-Aug-16	Pending	Pending	Pending
	PAK 14/2016	BUFFALO	06-Sep-16	Pending	Pending	Pending
	PAK 15/2016	CATTLE	08-Sep-16	Pending	Pending	Pending
	PAK 16/2016	CATTLE	08-Sep-16	Pending	Pending	Pending
	PAK 17/2016	CATTLE	12-Sep-16	Pending	Pending	Pending
	PAK 18/2016	CATTLE	10-Oct-16	Pending	Pending	Pending
	PAK 19/2016	CATTLE	16-Oct-16	Pending	Pending	Pending
	PAK 20/2016	BUFFALO	09-Nov-16	Pending	Pending	Pending
	PAK 21/2016	CATTLE	11-Nov-16	Pending	Pending	Pending
	PAK 22/2016	CATTLE	11-Nov-16	Pending	Pending	Pending
	PAK 23/2016	CATTLE	09-Dec-16	Pending	Pending	Pending
	PAK 24/2016	CATTLE	11-Dec-16	Pending	Pending	Pending
	PAK 25/2016	BUFFALO	12-Dec-16	Pending	Pending	Pending
	PAK 26/2016	CATTLE	12-Dec-16	Pending	Pending	Pending
	PAK 27/2016	CATTLE	12-Dec-16	Pending	Pending	Pending
	PAK 28/2016	CATTLE	22-Dec-16	Pending	Pending	Pending
	PAK 1/2017	BUFFALO	12-Jan-17	Pending	Pending	Pending
	PAK 2/2017	CATTLE	19-Jan-17	Pending	Pending	Pending
	PAK 3/2017	CATTLE	01-Feb-17	Pending	Pending	Pending
	PAK 4/2017	BUFFALO	02-Feb-17	Pending	Pending	Pending
	PAK 5/2017	BUFFALO	02-Feb-17	Pending	Pending	Pending
	PAK 6/2017	CATTLE	03-Feb-17	Pending	Pending	Pending

Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results		
				VI/ELISA	RT-PCR	Final report
	PAK 7/2017	CATTLE	03-Feb-17	Pending	Pending	Pending
	PAK 8/2017	CATTLE	03-Feb-17	Pending	Pending	Pending
	PAK 9/2017	BUFFALO	03-Feb-17	Pending	Pending	Pending
	PAK 10/2017	BUFFALO	04-Feb-17	Pending	Pending	Pending
	PAK 11/2017	BUFFALO	15-Feb-17	Pending	Pending	Pending
	PAK 12/2017	CATTLE	03-Mar-17	Pending	Pending	Pending
	PAK 13/2017	CATTLE	04-Mar-17	Pending	Pending	Pending
	PAK 14/2017	CATTLE	11-Mar-17	Pending	Pending	Pending
	PAK 15/2017	CATTLE	05-Apr-17	Pending	Pending	Pending
	PAK 16/2017	CATTLE	02-Aug-17	Pending	Pending	Pending
	PAK 17/2017	BUFFALO	02-Sep-17	Pending	Pending	Pending
	TOTAL	171				

Carried over from previous quarterly report:

Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results		
				VI/ELISA	RT-PCR	Final report
CAMBODIA	CAM 1/2016	Not known	02-Dec-16	O	POS	O
	CAM 2/2016	Not known	02-Dec-16	A	POS	A
	CAM 3/2016	Not known	02-Dec-16	O	POS	O
	CAM 4/2016	Not known	02-Dec-16	A	POS	A
	CAM 5/2016	Not known	02-Dec-16	A	POS	A
	TOTAL	5				

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 2017.

Table 4: Vaccine matching studies for O FMDV by VNT

Strain	Serotype	Topotype	Strain	O 3039	O1 Manisa	O/TUR/5/2009
CAM 1/2016	O	ME-SA	PanAsia	B	N	M
CAM 3/2016	O	ME-SA	PanAsia	N	N	M
ETH 30/2016	O	EA-4	-	M	M	M
ETH 50/2016	O	EA-4	-	B	M	M
IRN 8/2017	O	ME-SA	PanAsia-2	M	B	M
IRN 12/2017	O	ME-SA	PanAsia-2	M	N	M
LAO 2/2017	O	SEA	Mya-98	N	N	M
MOG 10/2017	O	ME-SA	PanAsia	N	N	M
MYA 1/2017	O	ME-SA	Ind-2001	N	N	N
MYA 5/2017	O	ME-SA	Ind-2001	B	B	M
NEP 3/2017	O	ME-SA	Ind-2001	M	M	M
NEP 24/2017	O	ME-SA	Ind-2001	M	M	M
TAI 40/2016	O	SEA	Mya-98	B	N	M
TAI 1/2017	O	SEA	Mya-98	N	B	M

Table 5: Vaccine matching studies for A FMDV by VNT

Strain	Serotype	Topotype	Strain	A/IRN/05	A/TUR/20/06	A22 IRAQ	A TUR 11	A TUR 14	A MAY 79
CAM 4/2016	A	ASIA	Sea-97	N	N	M	NT	NT	NT
CAM 5/2016	A	ASIA	Sea-97	N	N	M	NT	NT	NT
IRN 2/2017	A	ASIA	Iran-05	N	B	M	M	N	NT
IRN 4/2017	A	ASIA	G-VII	N	N	N	N	N	NT
IRN 7/2017	A	ASIA	Iran-05	N	M	M	N	B	NT
MOG 1/2016	A	ASIA	Sea-97	M	N	M	NT	NT	NT
MOG 2/2016	A	ASIA	Sea-97	M	N	M	NT	NT	NT
NEP 13/2017	A	ASIA	G-VII	N	N	N	NT	NT	N
TAI 52/2016	A	ASIA	Sea-97	M	N	M	NT	NT	N
TAI 57/2016	A	ASIA	Sea-97	N	N	N	NT	NT	N
TAI 4/2017	A	ASIA	Sea-97	N	N	M	NT	NT	M

Abbreviations used in tables

M	Vaccine Match *r_1 = ≥ 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*
B	Borderline *Any r_1 values between 0.28 to 0.32*
NT	Not tested against this vaccine

5. Annex 2

Recent FMD Publications (July to September 2017) cited by Web of Science (Pirbright Institute papers and authors are highlighted in **BOLD AND GREY**)

1. Ahmed, H.I., U. Farooq, A. Bin Zahur, K. Naeem, A. Latif, and H. Irshad (2017). Evidence of foot-and-mouth disease virus excretion in the milk of apparently healthy vaccinated buffaloes in Islamabad, Pakistan. *Turkish Journal of Veterinary & Animal Sciences*, **41**(3): 431-434.
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4. Ambagala, A., M. Fisher, M. Goolia, C. Nfon, T. Furukawa-Stoffer, R.O. Polo, and O. Lung (2017). Field-Deployable Reverse Transcription-Insulated Isothermal PCR (RT-iiPCR) Assay for Rapid and Sensitive Detection of *Foot-and-Mouth Disease Virus*. *Transboundary and Emerging Diseases*, **64**(5): 1610-1623.
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replication of Foot-and-mouth disease viruses in mice determine lethality. *Virology*, **509**: 195-204.
11. Caridi, F., A. Vazquez-Calvo, B. Borrego, K. McCullough, A. Summerfield, F. Sobrino, and M.A. Martin-Acebes (2017). Preserved immunogenicity of an inactivated vaccine based on *Foot-and-mouth disease virus* particles with improved stability. *Veterinary Microbiology*, **203**: 275-279.
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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)

September 2017:

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)* Asia 1 Shamir A Iran-05 *(or A TUR 06)* A22 Iraq A24 Cruzeiro O BFS or Campos SAT 2 Saudi Arabia *(or equivalent i.e. SAT 2 Eritrea)*
Medium Priority	A Eritrea-98 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

Note: 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 highlights an apparent gap in vaccines supplied by international manufacturers for this viral lineage.