



WRLFMD Quarterly Report January to March 2016

Reference Laboratory Contract Report

Foot-and-Mouth Disease





1. Summary of samples tested and reported FMD outbreaks

1.1. ASIA

Hong Kong SAR, P.R. China

FMD type O was isolated from one sample from pigs collected in Hong Kong in December 2015. Genotyping revealed it to belong to the **CATHAY toponotype**.

Iran

A batch of 27 samples was received from Iran in December 2015. **FMD types O, A and Asia 1** were identified and Genotyping results are presented below. Ten of the virus isolates revealed the introduction into the country of a new virus strain, currently known as **G-VII** (sometimes called G-18) belonging to the **ASIA toponotype**. Closely related viruses are normally found in the Indian subcontinent, but have recently been identified in Saudi Arabia, Turkey and Armenia.

Israel

Outbreaks of **FMD type O** were reported in pigs and cattle during November 2015 in the Hazafon (Northern) district. Genotyping showed the virus to belong to the ME-SA/PanAsia toponotype/lineage and to be closely related to viruses circulating in Southeast Asia. This lineage also spread to China and Kazakhstan in 2011.

Kuwait

Twelve outbreaks of **FMD type O** were reported during January and February 2016. Genotyping showed them to be caused by a virus belonging to the ME-SA/PanAsia-2^{BAL-09} toponotype/lineage/sub-lineage.

Nepal

FMD type O viruses isolated from samples received from Nepal (collected in 2015) mostly belonged to the O/ME-SA/Ind-2001d toponotype/lineage/sub-lineage. However, one virus (from Kathmandu) belonged to a new O/ME-SA/PanAsia-2 sub-lineage which we have named KAT-15.

Pakistan

A batch of 35 samples was received in December. **FMD types O, A and Asia 1** were identified and the genotyping results are presented below.

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Palestinian Autonomous Territories

An outbreak of **FMD type O** was reported in sheep in Nablus, West Bank during November and December 2015. The virus belonged to the ME-SA/PanAsia lineage and was closely related to the one in Israel (see above).

People's Republic of China

An outbreak of **FMD type O** was reported in pigs at Abattoir, Guanghan, Deyang, Sichuan on 02/03/2016. No genotyping has been reported.

Republic of Korea

Twenty outbreaks of **FMD type O** were reported in pigs in Jeollabuk-do and Chungcheongnam-do between January and March 2016. Genotyping showed them to belong to the O/SEA/Mya-98 lineage, closely related to FMD viruses recovered from earlier cases in the country in 2014.

Saudi Arabia

Outbreaks of **FMD O and A** have been reported on farms in 2015 and 2016. The FMD type A virus was identified as A/ASIA/G-VII (aka G-18) and the type O was O/ME-SA/Ind-2001d.

Thailand

A batch of 21 virus isolates was received from the RRL in Pakchong. **FMD types O and A** were isolated and the genotyping results are presented below.

United Arab Emirates

FMD type O (ME-SA/Ind-2001d) was identified in a sample from gazelle from Adu Dhabi.

1.2. AFRICA

Ethiopia

FMD types O, A and SAT 2 were detected from a batch of samples received from Ethiopia. Genotyping results are presented below.

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Malawi

An outbreak of **FMD type SAT 1** was reported on 02/01/2016 in cattle at Bangula Dip Tank, Bangula, Nsanje. The affected area is close to Mwabvi Game Reserve and infection is suspected to be through contact with buffalo from the game reserve during grazing. No genotyping has been reported.

South Africa

In December 2015 and January 2016, four outbreaks of **FMD SAT 3** were reported in cattle in the Limpopo region. No genotyping has been reported.

Sudan

A batch of 37 samples was received in December 2015. **FMD types O, A and SAT 2** were detected. Genotyping results are presented below.

1.3. SOUTH AMERICA

No new outbreaks of FMD were reported in the region.

1.4. Uncharacterised FMD viruses

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

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

Results from samples received at WRLFMD (status of samples being tested) are shown in Table 1 and a complete list of clinical sample diagnostics made by the WRLFMD between January and March 2016 is shown in Annex 1 Table 3. A record of all samples received by WRLFMD (January to March 2016) is shown in Annex 1 Table 2.

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

WRLFMD Batch No.	Date received	Country	Serotype	No. of samples	No. of sequences	Sequencing status
WRLFMD/2015/00031	20/11/2015	Iran	O	7	7	Completed*
			A	15	15	Completed*
			Asia 1	3	3	Completed*
WRLFMD/2015/00032	26/11/2015	Thailand	O	14	14	Completed*
			A	6	6	Completed*
WRLFMD/2015/00037	17/12/2015	Pakistan	O	10	10	Completed*
			A	9	9	Completed*
			Asia 1	9	9	Completed*
WRLFMD/2015/00038	03/12/2015	Sudan	O	6	6	Completed*
			A	5	5	Completed*
			SAT 2	6	6	Completed*
WRLFMD/2016/00001	15/01/2016	Saudi Arabia	A	2	2	Completed
WRLFMD/2016/00002	13/01/2016	Hong Kong SAR	O	1	1	Completed
WRLFMD/2016/00003	18/01/2016	Republic of Korea	O	5	5	Completed
WRLFMD/2016/00004	19/01/2016	Nepal	O	16	16	Completed
WRLFMD/2016/00005	26/01/2016	United Arab Emirates	O	1	1	Completed
WRLFMD/2016/00006	01/02/2016	Republic of Korea	O	2	2	Completed
WRLFMD/2016/00007	09/02/2016	Israel	O	10	10	Completed
WRLFMD/2016/00008	09/02/2016	Palestinian AT*	O	6	6	Completed
WRLFMD/2016/00009	10/02/2016	Kuwait	O	3	3	Completed
WRLFMD/2016/00010	25/02/2016	Ethiopia	O	1	1	Completed
			A	1	1	Completed
			SAT 2	7	7	Completed
WRLFMD/2016/00011	29/03/2016	Saudi Arabia	O	9	9	Completed
			A	6	6	Completed
				160	160	

*according to UN protocol (2012) accorded non-member observer state status as the *State of Palestine*

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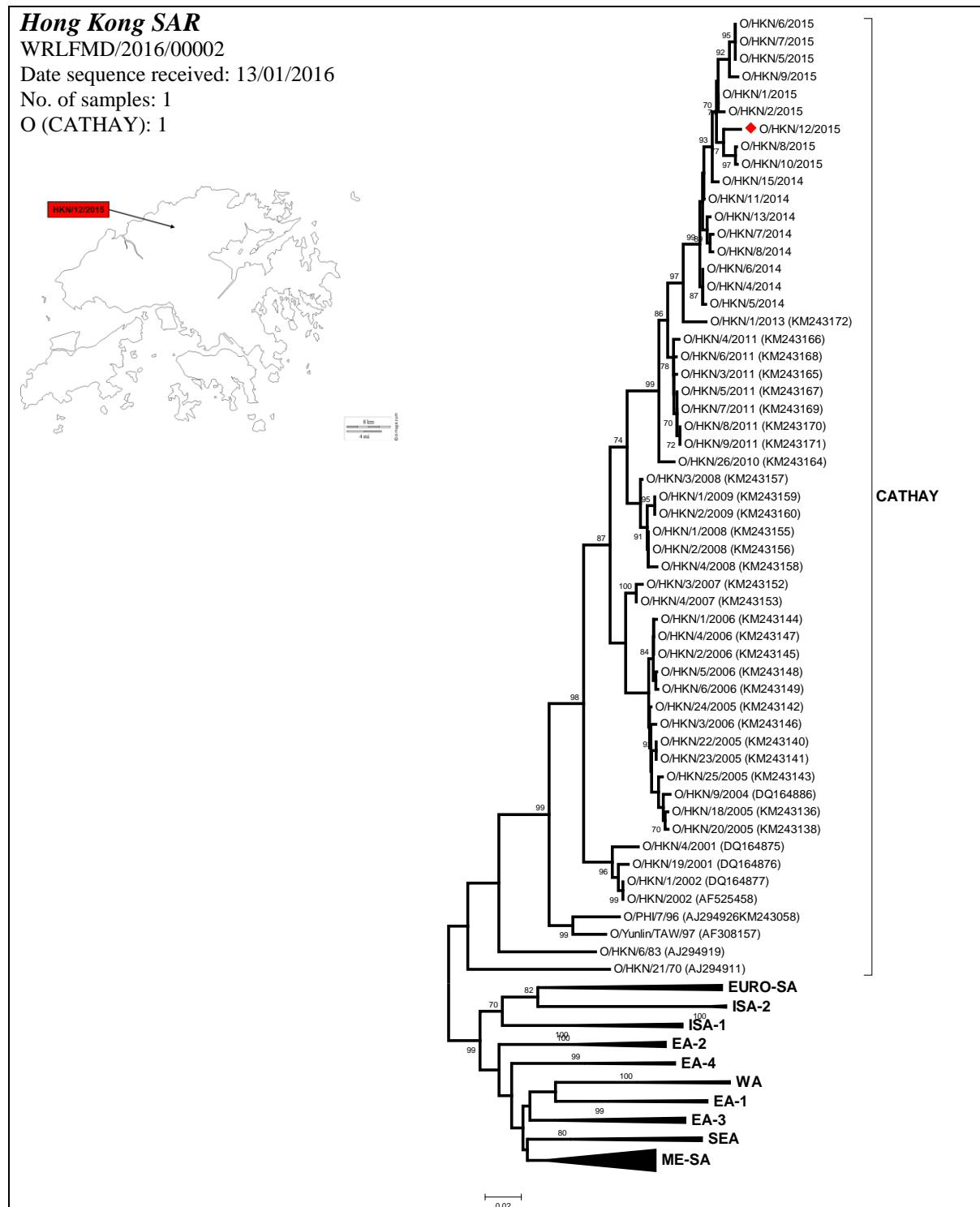
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2. Detailed Analysis

2.1. ASIA

Figure 1: Hong Kong, S.A.R. of P.R.C.

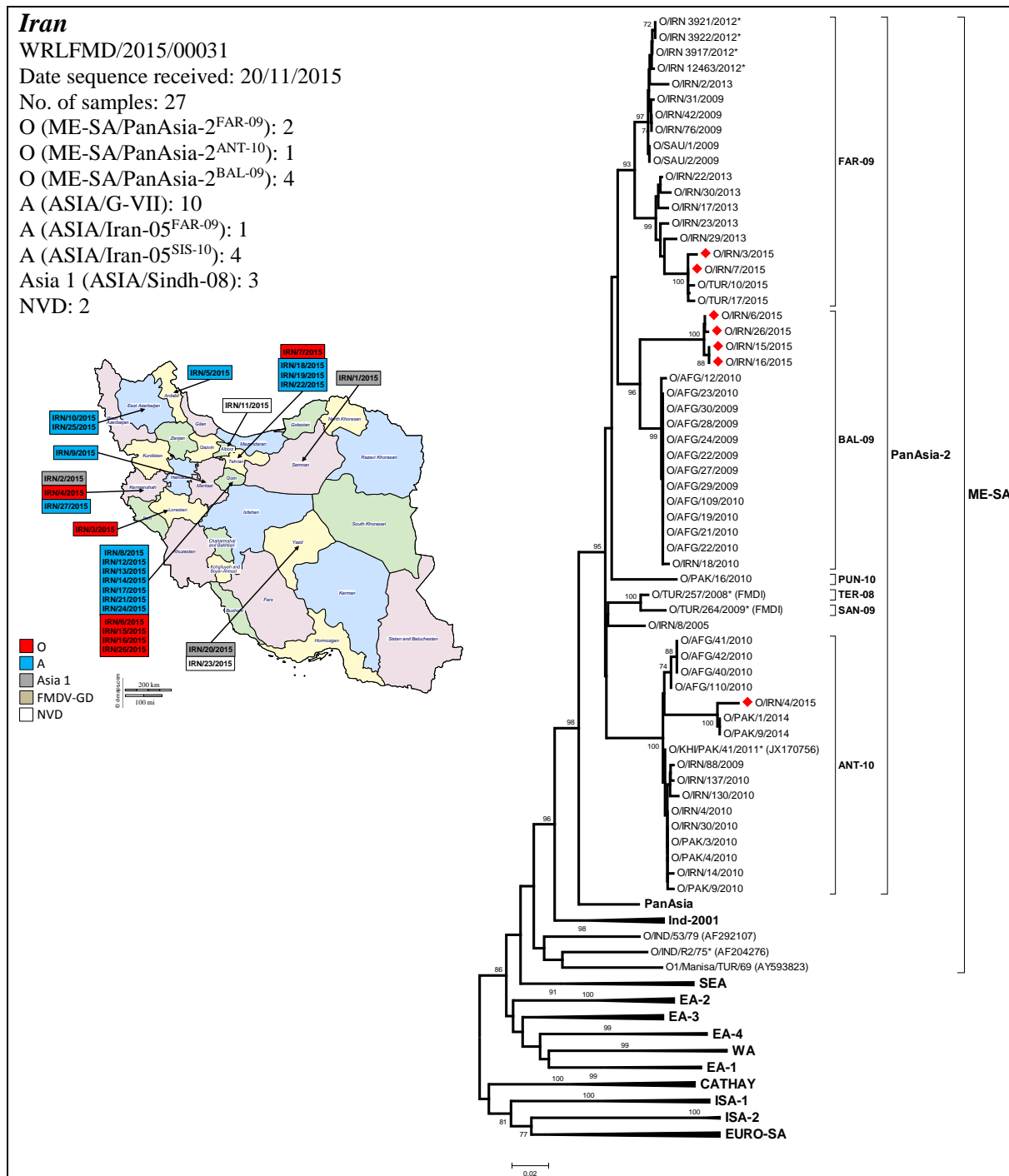


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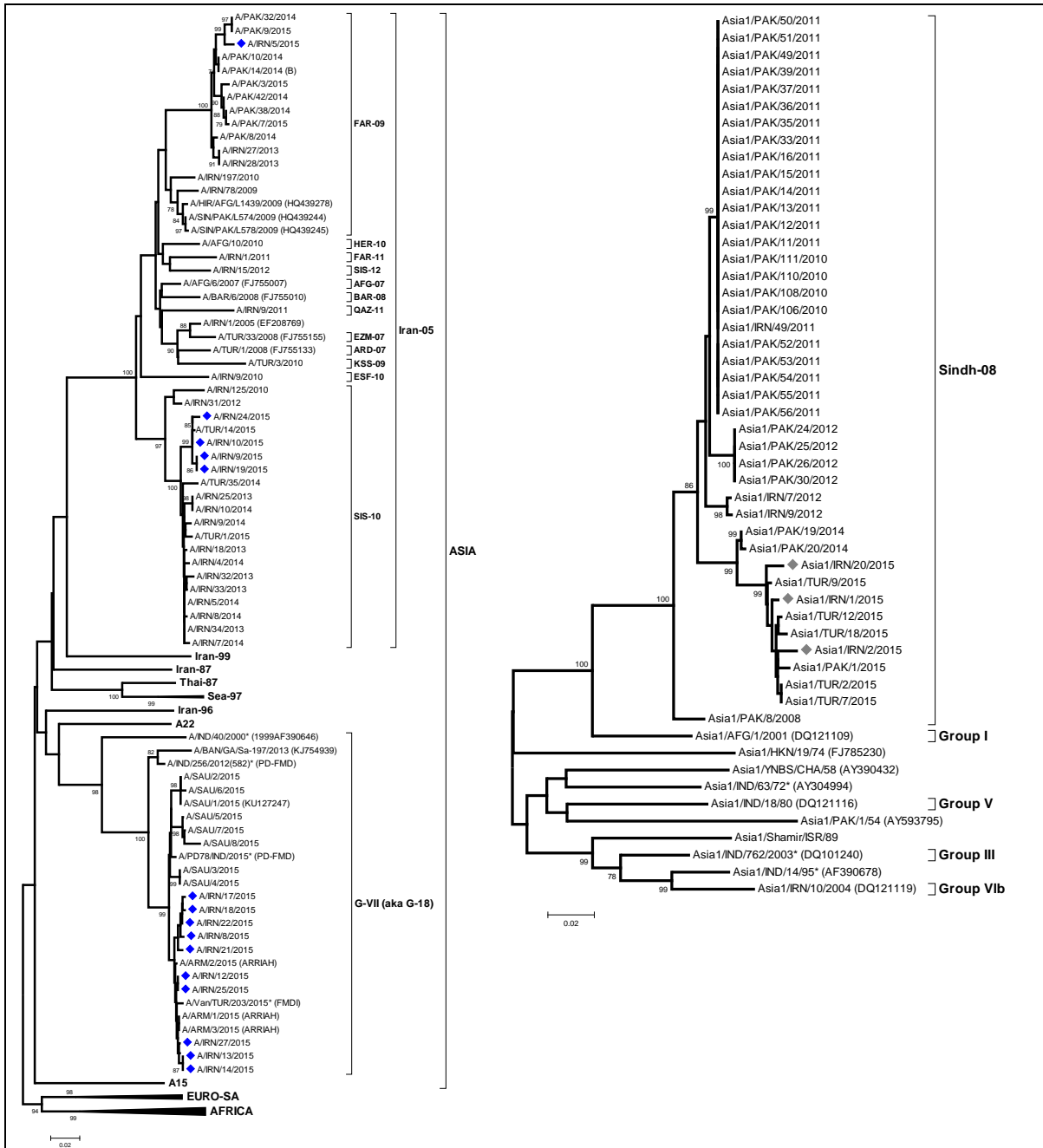


Figure 2: Iran (continued on next page)



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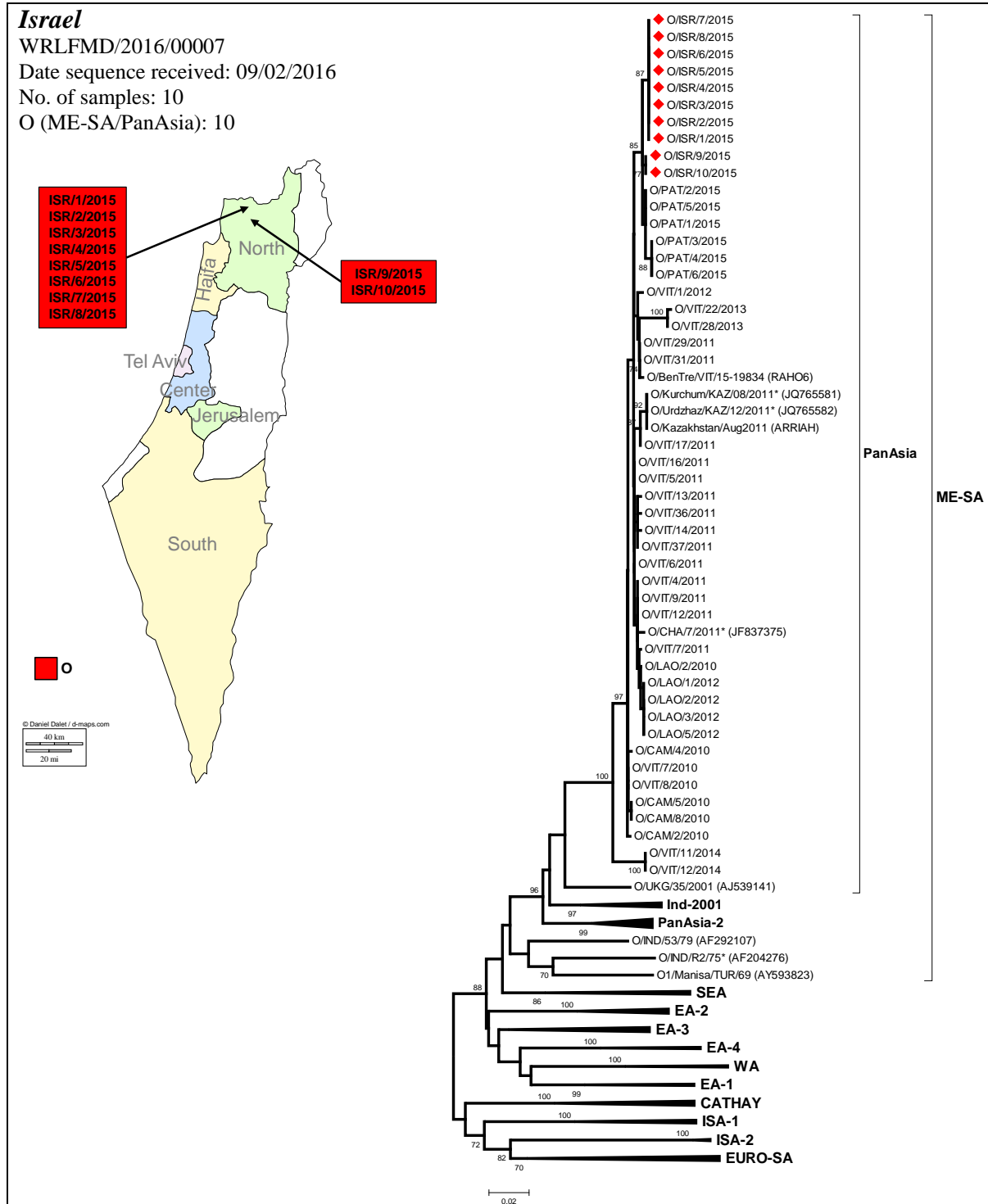


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Figure 3: Israel

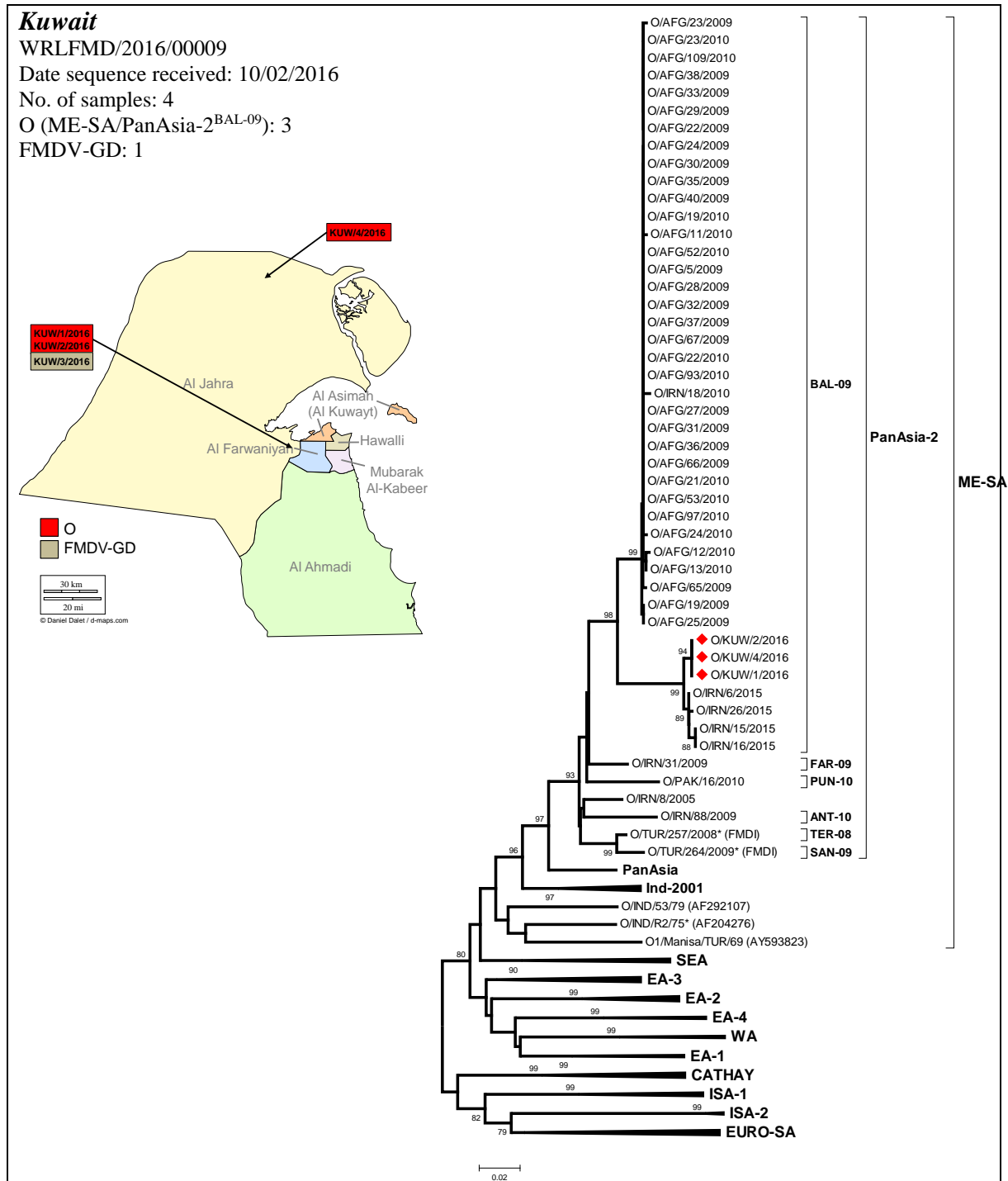


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Figure 4: Kuwait

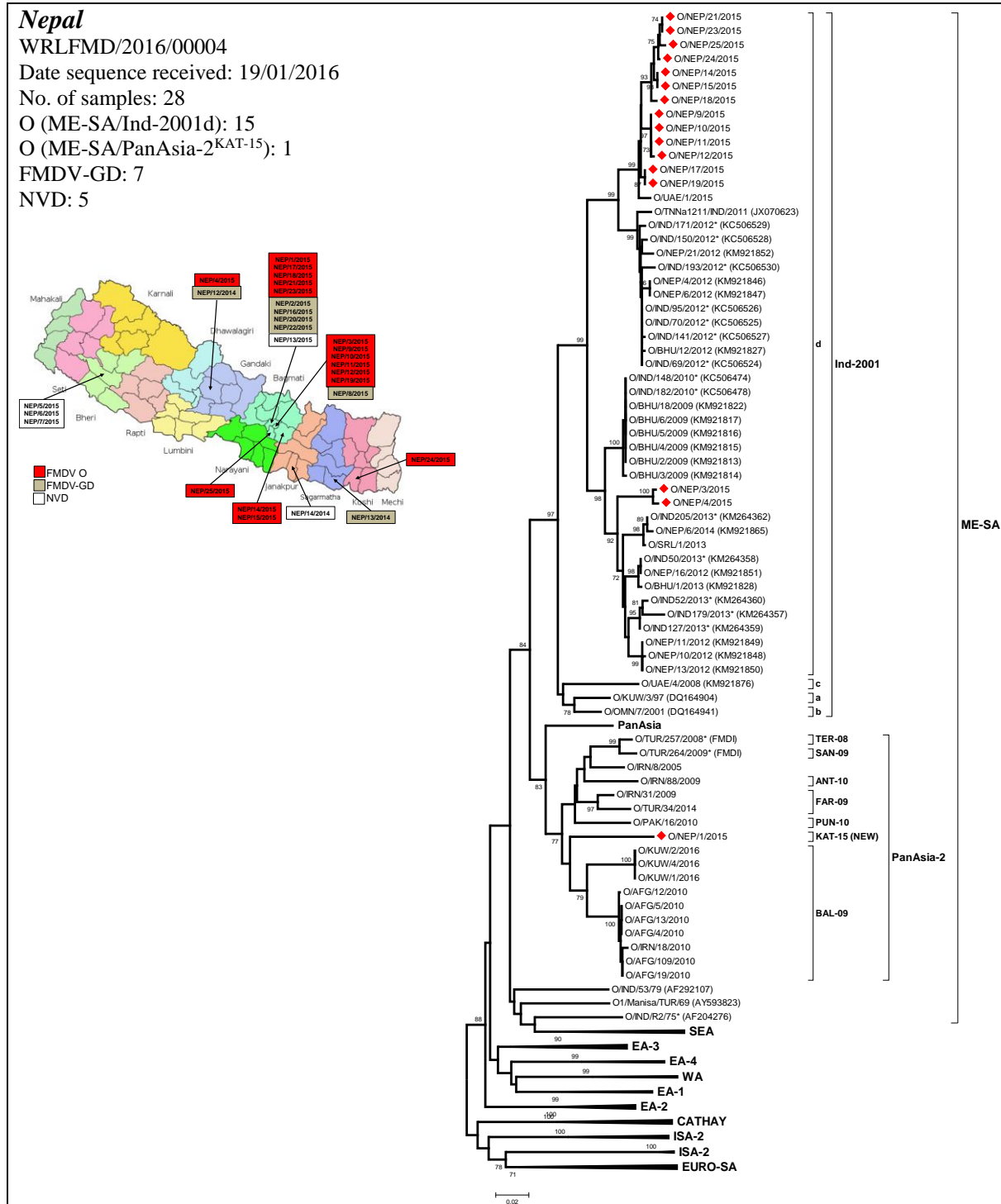


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Figure 5: Nepal

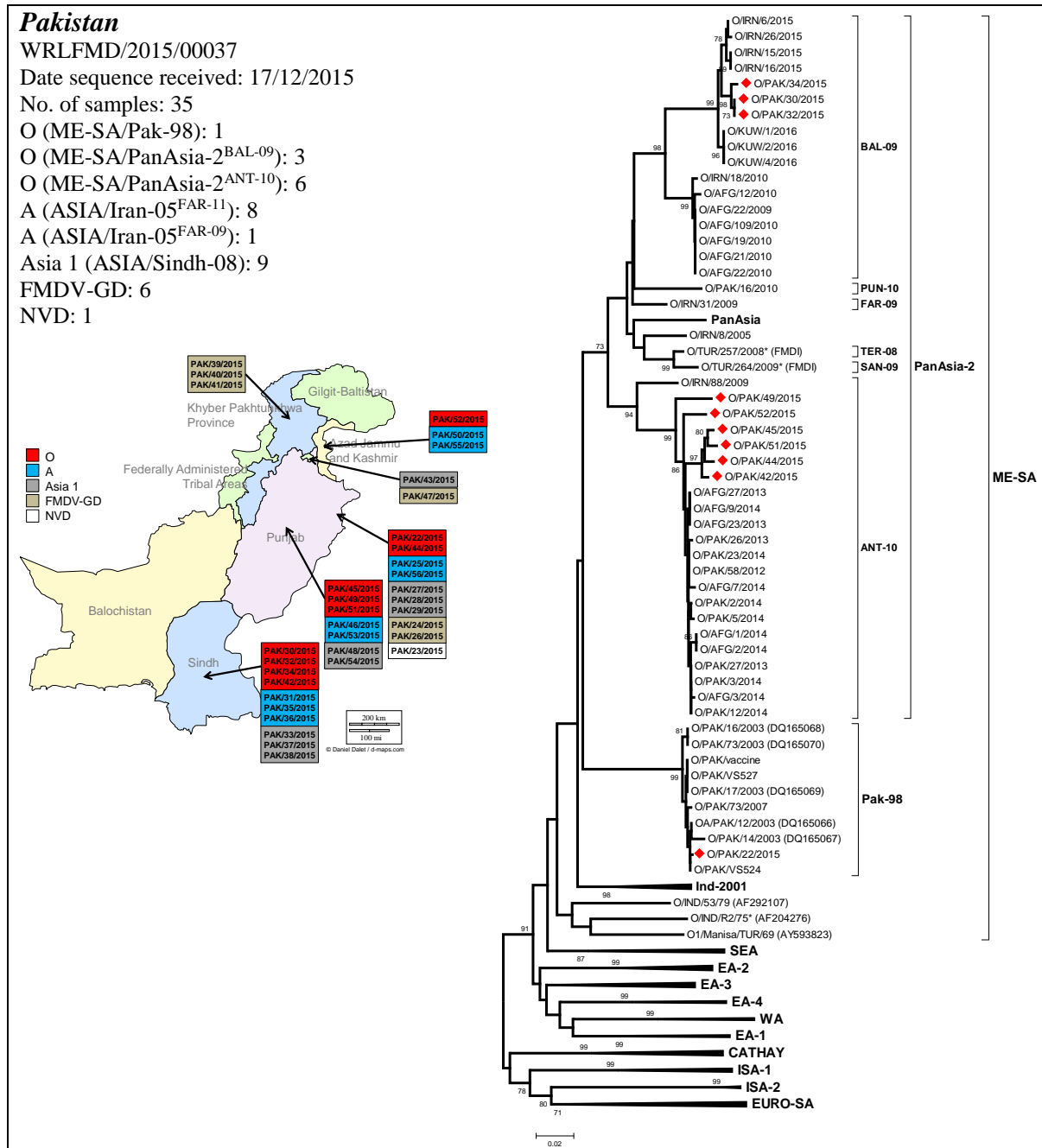


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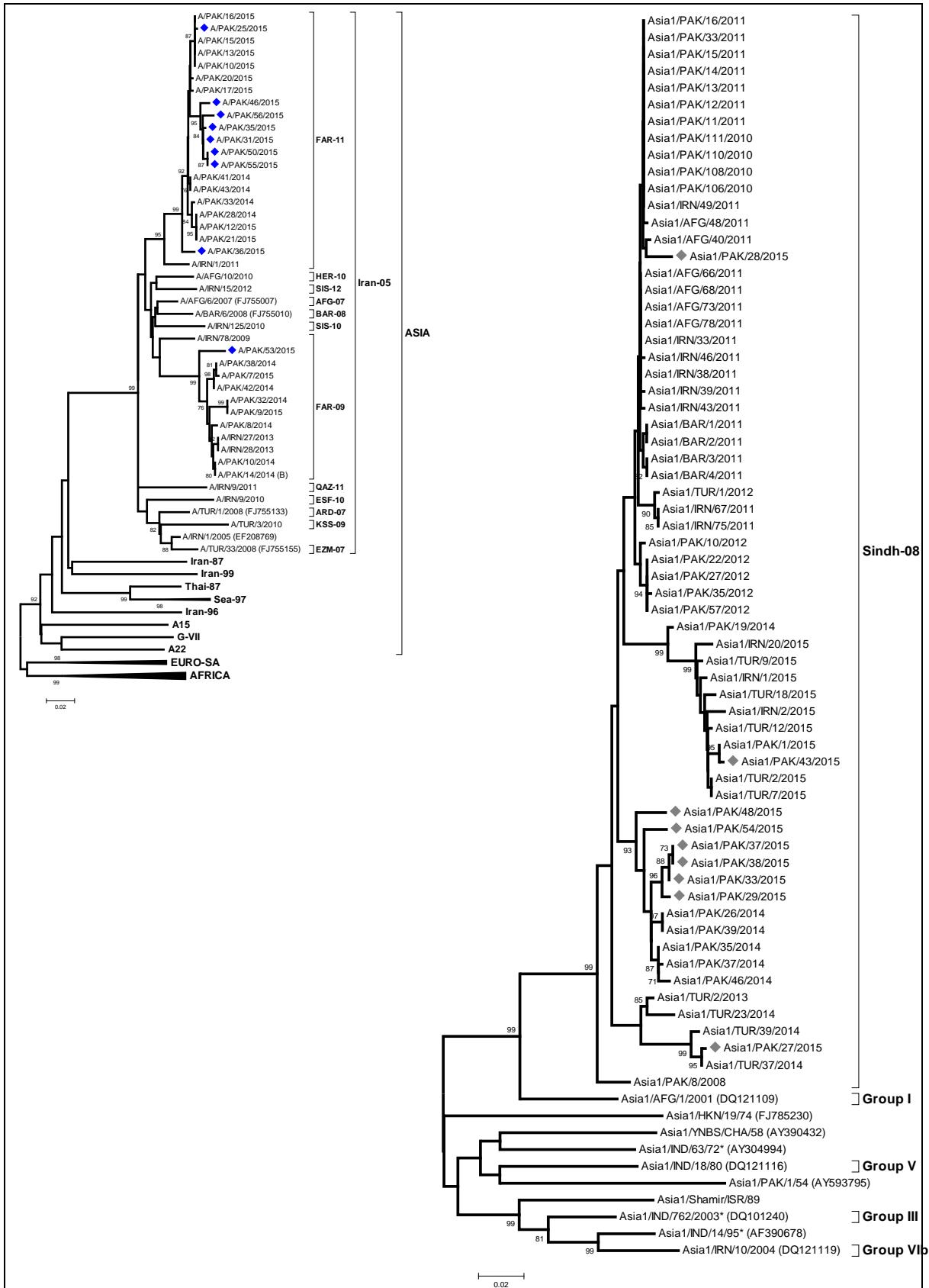


Figure 6: Pakistan (Continued on next page)



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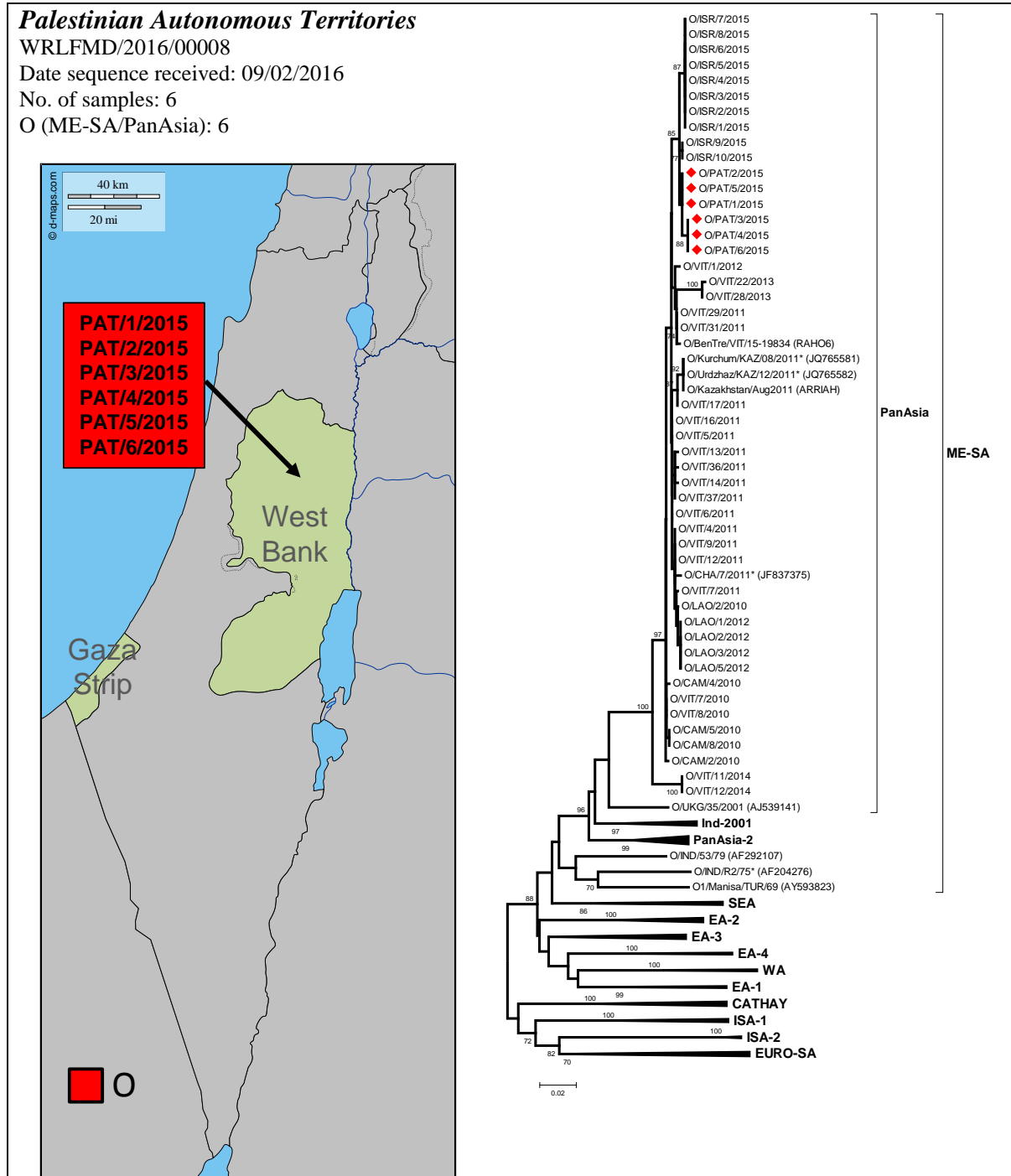


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Figure 7: Palestinian Autonomous Territories

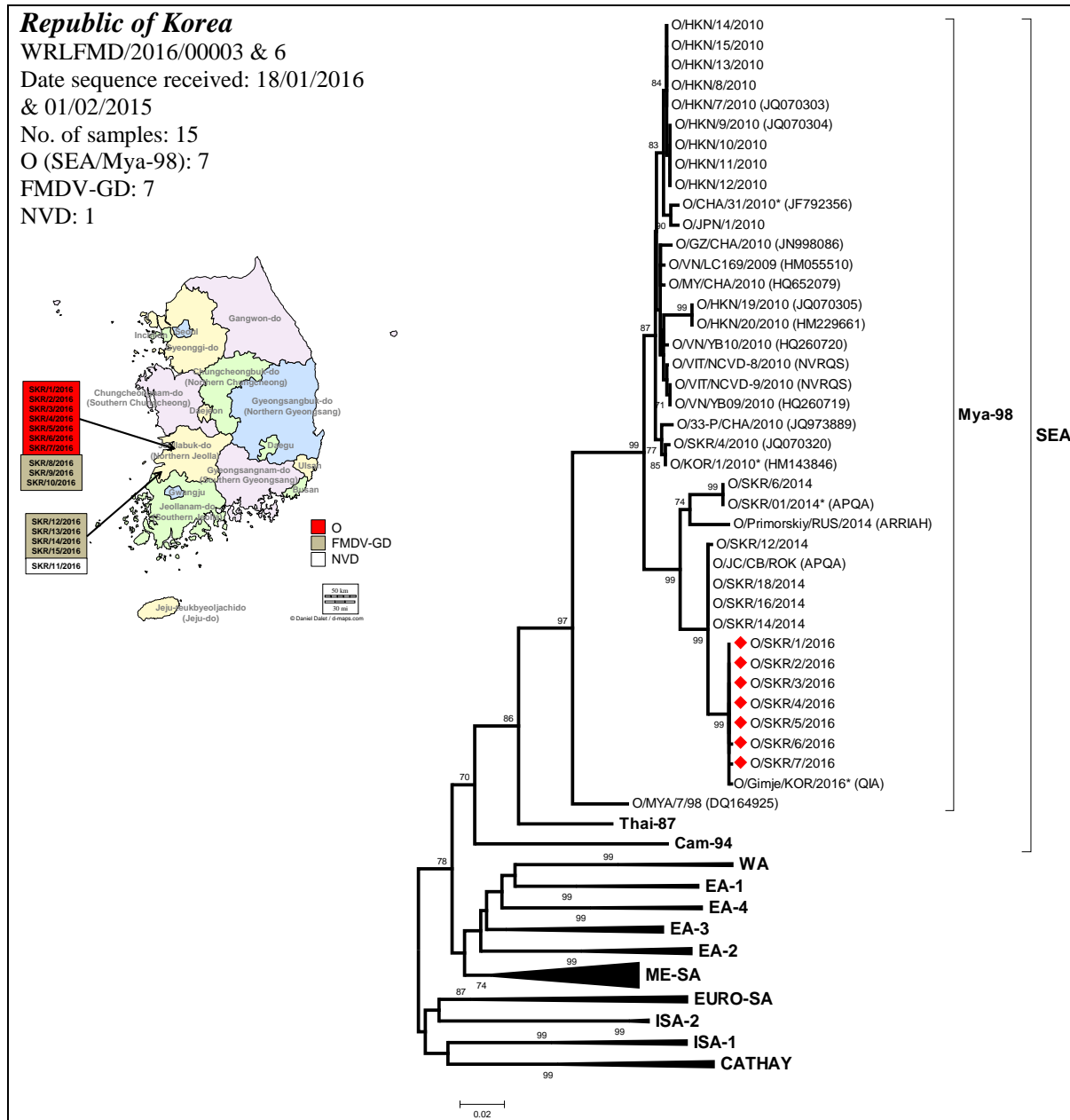


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Figure 8: Republic of Korea

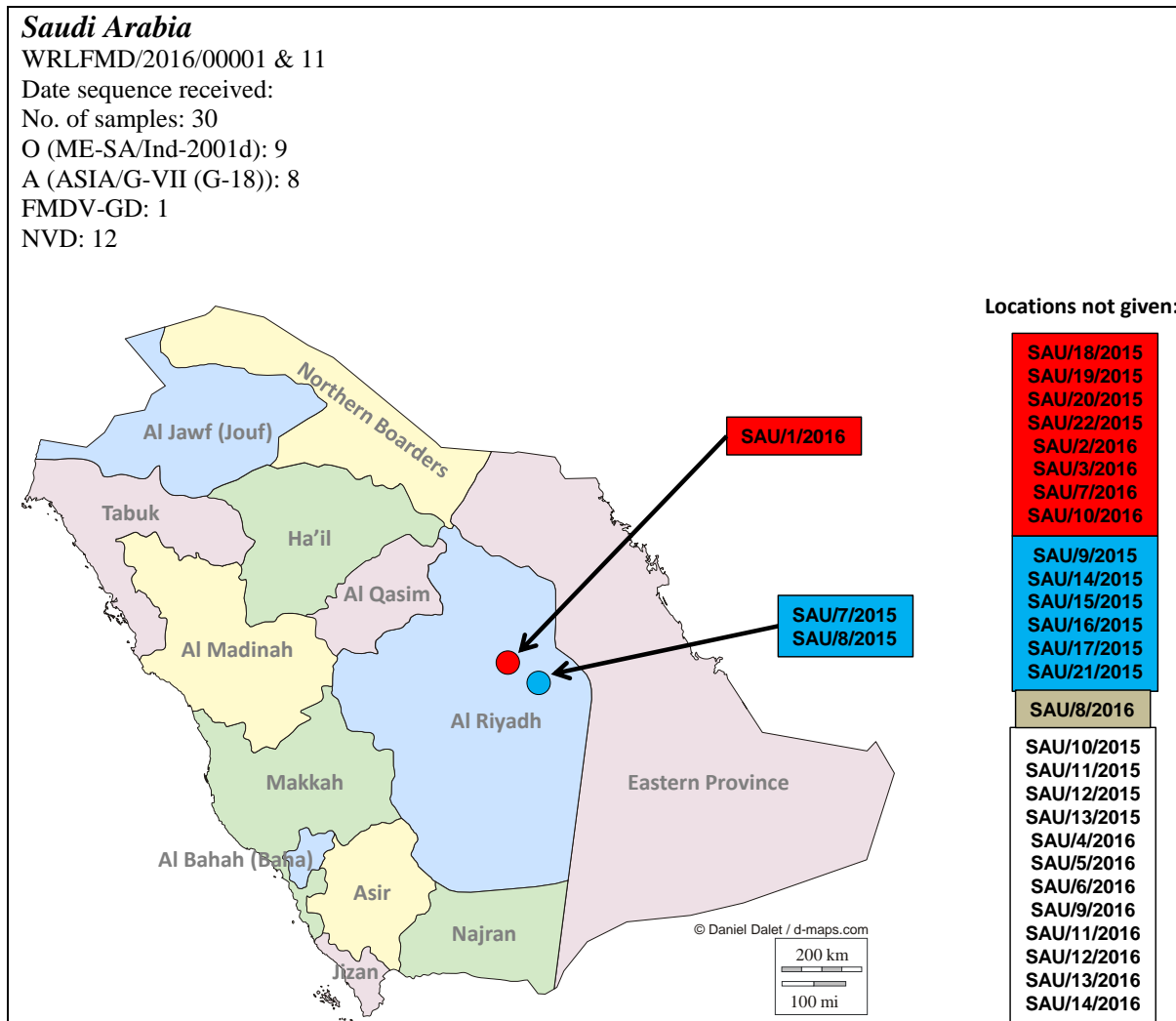


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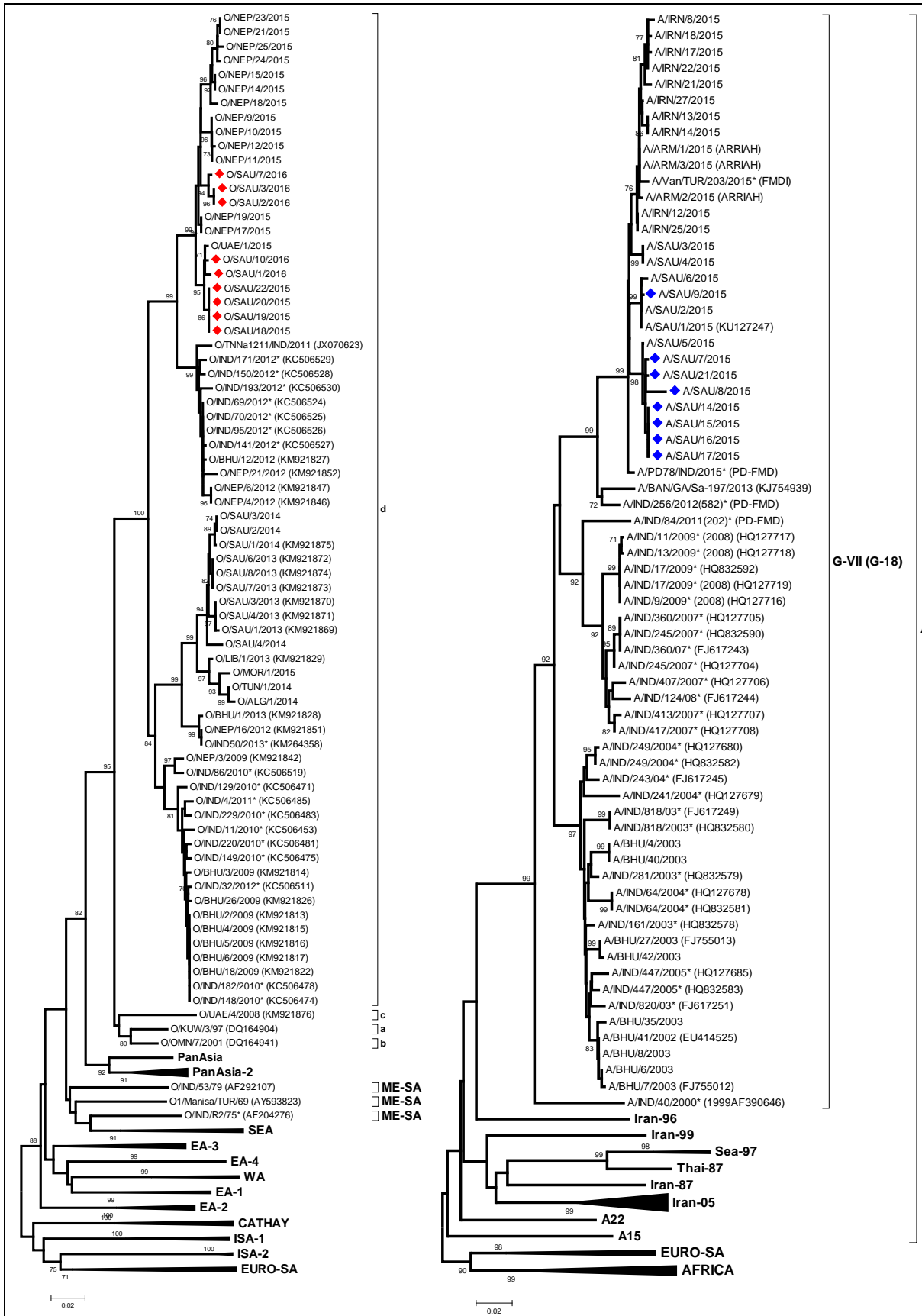


Figure 9: Saudi Arabia (continued on next page)



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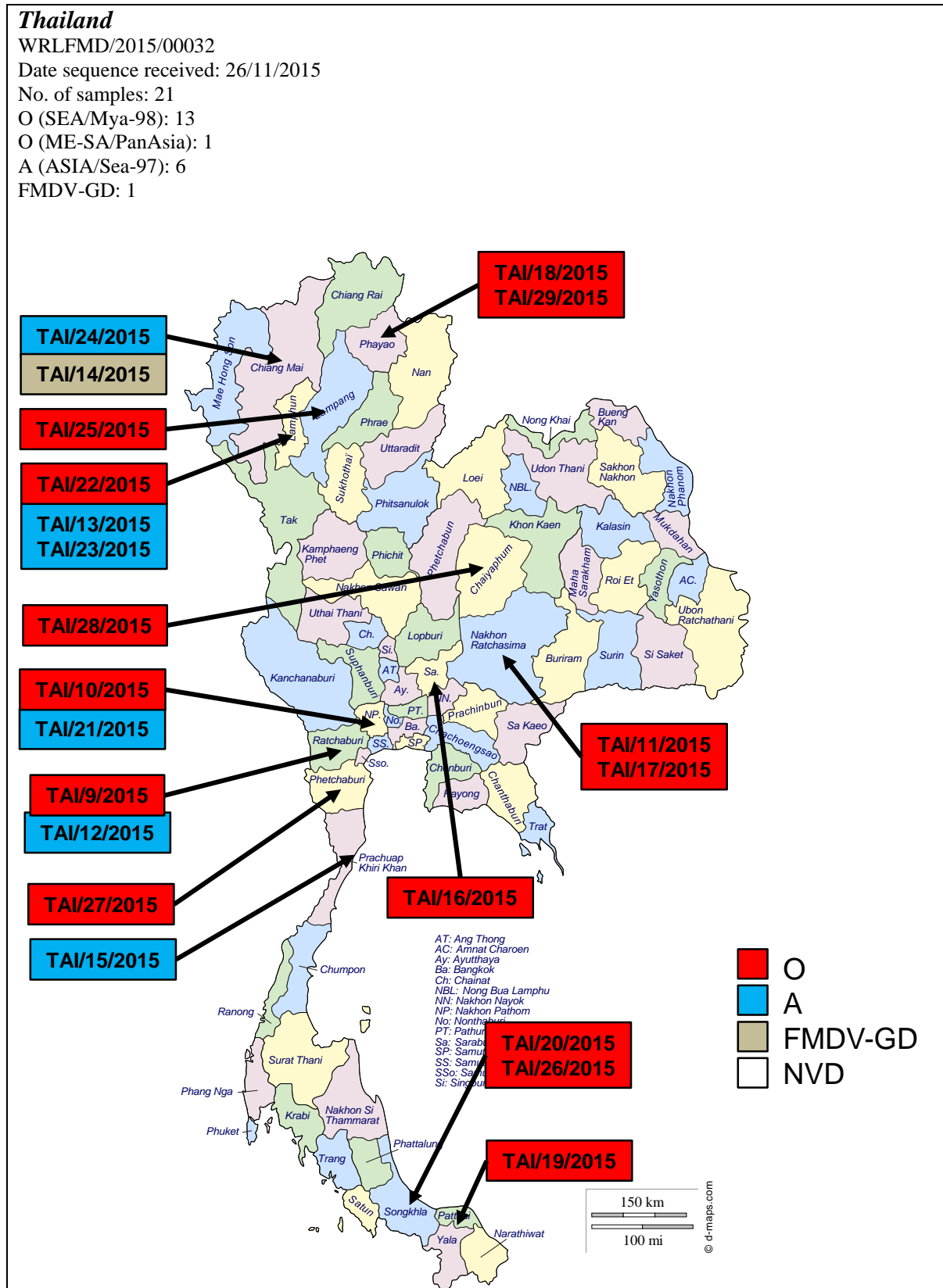


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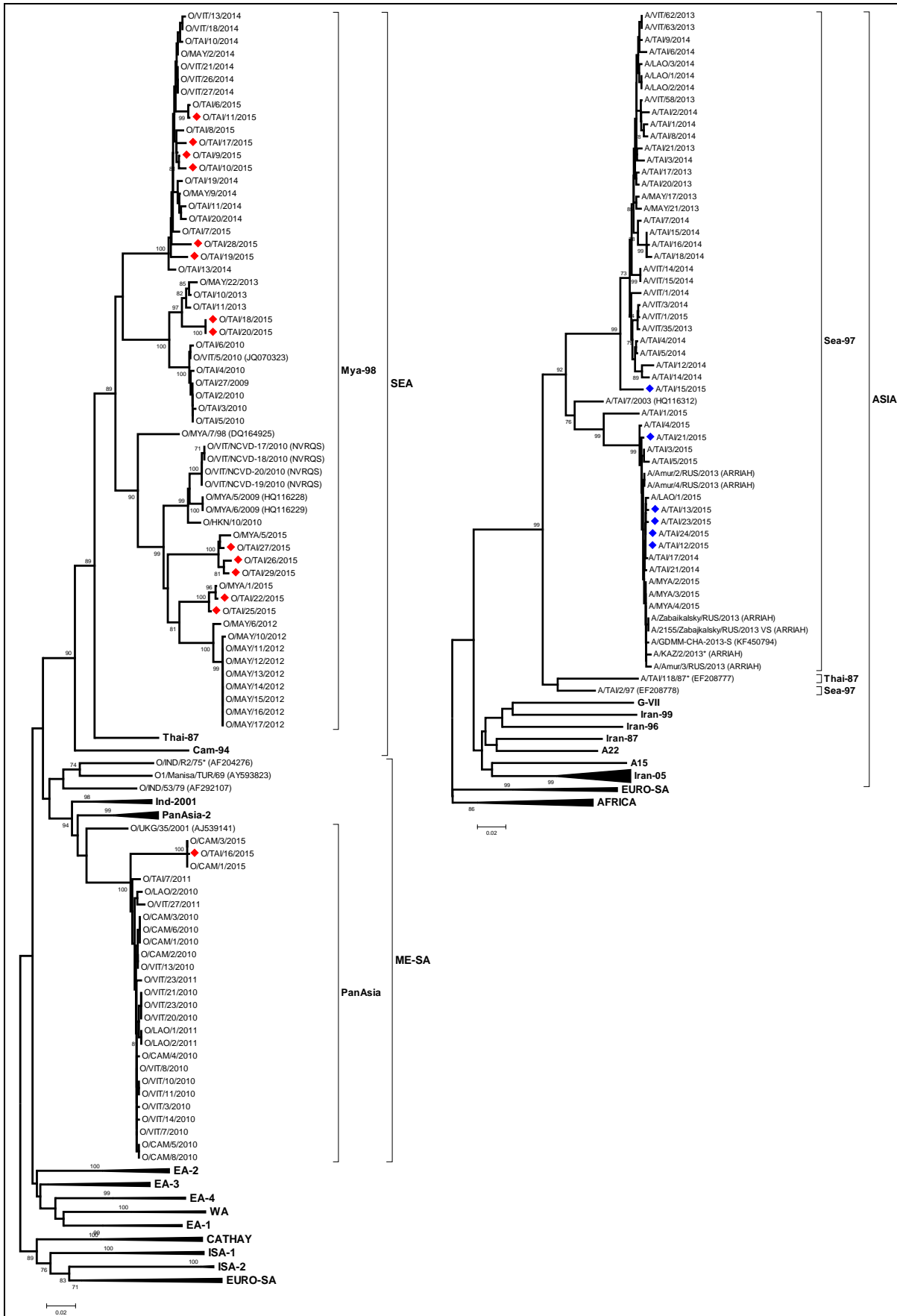


Figure 10: Thailand (continued on next page)



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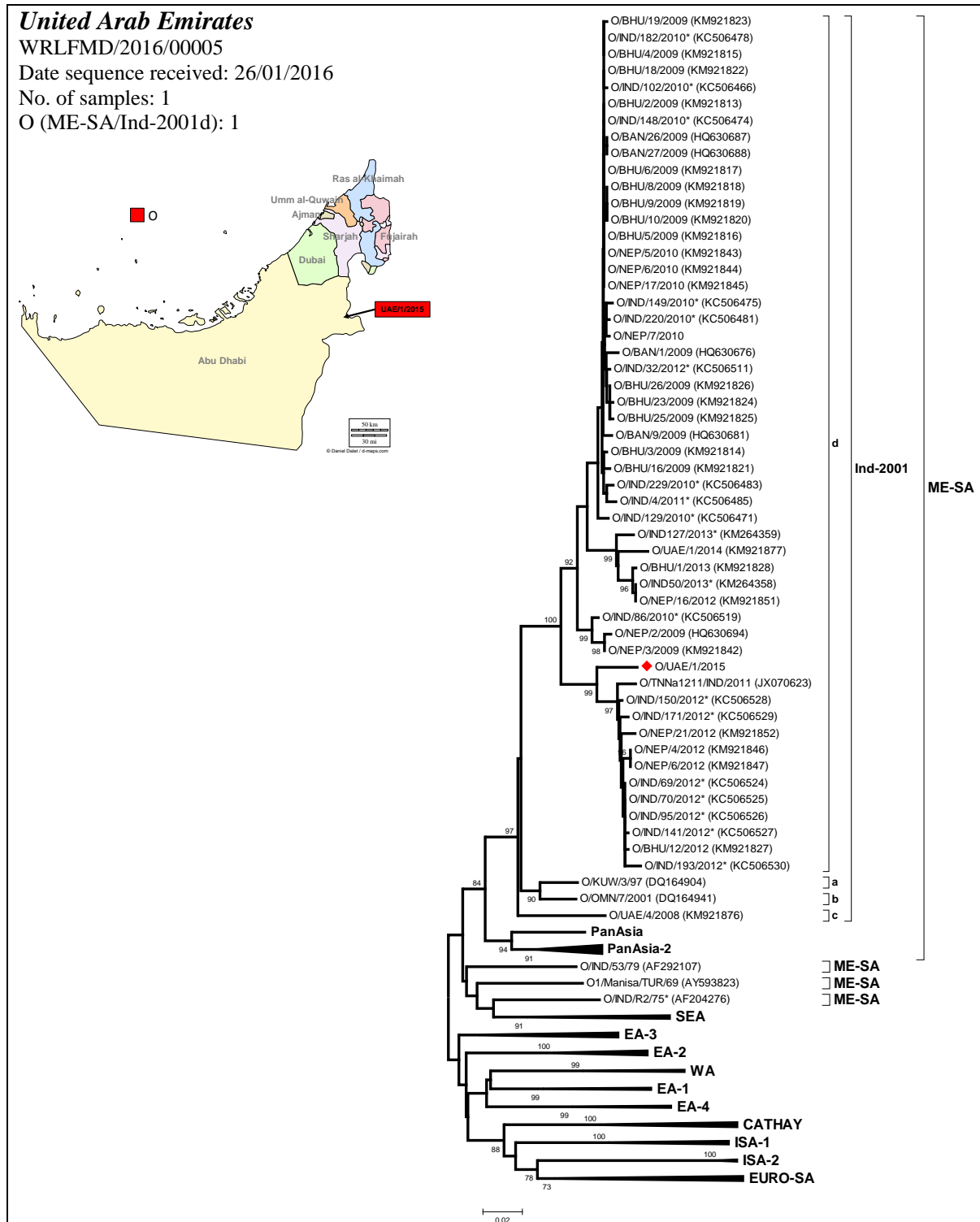


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Figure 11: United Arab Emirates



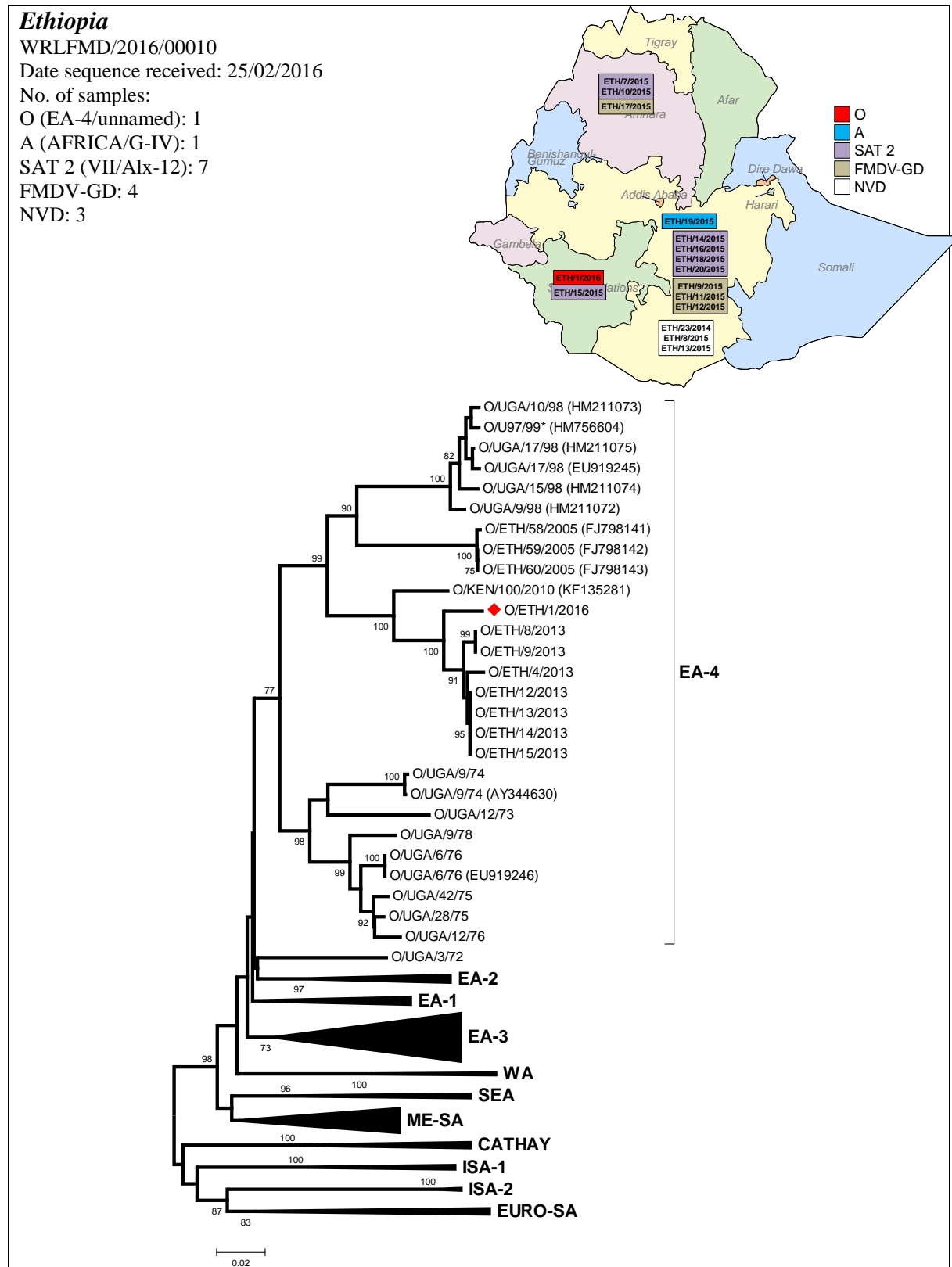
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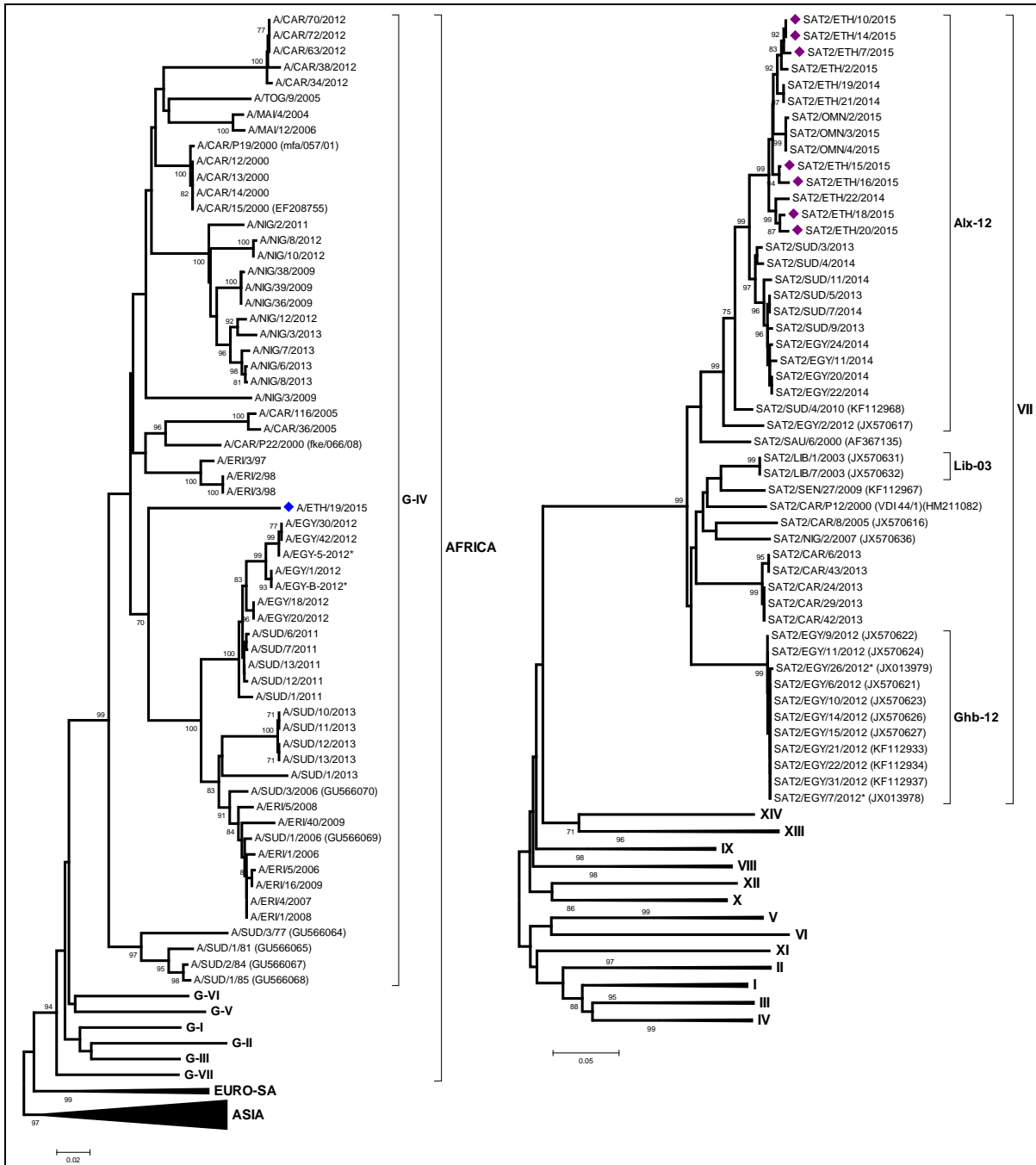
2.2. AFRICA

Figure 12: Ethiopia (continued on next page)



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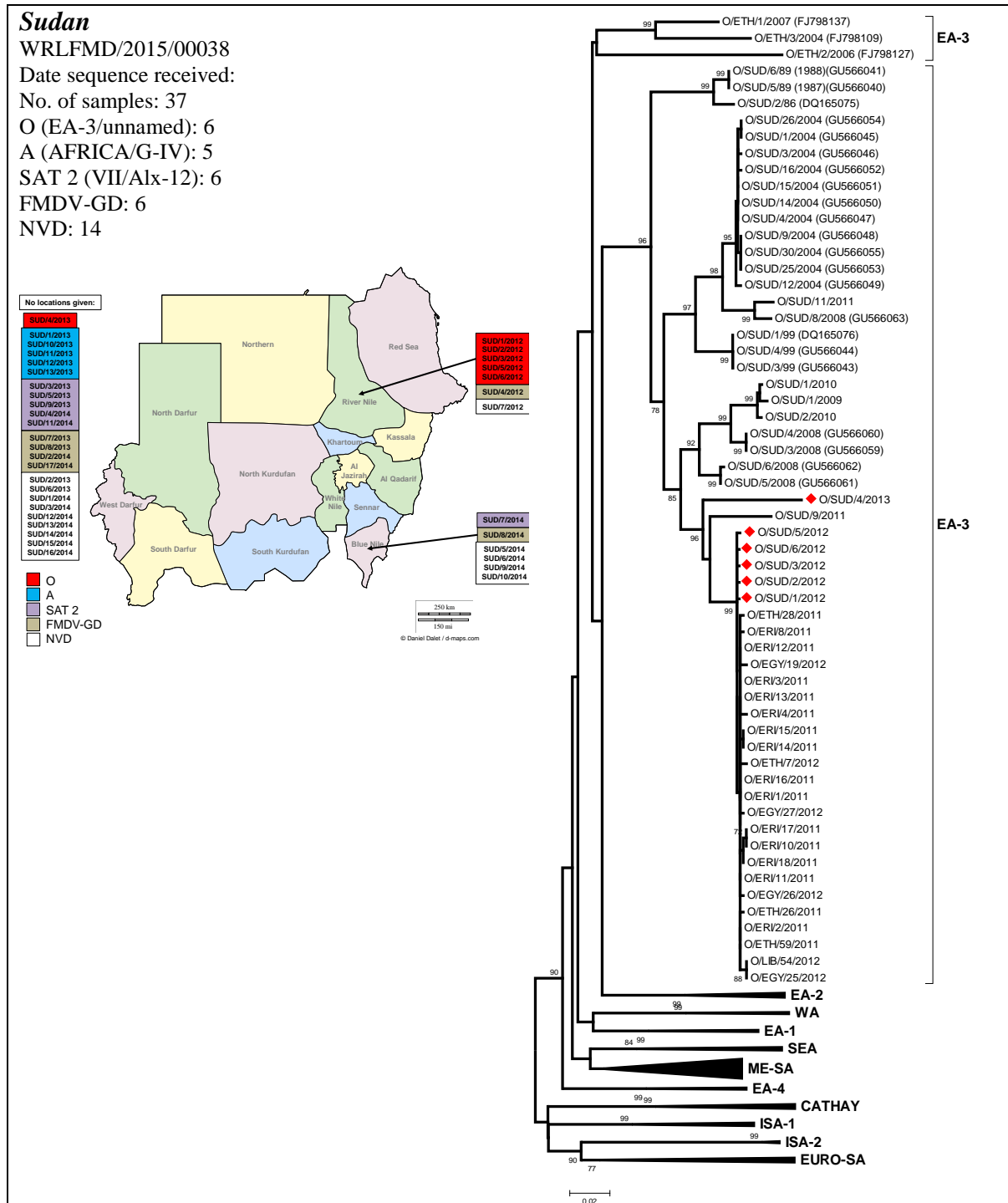


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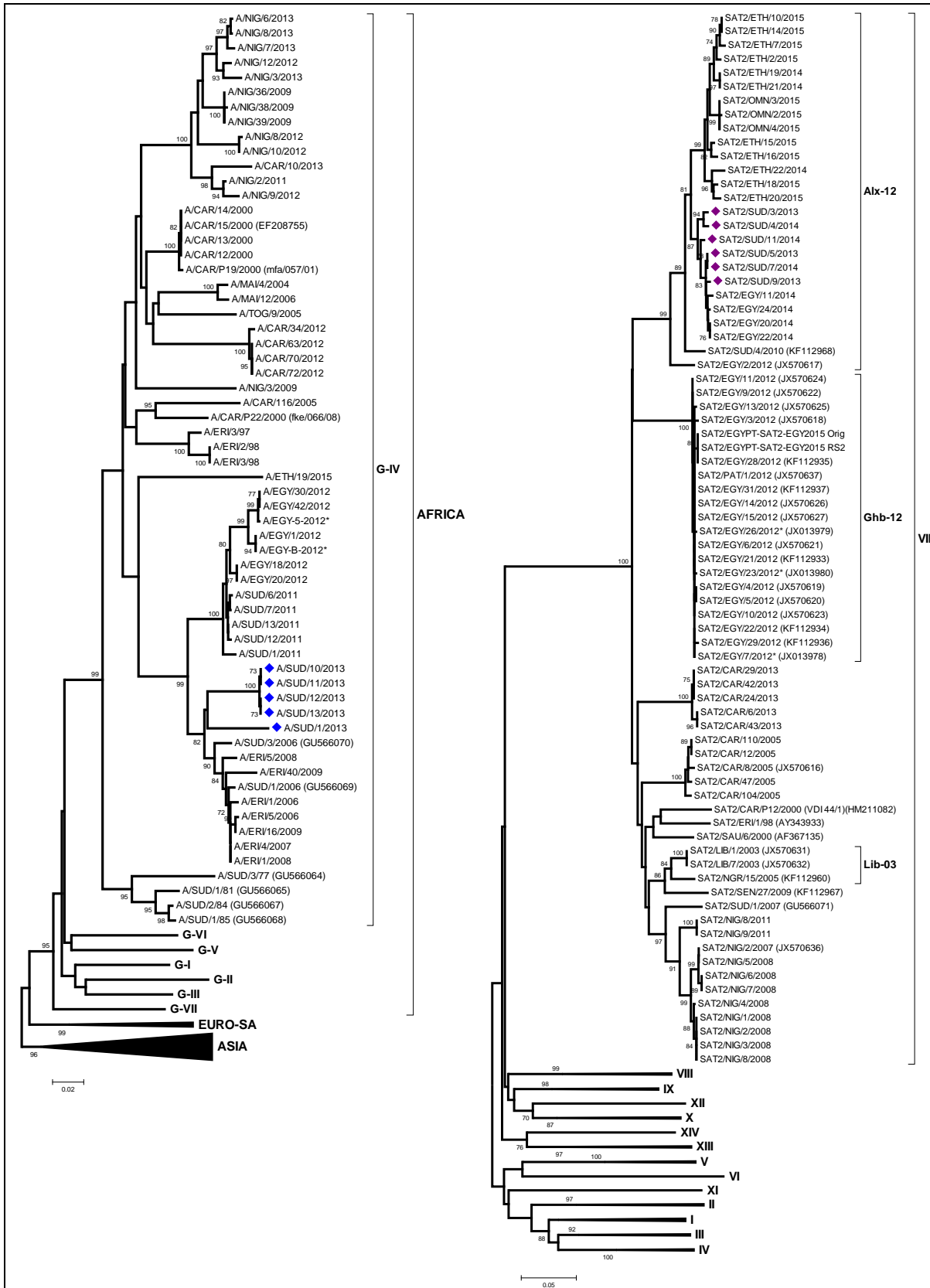


Figure 13: Sudan (continued on next page)



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5. Vaccine matching

For individual data see Table 4 (Annex 1).

Serotype Asia 1

Two field strains from Turkey were tested and both generated VNT r-values with the Asia-1 Shamir vaccine below the 0.3 cut-off which is indicative of a poor antigenic match. However, these results need to be placed in context of a previous *in vivo* PD₅₀ study which suggested that high-potency formulations of this vaccine were protective against field viruses within the Asia 1/Sindh-08 lineage.

Serotype A

Additional vaccine studies have been carried out for field viruses from the A/ASIA/G-VII lineage against three vaccine strains (A/IND/40/2000, A/TUR/11 and A/TUR/14: one from India and two from Turkey, respectively). For all three vaccines, these results indicated a poor antigenic match for the field viruses tested. Together with similar poor in-vitro vaccine matching data presented in the previous report, these findings reinforce the lack of evidence that is currently available to support the use of vaccines for this emerging lineage. An *in vivo* study using a PPG design protocol is currently underway at WRLFMD using a vaccine that has been deployed to the Middle East.

Serotype O

Two recent field isolates collected in Hong Kong SAR from the O/CATHAY lineage have been tested against five FMDV vaccine strains: all results were indicative of a poor antigenic match.

Serotype SAT 1 and SAT 2

Two SAT 1 and three SAT 2 field samples from Zimbabwe have been recently tested and the results are reported in at the end of Annex 1. Some of the results for the SAT 2 field viruses are indicative of an adequate vaccine-match, but for SAT 1 the samples are borderline/negative in the VNT. Only a limited number of SAT 1 and SAT 2 viruses are received in the WRLFMD therefore the results of these serotypes should be taken in consideration with the results from other countries.

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Annex 1

Summary of Submissions

Table 2: Summary of samples collected and received to WRLFMD (January to March 2016)

Country	N° of samples	Virus isolation in cell culture/ELISA							NVD	rRT-PCR for FMD (or SVD) virus (where appropriate)	
		FMD virus serotypes								Positive	Negative
		O	A	C	SAT 1	SAT 2	SAT 3	Asia 1			
Ethiopia	16	1	1	-	-	7	-	-	7	13	3
Hong Kong, SAR of PRC	1	1	-	-	-	-	-	-	-	1	-
Israel	10	10	-	-	-	-	-	-	-	10	-
Republic of Korea (South)	15	2	-	-	-	-	-	-	13	13	2
Kuwait	4	3	-	-	-	-	-	-	1	4	-
Nepal	28	16	-	-	-	-	-	-	12	23	5
Palestinian Autonomous Territories	6	6	-	-	-	-	-	-	-	6	-
Saudi Arabia	30	9	8	-	-	-	-	-	13	18	12
United Arab Emirates	1	1	0	-	-	-	-	-	-	1	-
TOTAL	111	49	9	-	-	7	-	-	46	89	22

Sample results pending from previous report:

Iran	25	7	13	-	-	-	-	3	2	23	2
Pakistan	35	10	9	-	-	-	-	9	7	34	1
Sudan	37	6	5	-	-	6	-	-	20	21	16
Thailand	21	14	6	-	-	-	-	-	1	21	-
TOTAL	118	37	33	-	-	6	-	12	30	99	19

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

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Clinical Samples

Table 3: Clinical sample diagnostics made by the WRLFMD® between January – March 2016

Country	WRL for FMD Sample Identification	Species	Date of Collection	Results		
				VI/ELISA	rRT-PCR	Final report
Ethiopia	ETH 23/2014	BOVINE	12-Dec-14	NEG	NEG	NVD
	ETH 7/2015	BOVINE	18-Apr-15	SAT 2	POS	SAT 2
	ETH 8/2015	BOVINE	14-May-15	NEG	NEG	NVD
	ETH 9/2015	BOVINE	24-Jul-15	NEG	POS	FMDV GD
	ETH 10/2015	CAPRINE	15-Aug-15	SAT 2	POS	SAT 2
	ETH 11/2015	BOVINE	03-Sep-15	NEG	POS	FMDV GD
	ETH 12/2015	BOVINE	04-Sep-15	NEG	POS	FMDV GD
	ETH 13/2015	BOVINE	05-Sep-15	NEG	NEG	NVD
	ETH 14/2015	BOVINE	01-Oct-15	SAT 2	POS	SAT 2
	ETH 15/2015	BOVINE	22-Oct-15	SAT 2	POS	SAT 2
	ETH 16/2015	BOVINE	14-Nov-15	SAT 2	POS	SAT 2
	ETH 17/2015	BOVINE	16-Nov-15	NEG	POS	FMDV GD
	ETH 18/2015	BOVINE	18-Dec-15	SAT 2	POS	SAT 2
	ETH 19/2015	BOVINE	20-Dec-15	A	POS	A
	ETH 20/2015	BOVINE	22-Dec-15	SAT 2	POS	SAT 2
ETH 1/2016	BOVINE	14-Jan-16	O	POS	O	
Hong Kong, SAR of PRC	HKN 12/2015	PIG	02-Dec-15	O	POS	O
Israel	ISR 1/2015	PIG	20-Nov-15	O	POS	O
	ISR 2/2015	PIG	20-Nov-15	O	POS	O
	ISR 3/2015	PIG	20-Nov-15	O	POS	O
	ISR 4/2015	PIG	20-Nov-15	O	POS	O
	ISR 5/2015	PIG	20-Nov-15	O	POS	O
	ISR 6/2015	PIG	20-Nov-15	O	POS	O
	ISR 7/2015	PIG	20-Nov-15	O	POS	O
	ISR 8/2015	PIG	20-Nov-15	O	POS	O
	ISR 9/2015	CATTLE	24-Nov-15	O	POS	O
	ISR 10/2015	CATTLE	16-Dec-15	O	POS	O
Republic Of Korea (South)	SKR 1/2016	PIG	12-Jan-16	NEG	NEG	NVD
	SKR 2/2016	PIG	12-Jan-16	NEG	POS	FMDV GD

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Country	WRL for FMD Sample Identification	Species	Date of Collection	Results			
				VI/ELISA	rRT-PCR	Final report	
	SKR 3/2016	PIG	12-Jan-16	NEG	POS	FMDV GD	
	SKR 4/2016	PIG	12-Jan-16	NEG	POS	FMDV GD	
	SKR 5/2016	PIG	12-Jan-16	NEG	POS	FMDV GD	
	SKR 6/2016	PIG	12-Jan-16	O	POS	O	
	SKR 7/2016	PIG	12-Jan-16	O	POS	O	
	SKR 8/2016	PIG	12-Jan-16	NEG	POS	FMDV GD	
	SKR 9/2016	PIG	12-Jan-16	NEG	POS	FMDV GD	
	SKR 10/2016	PIG	12-Jan-16	NEG	POS	FMDV GD	
	SKR 11/2016	PIG	14-Jan-16	NEG	NEG	NVD	
	SKR 12/2016	PIG	14-Jan-16	NEG	POS	FMDV GD	
	SKR 13/2016	PIG	14-Jan-16	NEG	POS	FMDV GD	
	SKR 14/2016	PIG	14-Jan-16	NEG	POS	NVD	
	SKR 15/2016	PIG	14-Jan-16	NEG	POS	FMDV GD	
	Kuwait	KUW 1/2016	CATTLE	30-Jan-16	O	POS	O
		KUW 2/2016	CATTLE	30-Jan-16	O	POS	O
KUW 3/2016		CATTLE	31-Jan-16	NEG	POS	FMDV GD	
KUW 4/2016		CATTLE	04-Feb-16	O	POS	O	
Nepal	NEP 12/2014	CATTLE	08-May-14	NEG	POS	FMDV GD	
	NEP 13/2014	CATTLE	12-Nov-14	NEG	POS	FMDV GD	
	NEP 14/2014	CATTLE	12-Nov-14	NEG	NEG	NVD	
	NEP 1/2015	CATTLE	18-Feb-15	O	POS	O	
	NEP 2/2015	CATTLE	23-Feb-15	NEG	POS	FMDV GD	
	NEP 3/2015	CATTLE	23-Feb-15	O	POS	O	
	NEP 4/2015	CATTLE	26-Mar-15	O	POS	O	
	NEP 5/2015	PIG	26-Jul-15	NEG	NEG	NVD	
	NEP 6/2015	PIG	26-Jul-15	NEG	NEG	NVD	
	NEP 7/2015	BUFFALO	02-Sep-15	NEG	NEG	NVD	
	NEP 8/2015	CATTLE	01-Nov-15	NEG	POS	FMDV GD	
	NEP 9/2015	CATTLE	01-Nov-15	O	POS	O	
	NEP 10/2015	CATTLE	01-Nov-15	O	POS	O	
NEP 11/2015	CATTLE	01-Nov-15	O	POS	O		
NEP 12/2015	CATTLE	01-Nov-15	O	POS	O		

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Country	WRL for FMD Sample Identification	Species	Date of Collection	Results			
				VI/ELISA	rRT-PCR	Final report	
	NEP 13/2015	CATTLE	01-Nov-15	NEG	NEG	NVD	
	NEP 14/2015	CATTLE	03-Nov-15	O	POS	O	
	NEP 15/2015	CATTLE	03-Nov-15	O	POS	O	
	NEP 16/2015	CATTLE	16-Nov-15	NEG	POS	FMDV GD	
	NEP 17/2015	CATTLE	01-Dec-15	O	POS	O	
	NEP 18/2015	PIG	01-Dec-15	O	POS	O	
	NEP 19/2015	CATTLE	02-Dec-15	O	POS	O	
	NEP 20/2015	CATTLE	05-Dec-15	NEG	POS	FMDV GD	
	NEP 21/2015	CATTLE	06-Dec-15	O	POS	O	
	NEP 22/2015	CATTLE	09-Dec-15	NEG	POS	FMDV GD	
	NEP 23/2015	CATTLE	09-Dec-15	O	POS	O	
	NEP 24/2015	CATTLE	11-Dec-15	O	POS	O	
	NEP 25/2015	CATTLE	14-Dec-15	O	POS	O	
	Palestinian Autonomous Territories	PAT 1/2015	SHEEP	11-Nov-15	O	POS	O
		PAT 2/2015	SHEEP	11-Nov-15	O	POS	O
PAT 3/2015		SHEEP	11-Nov-15	O	POS	O	
PAT 4/2015		SHEEP	11-Nov-15	O	POS	O	
PAT 5/2015		SHEEP	18-Nov-15	O	POS	O	
PAT 6/2015		SHEEP	14-Dec-15	O	POS	O	
Saudi Arabia	SAU 7/2015	CATTLE	23-Oct-15	A	POS	A	
	SAU 8/2015	CATTLE	30-Dec-15	A	POS	A	
	SAU 9/2015	BOVINE	05-Oct-15	A	POS	A	
	SAU 10/2015	BOVINE	07-Oct-15	NEG	NEG	NVD	
	SAU 11/2015	OVINE	07-Oct-15	NEG	NEG	NVD	
	SAU 12/2015	BOVINE	07-Oct-15	NEG	NEG	NVD	
	SAU 13/2015	BOVINE	26-Oct-15	NEG	NEG	NVD	
	SAU 14/2015	OVINE	26-Oct-15	A	POS	A	
	SAU 15/2015	OVINE	26-Oct-15	A	POS	A	
	SAU 16/2015	OVINE	26-Oct-15	A	POS	A	
	SAU 17/2015	OVINE	26-Oct-15	A	POS	A	
	SAU 18/2015	BOVINE	22-Dec-15	O	POS	O	
	SAU 19/2015	BOVINE	22-Dec-15	O	POS	O	

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Country	WRL for FMD Sample Identification	Species	Date of Collection	Results		
				VI/ELISA	rRT-PCR	Final report
	SAU 20/2015	BOVINE	22-Dec-15	O	POS	O
	SAU 21/2015	BOVINE	22-Dec-15	A	POS	A
	SAU 22/2015	BOVINE	22-Dec-15	O	POS	O
	SAU 1/2016	CATTLE	15-Feb-16	O	POS	O
	SAU 2/2016	BOVINE	19-Feb-16	O	POS	O
	SAU 3/2016	BOVINE	19-Feb-16	O	POS	O
	SAU 4/2016	BOVINE	19-Feb-16	NEG	NEG	NVD
	SAU 5/2016	BOVINE	19-Feb-16	NEG	NEG	NVD
	SAU 6/2016	BOVINE	19-Feb-16	NEG	NEG	NVD
	SAU 7/2016	BOVINE	19-Feb-16	O	POS	O
	SAU 8/2016	BOVINE	19-Feb-16	NEG	POS	FMDV GD
	SAU 9/2016	BOVINE	19-Feb-16	NEG	NEG	NVD
	SAU 10/2016	BOVINE	19-Feb-16	O	POS	O
	SAU 11/2016	BOVINE	19-Feb-16	NEG	NEG	NVD
	SAU 12/2016	BOVINE	19-Feb-16	NEG	NEG	NVD
	SAU 13/2016	BOVINE	19-Feb-16	NEG	NEG	NVD
	SAU 14/2016	BOVINE	19-Feb-16	NEG	NEG	NVD
United Arab Emirates	UAE 1/2015	MOUNTAIN GAZELLE	31-Dec-15	O	POS	O
TOTAL:		111				

Carried over from previous quarterly report:

Country	WRL for FMD Sample Identification	Species	Date of Collection	Results		
				VI/ELISA	RT-PCR	Final report
Iran	IRN 1/2015	CATTLE	24-Apr-15	ASIA-1	POS	ASIA-1
	IRN 2/2015	CATTLE	28-Apr-15	ASIA-1	POS	ASIA-1
	IRN 3/2015	CATTLE	28-Apr-15	O	POS	O
	IRN 4/2015	CATTLE	08-May-15	O	POS	O
	IRN 5/2015	CATTLE	25-May-15	A	POS	A
	IRN 6/2015	CATTLE	15-Jun-15	O	POS	O
	IRN 7/2015	CATTLE	16-Aug-15	O	POS	O
	IRN 9/2015	CATTLE	12-Sep-15	A	POS	A
	IRN 10/2015	CATTLE	12-Sep-15	A	POS	A

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Country	WRL for FMD Sample Identification	Species	Date of Collection	Results		
				VI/ELISA	rRT-PCR	Final report
	IRN 11/2015	CATTLE	14-Sep-15	NEG	NEG	NVD
	IRN 13/2015	CATTLE	28-Sep-15	A	POS	A
	IRN 14/2015	CATTLE	28-Sep-15	A	POS	A
	IRN 15/2015	CATTLE	01-Oct-15	O	POS	O
	IRN 16/2015	CATTLE	01-Oct-15	O	POS	O
	IRN 17/2015	CATTLE	09-Oct-15	A	POS	A
	IRN 18/2015	CATTLE	10-Oct-15	A	POS	A
	IRN 19/2015	CATTLE	15-Oct-15	A	POS	A
	IRN 20/2015	CATTLE	23-Oct-15	ASIA-1	POS	ASIA-1
	IRN 21/2015	CATTLE	24-Oct-15	A	POS	A
	IRN 22/2015	CATTLE	24-Oct-15	A	POS	A
	IRN 23/2015	CATTLE	25-Oct-15	NEG	NEG	NVD
	IRN 24/2015	CATTLE	26-Oct-15	A	POS	A
	IRN 25/2015	CATTLE	28-Oct-15	A	POS	A
	IRN 26/2015	SHEEP	03-Nov-15	O	POS	O
	IRN 27/2015	CATTLE	08-Nov-15	A	POS	A
Pakistan	PAK 22/2015	BUFFALO	03-Apr-15	O	POS	O
	PAK 23/2015	BUFFALO	13-May-15	NEG	NEG	NVD
	PAK 24/2015	CATTLE	01-Jun-15	NEG	POS	FMDV GD
	PAK 25/2015	CATTLE	05-Jun-15	A	POS	A
	PAK 26/2015	BUFFALO	02-Jul-15	NEG	POS	FMDV GD
	PAK 27/2015	BUFFALO	15-Jul-15	ASIA-1	POS	ASIA-1
	PAK 28/2015	CATTLE	01-Aug-15	ASIA-1	POS	ASIA-1
	PAK 29/2015	BUFFALO	27-Aug-15	ASIA-1	POS	ASIA-1
	PAK 30/2015	BUFFALO	29-Aug-15	O	POS	O
	PAK 31/2015	BUFFALO	31-Aug-15	A	POS	A
	PAK 32/2015	CATTLE	01-Sep-15	O	POS	O
	PAK 33/2015	BUFFALO	05-Sep-15	NEG	POS	ASIA-1
	PAK 34/2015	CATTLE	16-Sep-15	O	POS	O
	PAK 35/2015	CATTLE	16-Sep-15	A	POS	A
	PAK 36/2015	CATTLE	19-Sep-15	A	POS	A
	PAK 37/2015	CATTLE	22-Sep-15	ASIA-1	POS	ASIA-1

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Country	WRL for FMD Sample Identification	Species	Date of Collection	Results		
				VI/ELISA	rRT-PCR	Final report
---	PAK 38/2015	CATTLE	23-Sep-15	ASIA-1	POS	ASIA-1
---	PAK 39/2015	CATTLE	05-Oct-15	NEG	POS	FMDV GD
---	PAK 40/2015	CATTLE	05-Oct-15	NEG	POS	FMDV GD
---	PAK 41/2015	CATTLE	05-Oct-15	NEG	POS	FMDV GD
---	PAK 42/2015	CATTLE	05-Oct-15	O	POS	O
---	PAK 43/2015	CATTLE	08-Oct-15	ASIA-1	POS	ASIA-1
---	PAK 44/2015	CATTLE	09-Oct-15	O	POS	O
---	PAK 45/2015	CATTLE	14-Oct-15	O	POS	O
---	PAK 46/2015	BUFFALO	16-Oct-15	A	POS	A
---	PAK 47/2015	CATTLE	18-Oct-15	NEG	POS	FMDV GD
---	PAK 48/2015	CATTLE	19-Oct-15	ASIA-1	POS	ASIA-1
---	PAK 49/2015	BUFFALO	21-Oct-15	O	POS	O
---	PAK 50/2015	BUFFALO	21-Oct-15	A	POS	A
---	PAK 51/2015	BUFFALO	28-Oct-15	O	POS	O
---	PAK 52/2015	CATTLE	01-Nov-15	O	POS	O
---	PAK 53/2015	CATTLE	03-Nov-15	A	POS	A
---	PAK 54/2015	BUFFALO	06-Nov-15	ASIA-1	POS	ASIA-1
---	PAK 55/2015	CATTLE	12-Nov-15	A	POS	A
---	PAK 56/2015	CATTLE	04-Dec-15	A	POS	A
Sudan	SUD 1/2012	CATTLE	01-Feb-12	O	POS	O
	SUD 2/2012	CATTLE	01-Feb-12	O	POS	O
	SUD 3/2012	CATTLE	01-Feb-12	O	POS	O
	SUD 4/2012	CATTLE	01-Feb-12	NEG	POS	FMDV GD
	SUD 5/2012	CATTLE	01-Feb-12	O	POS	O
	SUD 6/2012	CATTLE	01-Feb-12	O	POS	O
	SUD 7/2012	CATTLE	01-Feb-12	NEG	NEG	NVD
	SUD 1/2013	CATTLE	19-Feb-13	A	POS	A
	SUD 2/2013	CATTLE	19-Feb-13	NEG	NEG	NVD
	SUD 3/2013	CATTLE	16-Apr-13	SAT 2	POS	SAT 2
	SUD 4/2013	CATTLE	30-Dec-13	O	POS	O
	SUD 5/2013	CATTLE	31-Dec-13	SAT 2	NEG	SAT 2
	SUD 6/2013	CATTLE	31-Dec-13	NEG	NEG	NVD

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Country	WRL for FMD Sample Identification	Species	Date of Collection	Results		
				VI/ELISA	rRT-PCR	Final report
	SUD 7/2013	CATTLE	31-Dec-13	NEG	POS	FMDV GD
	SUD 8/2013	CATTLE	31-Dec-13	NEG	POS	FMDV GD
	SUD 9/2013	CATTLE	31-Dec-13	SAT 2	POS	SAT 2
	SUD 10/2013	CATTLE	31-Dec-13	A	POS	A
	SUD 11/2013	CATTLE	31-Dec-13	A	POS	A
	SUD 12/2013	CATTLE	31-Dec-13	A	POS	A
	SUD 13/2013	CATTLE	31-Dec-13	A	POS	A
	SUD 1/2014	CATTLE	01-Jan-14	NEG	NEG	NVD
	SUD 2/2014	CATTLE	01-Jan-14	NEG	POS	FMDV GD
	SUD 3/2014	CATTLE	01-Jan-14	NEG	NEG	NVD
	SUD 4/2014	CATTLE	01-Jan-14	SAT 2	POS	SAT 2
	SUD 5/2014	CATTLE	01-Jan-14	NEG	NEG	NVD
	SUD 6/2014	CATTLE	01-Jan-14	NEG	NEG	NVD
	SUD 7/2014	CATTLE	01-Jan-14	SAT 2	NEG	SAT 2
	SUD 8/2014	CATTLE	01-Jan-14	NEG	POS	FMDV GD
	SUD 9/2014	CATTLE	01-Jan-14	NEG	NEG	NVD
	SUD 10/2014	CATTLE	01-Jan-14	NEG	NEG	NVD
	SUD 11/2014	CATTLE	01-Jan-14	SAT 2	POS	SAT 2
	SUD 12/2014	CATTLE	03-Jan-14	NEG	NEG	NVD
	SUD 13/2014	CATTLE	03-Jan-14	NEG	NEG	NVD
	SUD 14/2014	CATTLE	04-Jan-14	NEG	NEG	NVD
	SUD 15/2014	CATTLE	05-Jan-14	NEG	NEG	NVD
	SUD 16/2014	CATTLE	05-Jan-14	NEG	NEG	NVD
	SUD 17/2014	CATTLE	05-Jan-14	NEG	POS	FMDV GD
Thailand	TAI 9/2015	CATTLE	27-Feb-15	O	POS	O
	TAI 10/2015	PIG	03-Mar-15	O	POS	O
	TAI 11/2015	CATTLE (DAIRY)	17-Mar-15	O	POS	O
	TAI 12/2015	PIG	07-Apr-15	A	POS	A
	TAI 13/2015	CATTLE (DAIRY)	30-Apr-15	A	POS	A
	TAI 14/2015	CATTLE (DAIRY)	11-May-15	NEG	POS	FMDV GD

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Country	WRL for FMD Sample Identification	Species	Date of Collection	Results		
				VI/ELISA	rRT-PCR	Final report
	TAI 15/2015	CATTLE (DAIRY)	11-May-15	A	POS	A
	TAI 16/2015	CATTLE (DAIRY)	20-May-15	O	POS	O
	TAI 17/2015	CATTLE (DAIRY)	04-Jun-15	O	POS	O
	TAI 18/2015	BUFFALO	28-Jul-15	O	POS	O
	TAI 19/2015	CATTLE	26-Aug-15	O	POS	O
	TAI 20/2015	CATTLE	28-Aug-15	O	POS	O
	TAI 21/2015	CATTLE (DAIRY)	04-Sep-15	A	POS	A
	TAI 22/2015	BUFFALO	08-Sep-15	O	POS	O
	TAI 23/2015	CATTLE	10-Sep-15	A	POS	A
	TAI 24/2015	CATTLE (DAIRY)	11-Sep-15	A	POS	A
	TAI 25/2015	CATTLE	14-Sep-15	O	POS	O
	TAI 26/2015	CATTLE	22-Sep-15	O	POS	O
	TAI 27/2015	CATTLE	28-Sep-15	O	POS	O
	TAI 28/2015	CATTLE	08-Oct-15	O	POS	O
	TAI 29/2015	CATTLE	09-Oct-15	O	POS	O
TOTAL:		118				

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

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Antigenic Characterisation

Table 4: Antigenic characterisation of FMD field isolates by matching with vaccine strains by 2dmVNT from January to March 2016

Vaccine matching studies for Asia 1 FMDV by VNT

Sample				Asia 1 IND 8/79	Asia 1 Shamir
ID	Serotype	Topotype	Strain		
TUR/37/2014	Asia-1	ASIA		N	N
TUR/12/2015	Asia-1	ASIA	Sindh-08	N	N

Vaccine matching studies for A FMDV by VNT

Sample				A/IND/40/2000*	A/TUR/11	A/TUR/14
ID	Serotype	Topotype	Strain			
SAU/1/2015**	A	ASIA	G-VII	N	N	N
IRN/8/2015**	A	ASIA	G-VII	N	N	N
IRN/12/2015**	A	ASIA	G-VII	N	N	N

* Multiple BVS tested

** Additional vaccine matching data can be found in Q4 2015

Vaccine matching studies for O FMDV by VNT

Sample				O 3039	O Manisa	O/SKR /7/10	O/Russia /2000*	O/TUR/ 5/2009
ID	Serotype	Topotype	Strain					
HKN/8/2015	O	CATHAY	-	N	N	N	M	N
HKN/9/2015	O	CATHAY	-	N	N	N	M	N

* homologous neutralisation titre is below the acceptable limit and caution should be taken when interpreting these results.

Vaccine matching studies for SAT 1 FMDV by VNT

Sample				SAT1/Rho
ID	Serotype	Topotype	Strain	
ZIM/10/2015	SAT1	II(SEZ)		Borderline
ZIM/14/2015	SAT1	II(SEZ)		N

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Vaccine matching studies for SAT 2 FMDV by VNT

Sample					
<i>ID</i>	<i>Serotype</i>	<i>Topotype</i>	<i>Strain</i>	SAT 2 ERI	SAT 2 ZIM
ZIM/13/2015	SAT2	II		M	M
ZIM/20/2015	SAT2	II		N	Borderline
ZIM/5/2015	SAT2	II		Borderline	N

Abbreviations used in tables:

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
NT	Not tested against this vaccine

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Annex 2

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

1. Aiki-Raji, C.O., D.O. Oluwayelu, I.A. Adeyemo, and A.I. Adebisi (2016). Seroprevalence of foot-and-mouth disease in slaughtered pigs in Ibadan, southwest Nigeria. *Alexandria Journal of Veterinary Sciences*, **48**(2): 18-22.
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Annex 3

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

Note: Virus strains are NOT listed in order of importance

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

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

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

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