FAO/OIE Reference Laboratory Report
October - December 2006

Foot-and-Mouth Disease

FMD Trends

Summary

As in the earlier part of 2006, no outbreaks were officially reported in FMD-free countries that did not practice vaccination and FMD remained largely confined to traditionally infected areas between October and December 2006. However, within endemically infected areas there have been upsurges of cases which may indicate an enhanced risk of collateral spread. Matching tests to check the availability of suitable vaccines to protect against these strains continue to reveal gaps in the cover against serotypes A and SAT 2, for example in the case of recent outbreaks due to serotype A in Mauritania, where there may be potential for northward spread to the southern Mediterranean coast. The finding of serotype A in Jordan represents a changed epidemiological situation, since this serotype has not been reported from this part of the Middle East for many years.

In China there have been continued outbreaks of FMDV serotype Asia 1 during this quarter. Fresh outbreaks in cattle have occurred in 4 locations: Chongqing (3 cases), Yongdeng in Gansu province (9 cases), Datong in Qinghai province (53 cases) and Qushui in Tibet (128 cases). In total, 874 outbreaks have been reported to OIE in China during 2006. Control measures used continue to be vaccination and stamping out (2222 animals have been reported as slaughtered during 2006) in combination with movement controls.

In Brazil, clinical and serological surveillance has continued following outbreaks in the States of Paraná and Mato Grosso do Sul earlier in 2006. Investigations (performed during October 2006) carried out in the municipality of Loanda (Paraná) have indicated that FMDV is not circulating. As a consequence, the sanitary restrictions applied in the State of Paraná have been lifted. Elsewhere in Brazil, in the State of Mato Grosso do Sul, the survey on FMDV circulation is still in progress.

In Africa, there were reports to OIE of outbreaks in Guinea, but the serotype was not established. Subsequently, WRL received samples from Mauritania that were found to be serotype A of the indigenous west-Africa topotype. No new cases of FMDV SAT1 have been reported in Botswana since the last report. Cattle, goats and pigs in the affected area (Selibe Phikwe district - zone 7) were subjected to a routine clinical inspection and showed no evidence of any new FMDV infection. Elsewhere in Africa, there have been a reoccurrence of FMDV outbreaks in Guinea in two regions in Dragueda, Bankon, and Kouroudakoro, Commune urbaine (both in Siguiri Province in the north-east, close to the border with Mali). Thirty seven cases have been reported resulting in the deaths of 12 cattle. The source of these outbreaks is considered to be linked to contact at grazing with animals intended for slaughter originating from a neighbouring country.

In Iran and Turkey, in the latter part of 2006 there has been a reduction in reports of outbreaks due to serotype A, but an increase in reports of outbreaks due to serotype O. In the past month, there have been new outbreaks of FMDV serotype O in northern Israel and there have been outbreaks of serotypes O and A in Jordan. The Jordan outbreaks represent an extension of those in Iran and Turkey and demonstrate that this is a virus with considerable potential for spread. Samples have not yet been received from Israel, where the first outbreak report was in Netu'a close to the border with Lebanon. This outbreak involved goats and resulted in the sudden deaths of 90 kids without any other clinical signs. About 60% of the mothers in the affected herd showed slight clinical symptoms (superficial ulcers on the mammary gland). The second outbreak (reported 1/1/07) occurred on a cattle farm in Mevo Hamma approximately 50 miles south-east of the first reported case. This outbreak comprised 15 cases resulting in 5 deaths of calves (1-3 months old). These calves had not yet been vaccinated: the older calves were not affected due to previous vaccination. Movement restrictions and vaccination in response to the outbreak) are being use in attempts to control spread of disease.

STOP PRESS:

There have been reports of new outbreaks of FMD in Turkey close to Greece. OIE WAHID system has provided information that on Jan 4, 2007, 2 cattle were reported and then clinically confirmed to have FMD in the village of Ogulpasa (Edirne) near the border with Greece. The affected cattle were mainly young primovaccinated animals and there is so far no evidence of further spread of the disease. According to tests done in Turkey, the virus responsible is of the A Iran 05 strain.

The WRL vaccine recommendations remain unchanged.

Results from samples received to WRL

Middle East/southern Asia

FMDV serotype O
Samples have been received from Iran and Jordan and sequences from Turkey (see Table 1). Analysis of virus sequences indicates that a FMDV type O lineage derived from the PanAsia strain has emerged (possibly from India around 2001) and spread east to Malaysia, north to Nepal and Bhutan and west to Pakistan, Afghanistan, Iran, Turkey and Jordan (see phylogenetic tree presented as Fig 1 – Annex 2). Analysis of further samples is on-going.

FMDV serotype A
Two partial FMDV sequences (1266/2006 and 1416/2006) were received from Fuat Özyörük, Turkey. These were both type A (strain A Iran 05 within Asia topotype) and show that this strain of FMDV continues to circulate in Turkey (see Fig 2, Annex 2). The same A Iran 05 strain was found in some of the samples from Jordan (others containing type O virus - as above).

Southeast Asia and the Far East

FMDV serotype A
Sequencing of samples collected in Thailand and Malaysia during 2005 indicates that serotype A viruses in these 2 countries have high similarity (Fig 3, Annex 2)

Africa

FMDV serotype SAT 2
Sequencing of FMDV SAT2 in Niger in 2005 showed that it was closely related to the 2003 outbreak in Libya (where SAT2 does not normally occur) providing evidence of the risk posed to the southern Mediterranean from outbreaks in sub-Saharan states – see Fig 4, Annex 2.

Table 1: Status of sequencing on samples received between October - December 2006

Country	Serotype	No of samples.	Status	Comments
Iran	O	47	in progress	some isolates are on the tree
Iran	A	2	in progress	
Malaysia	O	5	in progress	
Mauritania	A	7	in progress	
Botswana	SAT1	2	completed	
Botswana	SAT2	1	in progress	
Ethiopia	O	7	done	plus 2 not done, since no virus isolated
Jordan	O	3	completed	
Jordan	A	3	in progress	

Vaccine matching

FMDV isolates of serotype A (Iran, Mauritania, Pakistan and Turkey) and Serotype O (Iran) collected in 2006 were further characterized by liquid phase blocking ELISA (LPBE: Annex 1; TABLE D).

r-values for 2 serotype A viruses collected recently from Iran (IRN 05/2006 and IRN 07/2006) showed closest match to A22. Similar results were generated by VNT for these isolates and were presented in the previous report. Two isolates tested from Mauritania (MAU 01/2006 and MAU 03/2006) generated r-values indicative of a protective response only with the A KEN 35/80 vaccine strain. However, this strain is only produced locally in Kenya and is not available from international vaccine manufacturers. Two isolates from Pakistan had different r-value profiles when tested by LPBE although both had high match to the A SAU 95 vaccine strain. These differences were evident even though phylogenetic analysis indicates that these two isolates are closely related to each other (see phylogenetic analysis performed in quarterly report April-June 2006). Further testing by LPBE of 8 serotype A isolates from Turkey (all characterized by VP1 sequencing as Irn05 strain) showed that the majority had closest match to A22.

Publication of data to the scientific community and the industry

FMD papers published in the reporting period from the Pirbright Laboratory (Pirbright authors underlined):

1. Reid SM, King DP, Shaw AE, Knowles NJ, Hutchings GH, Cooper EJ, Smith AW, Ferris NP. Development of a real-time reverse transcription polymerase chain reaction assay for detection of marine caliciviruses (genus Vesivirus). J Virol Methods. 2006 Dec 20; [Epub ahead of print]

2. Kitching P, Hammond J, Jeggo M, Charleston B, Paton D, Rodriguez L, Heckert Global FMD control-Is it an option? Vaccine. 2006 Nov 9; [Epub ahead of print]

3. Inoue T, Parida S, Paton DJ, Linchongsubongkoch W, Mackay D, Oh Y, Aunpomma D, Gubbins S, Saeki T. Development and evaluation of an indirect enzyme-linked immunosorbent assay for detection of foot-and-mouth disease virus nonstructural protein antibody using a chemically synthesized 2B peptide as antigen. J Vet Diagn Invest. 2006 Nov;18(6):545-52.

4. Moffat K, Knox C, Howell G, Clark SJ, Yang YG, Belsham GJ, Ryan M, Wileman T. Inhibition of the secretory pathway by the Foot-and-Mouth Disease Virus 2BC protein is reproduced by co-expression of 2B with 2C and the site of inhibition is determined by the subcellular location of 2C. J Virol. 2006 Nov 22; [Epub ahead of print]

5. Bronsvoort BM, Toft N, Bergmann IE, Sorensen KJ, Anderson J, Malirat V, Tanya VN, Morgan KL. Evaluation of three 3ABC ELISAs for foot-and-mouth disease non-structural antibodies using latent class analysis.BMC Vet Res. 2006 Oct 16;2:30.

6. Niborski V, Li Y, Brennan F, Lane M, Torche AM, Remond M, Bonneau M, Riffault S, Stirling C, Hutchings G, Takamatsu H, Barnett P, Charley B, Schwartz-Cornil I. Efficacy of particle-based DNA delivery for vaccination of sheep against FMDV. Vaccine. 2006 Nov 30;24(49-50):7204-13.

Papers presented at the EUFMD Research Group Open Meeting in Paphos, Cyprus, 17-19 Oct 2006, by IAH-Pirbright authors:

King:	Global Update of Foot-and-Mouth Disease
Knowles:	Recent Molecular epidemiology of foot-and-mouth disease virus Asia 1
Wadsworth:	Recent spread of new strains of foot-and-mouth disease virus type A in the Middle East and North Africa
Cottam:	Genetic tracing of UK foot-and-mouth disease virus outbreak in 2001
Bankowski:	Understanding FMDV transmission in bovine – preliminary data from animal experiments.
Gloster:	Airborne spread of foot-and-mouth disease
Charleston:	Dissecting immune responses
Mahapatra:	Use of monoclonal antibodies for FMFV vaccine selection
Paton:	Preliminary results to evaluate cross-protection between O Manisa and O Campos in cattle
Oh:	Use of cell-mediated immunity for FMD vaccine evaluation
Cox:	Further evaluation of higher potency vaccines for protection from FMDV direct contact challenge
Reid:	Diagnosis of FMDV by RT-PCR: prospects for mobile assays
Paton:	Preliminary study of the use of thermal imaging to assess surface temperatures during foot-and-mouth disease virus infection in cattle, sheep and pigs.
Dukes:	Rapid, simple, field deployable FMDV detection
Fleming:	Bovine serum panel for evaluation of FMDV non-structural protein antibody tests
Parida:	Evaluation of emergency FMD vaccine in pigs following direct contact challenge
Ferris:	FAO collaborative studies for FMD standardization: Phase XIX – virological assays
Li:	Laboratory comparative testing exercise Phase XIX – Serology
Zhang:	Quantitative analysis of cytokine mRNA induction in micro-dissected epithelium in cattle during foot-and-mouth disease virus infection
Ryan:	Foot-and-mouth disease virus infection in foetal lambs
Horsington:	Detection of an amino acid change in the VP2 region of foot-and-mouth disease virus associated with persistent infection in experimentally infected cattle.
Stirling:	Plans for displaying reference laboratory information via the World Wide Web.

Annex 1.

Table A: Summary of clinical sample diagnostics made by the WRL between October - December 2006

Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results		
				VI/ELISA	RT-PCR	Final report
BOTSWANA	BOT 19/2006	Buffalo	17.07.06	NVD	Negative	NVD
	BOT 20/2006	Buffalo	17.07.06	SAT 1	Positive	SAT 1
	BOT 21/2006	Buffalo	17.07.06	NVD	Negative	NVD
	BOT 22/2006	Buffalo	17.07.06	SAT 1	Positive	SAT 1
	BOT 23/2006	Buffalo	17.07.06	NVD	Negative	NVD
	BOT 24/2006	Buffalo	17.07.06	SAT 2	Negative	SAT 2
	BOT 25/2006	Buffalo	17.07.06	NVD	Negative	NVD
	BOT 26/2006	Buffalo	17.07.06	NVD	Negative	NVD
	BOT 27/2006	Buffalo	19.07.06	NVD	Negative	NVD
	BOT 28/2006	Buffalo	19.07.06	NVD	Positive	FMDV GD
	BOT 29/2006	Buffalo	19.07.06	NVD	Positive	FMDV GD
	BOT 30/2006	Buffalo	20.07.06	NVD	Negative	NVD
	BOT 31/2006	Buffalo	20.07.06	NVD	Negative	NVD
	BOT 32/2006	Buffalo	20.07.06	NVD	Negative	NVD
	BOT 33/2006	Buffalo	21.07.06	NVD	Positive	FMDV GD
	BOT 34/2006	Buffalo	21.07.06	NVD	Negative	NVD
	BOT 35/2006	Buffalo	21.07.06	NVD	Negative	NVD
	BOT 36/2006	Buffalo	24.07.06	NVD	Negative	NVD
	BOT 37/2006	Buffalo	26.07.06	NVD	Negative	NVD
ETHIOPIA	ETH 69/2005	Cattle	00.12.05	NVD	Positive	FMDV GD
	ETH 70/2005	Cattle	00.12.05	NVD	Negative	NVD
	ETH 71/2005	Cattle	00.12.05	NVD	Negative	NVD
	ETH 72/2005	Cattle	00.12.05	O	Positive	O
	ETH 1/2006	Cattle	00.01.06	O	Positive	O
	ETH 2/2006	Cattle	00.05.06	O	Positive	O
	ETH 3/2006	Cattle	00.05.06	NVD	Positive	FMDV GD
	ETH 4/2006	Cattle	00.05.06	O	Positive	O
	ETH 5/2006	Cattle	00.05.06	NVD	Positive	FMDV GD
	ETH 6/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 7/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 8/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 9/2006	Cattle	00.05.06	NVD	Positive	FMDV GD
	ETH 10/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 11/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 12/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 13/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 14/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 15/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 16/2006	Cattle	00.05.06	NVD	Positive	FMDV GD
	ETH 17/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 18/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 19/2006	Cattle	00.05.06	O	Positive	O
	ETH 20/2006	Cattle	00.05.06	O	Positive	O
	ETH 21/2006	Cattle	00.05.06	O	Positive	O
	ETH 22/2006	Cattle	00.05.06	NVD	Positive	FMDV GD

	ETH 23/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 24/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 25/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 26/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 27/2006	Cattle	00.05.06	O	Positive	O
	ETH 28/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 29/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 30/3006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 31/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 32/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 33/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 34/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 35/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 36/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 37/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 38/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 39/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 40/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 41/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 42/2006	Cattle	00.05.06	NVD	Negative	NVD
	ETH 43/2006	Cattle	00.10.06	O	Positive	O
	ETH 44/2006	Cattle	00.10.06	NVD	Positive	FMDV GD
IRAN	IRN 29/2006	Cattle	00.09.06	O	Positive	O
	IRN 30/2006	Cattle	02.11.06	O	Positive	O
	IRN 31/2006	Cattle	04.11.06	O	Positive	O
	IRN 32/2006	Cattle	07.11.06	O	Positive	O
	IRN 33/2006	Sheep	08.11.06	O	Positive	O
	IRN 34/2006	Cattle	11.11.06	O	Positive	O
	IRN 35/2006	Cattle	11.11.06	O	Positive	O
	IRN 36/2006	Cattle	14.11.06	NVD	Negative	NVD
	IRN 37/2006	Cattle	19.11.06	O	Positive	O
	IRN 38/2006	Cattle	19.11.06	O	Positive	O
	IRN 39/2006	Cattle	20.11.06	O	Positive	O
	IRN 40/2006	Cattle	20.11.06	NVD	Negative	NVD
	IRN 41/2006	Cattle	20.11.06	NVD	Negative	NVD
	IRN 42/2006	Cattle	20.11.06	O	Positive	O
	IRN 43/2006	Sheep	21.11.06	O	Positive	O
	IRN 44/2006	Cattle	21.11.06	O	Positive	O
	IRN 45/2006	Cattle	21.11.06	O	Positive	O
	IRN 46/2006	Cattle	23.11.06	O	Positive	O
	IRN 47/2006	Cattle	25.11.06	O	Positive	O
	IRN 48/2006	Cattle	25.11.06	O	Positive	O
	IRN 49/2006	Cattle	25.11.06	O	Positive	O
	IRN 50/2006	Cattle	25.11.06	O	Positive	O
	IRN 51/2006	Buffalo	25.11.06	O	Positive	O
	IRN 52/2006	Cattle	27.11.06	O	Positive	O
	IRN 53/2006	Cattle	27.11.06	O	Positive	O
	IRN 54/2006	Cattle	00.11.06	A	Positive	A
	IRN 55/2006	Cattle	00.11.06	O	Positive	O
	IRN 56/2006	Cattle	00.11.06	O	Positive	O
	IRN 57/2006	Cattle	00.11.06	A	Positive	A
	IRN 58/2006	Cattle	05.12.06	O	Positive	O
	IRN 59/2006	Cattle	05.12.06	O	Positive	O
	IRN 60/2006	Cattle	05.12.06	O	Positive	O

	IRN 61/2006	Cattle	06.12.06	O	Positive	O
	IRN 62/2006	Cattle	NK	NVD	Negative	NVD
	IRN 63/2006	Cattle	NK	NVD	Negative	NVD
	IRN 64/2006	Cattle	NK	O	Positive	O
JORDAN	JOR 1/2006	Sheep	06.12.06	NVD	Negative	NVD
	JOR 2/2006	Cattle	06.12.06	A	Positive	A
	JOR 3/2006	Cattle	06.12.06	A	Positive	A
	JOR 4/2006	Cattle	06.12.06	A	Positive	A
	JOR 5/2006	Sheep	06.12.06	O	Positive	O
	JOR 6/2006	Cattle	06.12.06	O	Positive	O
	JOR 7/2006	Sheep	06.12.06	O	Positive	O
MAURITANIA	MAU 1/2006	Cattle	17.11.06	A	Positive	A
	MAU 2/2006	Cattle	17.11.06	NVD	Negative	NVD
	MAU 3/2006	Cattle	17.11.06	A	Positive	A
	MAU 4/2006	Cattle	17.11.06	A	Positive	A
	MAU 5/2006	Cattle	17.11.06	A	Positive	A
	MAU 6/2006	Cattle	17.11.06	A	Positive	A
	MAU 7/2006	Cattle	17.11.06	A	Positive	A
	MAU 8/2006	Cattle	17.11.06	A	Positive	A
	TOTAL : 118					

*	Institute for Animal Health, Pirbright Laboratory, Woking, Surrey GU24 0NF
FMD(V)	foot-and-mouth disease (virus)
GD	genome detected
VI/ELISA	FMDV serotype identified following virus isolation in cell culture and antigen detection ELISA
RT-PCR	reverse transcription polymerase chain reaction on epithelial suspension for FMD and SVD viral genome
NVD	no foot-and-mouth disease, swine vesicular disease or vesicular stomatitis virus detected
NK	not known

NPF, 11 January 2007

TABLE B: Summary of samples collected in 2006 received to IAH

Country	No. of samples	Virus isolation in cell culture/ELISA									RT-PCR for FMD (or SVD) virus (where appropriate)	
		FMD virus serotypes							SVD virus	NVD		
		O	A	C	SAT 1	SAT 2	SAT 3	Asia 1			Positive	Negative
BOTSWANA	37	-	-	-	9	4	-	-	-	24	22	15
D.R.OF CONGO	116	42	-	-	-	-	-	-	-	74	78	38
EGYPT	5	-	5	-	-	-	-	-	-	-	5	-
ETHIOPIA	44	8	-	-	-	-	-	-	-	36	14	30
CHINA (HONG KONG)	5	5	-	-	-	-	-	-	-	-	5	-
IRAN	64	50	4	-	-	-	-	-	-	10	55	9
IRELAND	6	-	-	-	-	-	-	-	-	6	-	6
ISRAEL	2	2	-	-	-	-	-	-	-	-	2	-
JORDAN	7	3	3	-	-	-	-	-	-	1	6	1
KENYA	10	-	1	-	3	-	-	-	-	6	8	2
KUWAIT	3	2	-	-	-	-	-	-	-	1	2	1
LAOS	5	4	1	-	-	-	-	-	-	-	5	-
MALAYSIA	5	4	-	-	-	-	-	-	-	1	5	-
MAURITANIA	8	-	7	-	-	-	-	-	-	1	7	1
PAKISTAN	53	21	9	-	-	-	-	-	-	23	50	3
RWANDA	1	-	-	-	-	-	-	-	-	1	-	1
SENEGAL	9	1	-	-	-	-	-	-	-	8	-	9
TURKEY	21	14	3	-	-	-	-	-	-	4	19	2
UNITED KINGDOM	9	-	-	-	-	-	-	-	-	9	-	9
VIETNAM	11	7	-	-	-	-	-	4	-	-	11	-
TOTAL	**421**	**163**	**33**	**-**	**12**	**4**	**-**	**4**	**-**	**205**	**294**	**127**

*	Institute for Animal Health, Pirbright Laboratory, Woking, Surrey GU24 0NF
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
RT-PCR	reverse transcription polymerase chain reaction for FMD (or SVD) viral genome

TABLE C: The following samples were additionally received by the OIE/FAO World Reference Laboratory for Foot and Mouth Disease in 2006

Country	Sample year	No. of samples	ELISA/Virus isolation in cell culture									RT-PCR for FMD (or SVD) virus	
			FMD virus serotypes							SVD	NVD		
			O	A	C	SAT 1	SAT 2	SAT 3	Asia 1	virus		Positive	Negative
BENIN	2005	16	-	-	-	-	-	-	-	-	16	-	16
CHINA (HONG KONG)	2005	10	8	-	-	-	-	-	-	-	2	9	1
ETHIOPIA	2005	4	1	-	-	-	-	-	-	-	3	2	2
ISRAEL	2004	5	5	-	-	-	-	-	-	-	-	5	-
	2005	2	2	-	-	-	-	-	-	-	-	2	-
KENYA	2004	25	4	-	-	1	4	-	-	-	16	21	4
	2005	31	6	2	-	9	2	-	-	-	12	31	-
MALAYSIA	2005	1	1	-	-	-	-	-	-	-	-	1	-
MYANMAR	2004	1	-	-	-	-	-	-	1	-	-	1	-
NIGER	2005	16	3	-	-	-	1	-	-	-	12	6	10
RWANDA	2005	1	-	-	-	-	-	-	-	-	1	-	1
SAUDI ARABIA	2005	2	-	2	-	-	-	-	-	-	-	2	-
THAILAND	2005	11	6	5	-	-	-	-	-	-	-	11	-
TURKEY	2005	12	5	7	-	-	-	-	-	-	-	12	-
VIETNAM	2004	7	2	5	-	-	-	-	-	-	-	7	-
	2005	13	6	5	-	-	-	-	2	-	-	13	-
TOTAL		**157**	**49**	**26**	**-**	**10**	**7**	**-**	**3**	**-**	**62**	**123**	**34**

*	Institute for Animal Health, Pirbright Laboratory, Woking, Surrey GU24 0NF
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 foot-and-mouth disease, swine vesicular disease or vesicular stomatitis virus detected
RT-PCR	reverse transcription polymerase chain reaction for FMD (or SVD) viral genome

NPF, 11 January 2007

International Serological Testing

By SP ELISA, VNT or NSP ELISA, 1005 and 6 serological tests were performed to detect antibodies against FMDV and VSV respectively. These tests were performed on the request by Botswana, France and USA for FMDV; and Netherland for VSV, respectively.

TABLE D: Number of serological tests for FMDV and VSV performed between October and December 2006.

FMDV

Country	Species	Number of tests performed to detect FMDV antibodies		
		LPBE	VNT	NSP ELISA
Botswana	Bovine	150	150	50
France	Bovine	240	240	
UK	Unknown		24	
USA	Bovine	156		

VSV

Country	Species	Number of tests perfomed to detect VSV antibodies (Indiana and New Jersey), VNT
Netherlands	Equine	6

In addition to the above, 11 tests by NSP ELISA have been performed for FMDV suspected cases from Jordan.

TABLE E: Antigenic characterisation of FMD field isolates by matching with vaccine strains (by ELISA) - r Values data from 1st Oct to 31st Dec 2006

Serotype A Isolates	Vaccine strains									
	A22	A May97	5925	A Irn 87	A22	A Irn01 1782	A Ken 35/80	A May97 VJp	A 4164	A Sau95
IRN 05/06			0.09	0.06	0.5					
IRN 07/06			0.2	0.03	0.5					
MAU 01/06	0.03			0.09		0.13	0.53	0.14		
MAU 03/06	0.03			0.06		0.13	0.61	0.15		
PAK 01/06		0.43	0.3	0.03	>1.0				0.22	>1.0
PAK 05/06			0.08	0.22	0.09			0.13	0.14	>1.0
TUR 04/06			0.11	0.16	0.15			0.25	0.43	0.35
TUR 08/06			0.25	0.06	0.53			0.08	0.13	0.43
TUR 09/06			1.0	0.19	0.86			0.22		
TUR 12/06			0.43	0.07	0.71			0.16	0.16	0.35
TUR 14/06			<0.07	0.14	0.22			0.19		>1.0
TUR 16/06			0.09	0.14	1.0			0.12		0.31
TUR 18/06			0.43	0.10	0.61			0.12	0.06	0.21
TUR 20/06			0.09	0.43	0.3			0.38		>1.0

Serotype O Isolates	Vaccine strains			
	Manisa	O 3039	O 4174	O Tai 189/87
IRN 13/2006	>1.0	0.75	0.34	>1.0
IRN 14/2006	>1.0	0.61	0.25	>1.0
IRN 16/2006	>0.86	0.61	0.38	>1.0
IRN 20/2006	>0.86	0.53	0.25	>1.0
IRN 26/2006	1.0	nd	0.27	>1.0

Interpretation of r_1 values

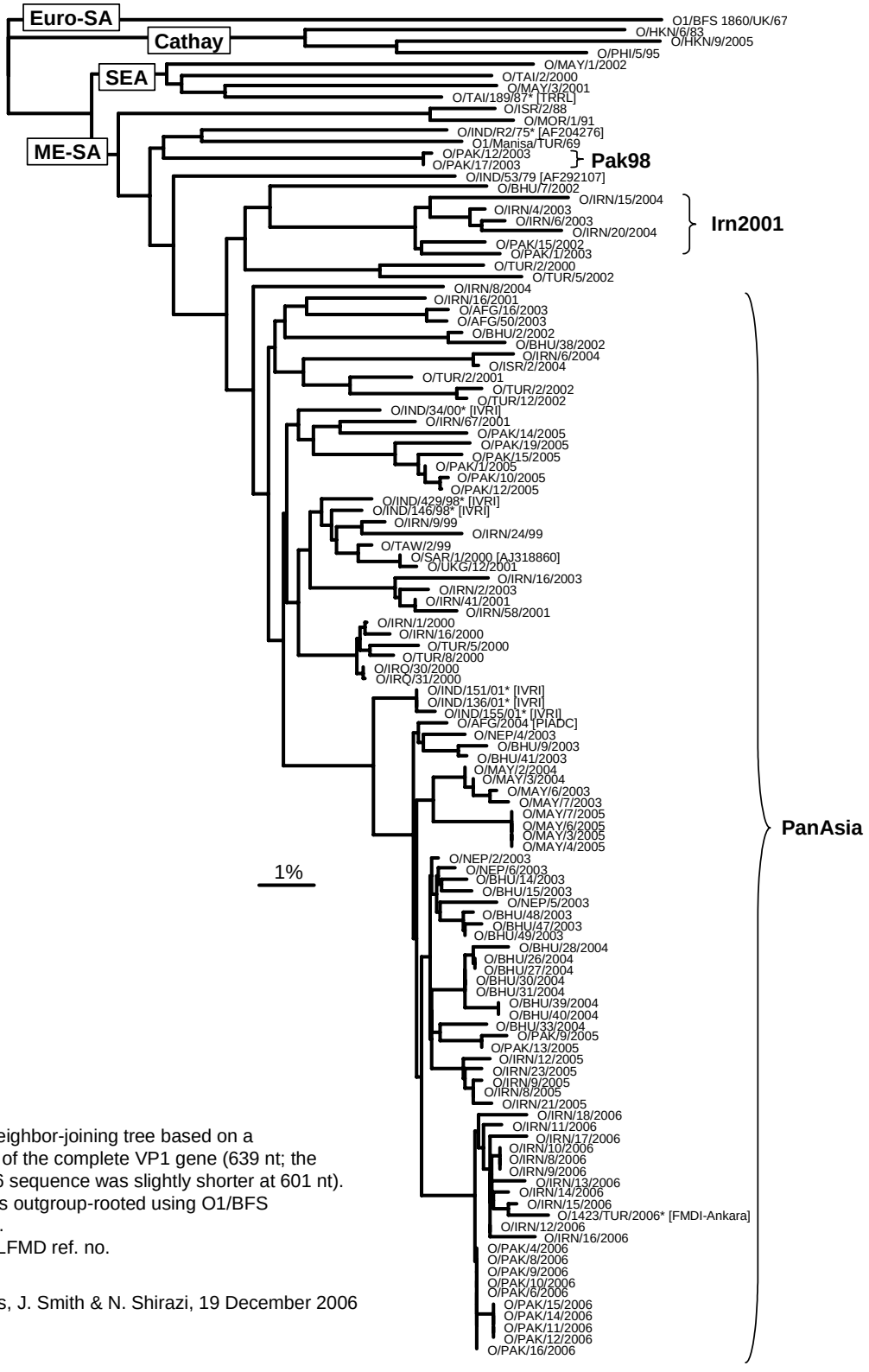
In the case of ELISA:

r_1 = 0.4-1.0. 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.
r_1 = 0.2-0.39, Suggests that the field isolate is antigenically related to the vaccine strain. The vaccine strain might be suitable for use if no closer match can be found provided that a potent vaccine is used and animals are preferably immunised more than once.
r_1 = <0.2. Suggests that the field isolate is so different from the vaccine strain that the vaccine is unlikely to protect

Annex 2: Phylogenetic analysis of characterised FMDV isolates:

Fig 1 Serotype O FMDV from the Middle East (Turkey and Iran)

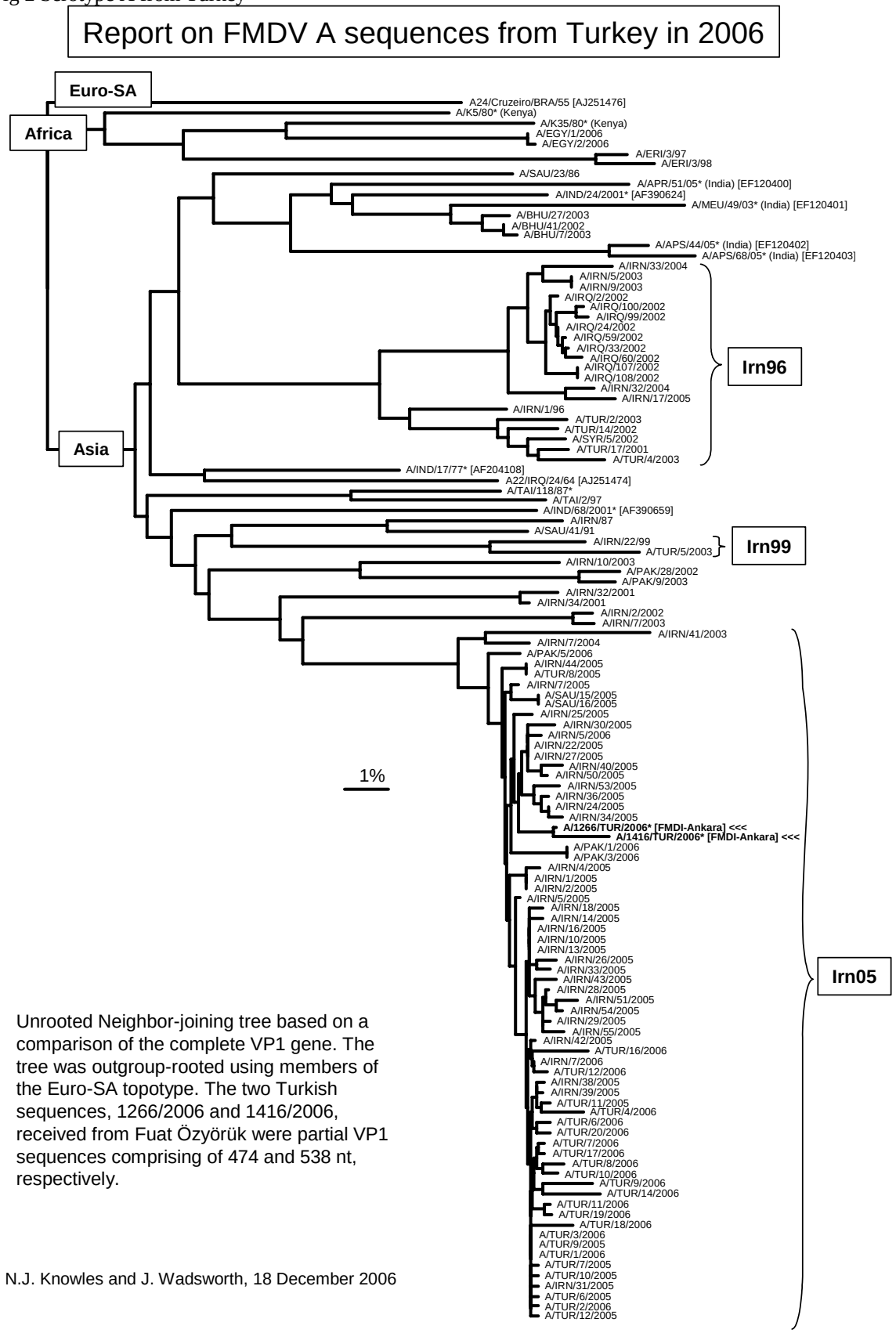
Further report on O Iran 2006 / O Turkey 2006



Unrooted Neighbor-joining tree based on a comparison of the complete VP1 gene (639 nt; the Turkey 2006 sequence was slightly shorter at 601 nt). The tree was outgroup-rooted using O1/BFS 1860/UK/67.
*, not a WRLFMD ref. no.

N.J. Knowles, J. Smith & N. Shirazi, 19 December 2006

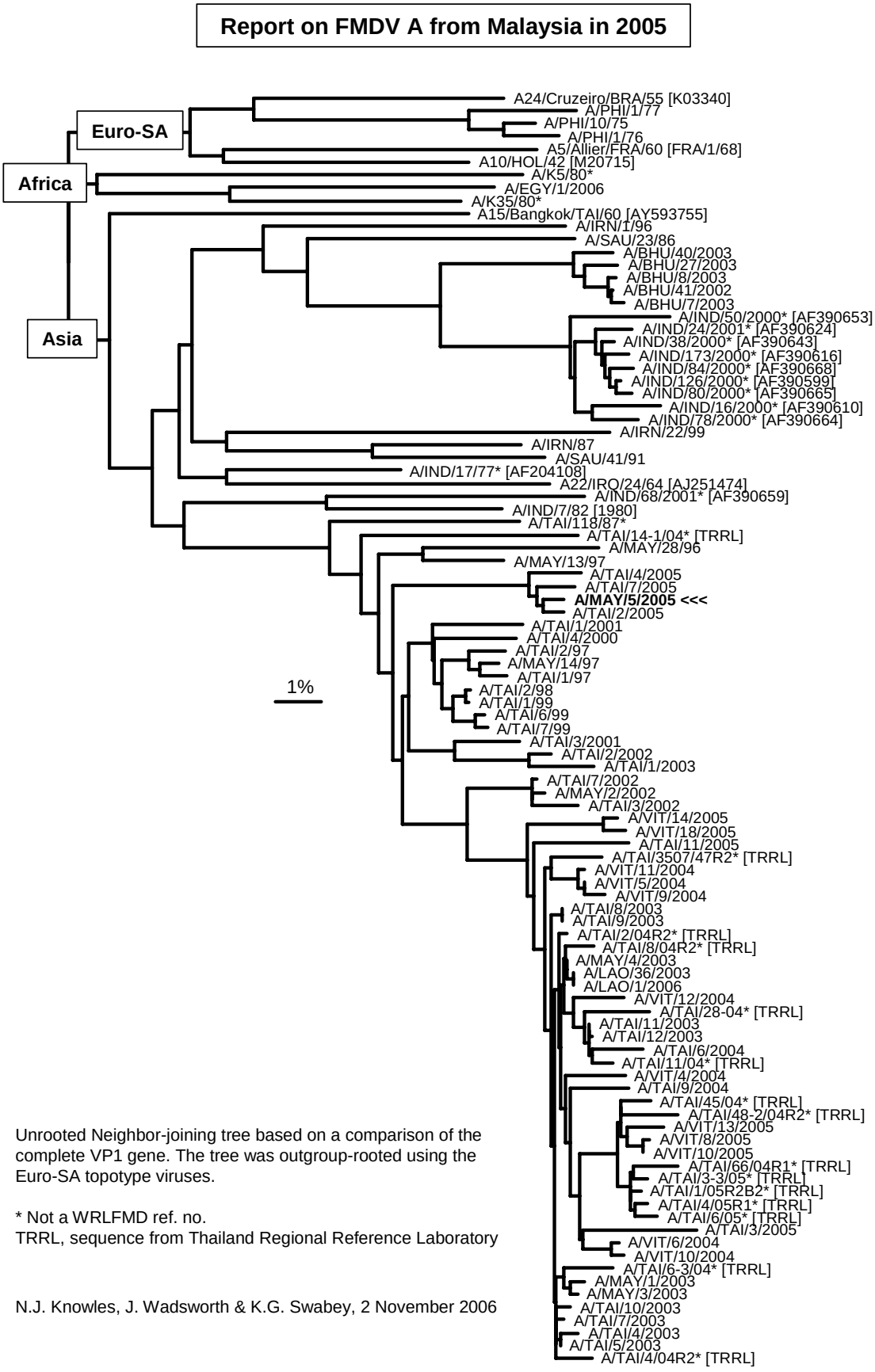
Fig 2 Serotype A from Turkey



Unrooted Neighbor-joining tree based on a comparison of the complete VP1 gene. The tree was outgroup-rooted using members of the Euro-SA topotype. The two Turkish sequences, 1266/2006 and 1416/2006, received from Fuat Özyörük were partial VP1 sequences comprising of 474 and 538 nt, respectively.

N.J. Knowles and J. Wadsworth, 18 December 2006

Fig 3 Serotype A from South East Asia (including recent samples from Malaysia

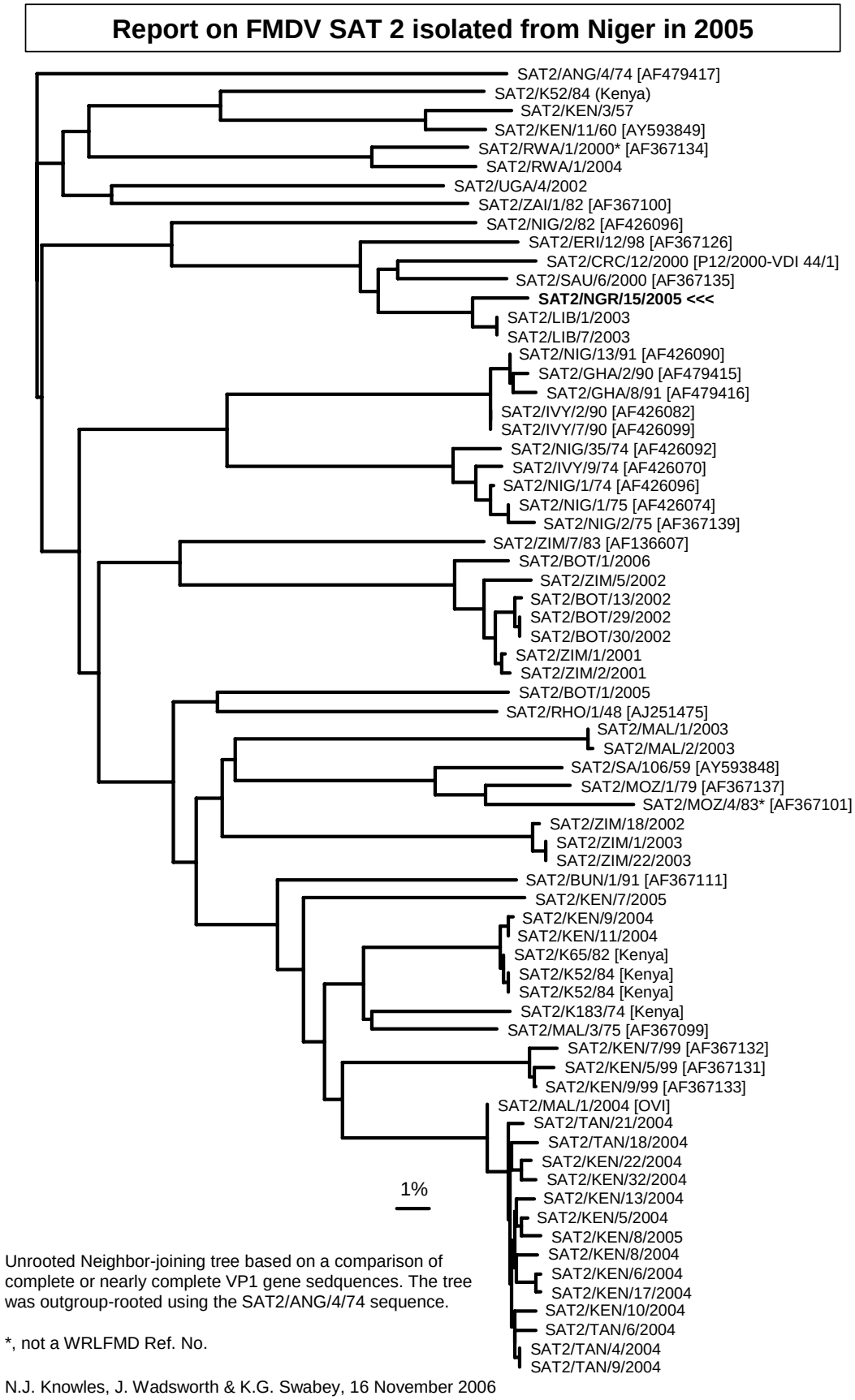


Unrooted Neighbor-joining tree based on a comparison of the complete VP1 gene. The tree was outgroup-rooted using the Euro-SA topotype viruses.

* Not a WRLFMD ref. no.
TRRL, sequence from Thailand Regional Reference Laboratory

N.J. Knowles, J. Wadsworth & K.G. Swabey, 2 November 2006

Fig 4 Serotype SAT2 from Niger



Annex 3. Recent FMD Publications cited by PubMed

1: Wijnker JJ, Haas B, Berends BR.
Removal of foot-and-mouth disease virus infectivity in salted natural casings by minor adaptation of standardized industrial procedures.
Int J Food Microbiol. 2006 Dec 27; [Epub ahead of print]

2: Vosloo W, de Klerk LM, Boshoff CI, Botha B, Dwarka RM, Keet D, Haydon DT.
Characterisation of a SAT-1 outbreak of foot-and-mouth disease in captive African buffalo (Syncerus caffer): Clinical symptoms, genetic characterisation and phylogenetic comparison of outbreak isolates.
Vet Microbiol. 2006 Dec 26; [Epub ahead of print]

3: Reid SM, King DP, Shaw AE, Knowles NJ, Hutchings GH, Cooper EJ, Smith AW, Ferris NP.
Development of a real-time reverse transcription polymerase chain reaction assay for detection of marine caliciviruses (genus Vesivirus).
J Virol Methods. 2006 Dec 20; [Epub ahead of print]

4: Sahle M, Dwarka RM, Venter EH, Vosloo W.
Comparison of SAT-1 foot-and-mouth disease virus isolates obtained from East Africa between 1971 and 2000 with viruses from the rest of sub-Saharan Africa.
Arch Virol. 2006 Dec 28; [Epub ahead of print]

5: Klinkenberg D, Fraser C, Heesterbeek H.
The effectiveness of contact tracing in emerging epidemics.
PLoS ONE. 2006 Dec 20;1:e12.

6: Nagendrakumar SB, Mythili T, Maroudam V, Madhan M, Thiagarajan V A D.
Comparison of different methods of routine typing of Indian isolates of foot-and-mouth disease virus.
Acta Virol. 2006;50(4):279-80.

7: Pan L, Zhang YG, Wang YL, Wang BQ, Xie QG.
[Protective immune response of guinea pigs against challenge with foot and mouth disease virus by immunization with foliar extracts from transgenic tomato plants expressing the FMDV structural protein VP1]
Wei Sheng Wu Xue Bao. 2006 Oct;46(5):796-801. Chinese.

8: Storey P, Theron J, Maree FF, O'neill HG.
A second RGD motif in the 1D capsid protein of a SAT1 type foot-and-mouth disease virus field isolate is not essential for attachment to target cells.
Virus Res. 2006 Dec 9; [Epub ahead of print]

9: Eble PL, Bouma A, Weerdmeester K, Stegeman JA, Dekker A.
Serological and mucosal immune responses after vaccination and infection with FMDV in pigs.
Vaccine. 2007 Jan 22;25(6):1043-54. Epub 2006 Oct 9.

10: Mateo R, Mateu MG.
Deterministic, Compensatory Mutational Events in the Capsid of Foot-and-Mouth Disease Virus, in Response to the Introduction of Mutations Found in Viruses from Persistent Infections.
J Virol. 2006 Dec 6; [Epub ahead of print]

11: Sierra M, Airaksinen A, Gonzalez-Lopez C, Agudo R, Arias A, Domingo E.
Foot-and-mouth disease virus mutant with decreased sensitivity to ribavirin: implications for error catastrophe.
J Virol. 2006 Dec 6; [Epub ahead of print]

12: Klein J, Parlak U, Ozyoruk F, Christensen LS.
The molecular epidemiology of Foot-and-Mouth Disease virus serotypes A and O

from 1998 to 2004 in Turkey.
BMC Vet Res. 2006 Dec 4;2:35.

13: Thurmond MC, Perez AM.
Modeled detection time for surveillance for foot-and-mouth disease virus in bulk tank milk.
Am J Vet Res. 2006 Dec;67(12):2017-24.

14: Domenech J, Lubroth J, Eddi C, Martin V, Roger F.
Regional and International Approaches on Prevention and Control of Animal Transboundary and Emerging Diseases.
Ann N Y Acad Sci. 2006 Oct;1081:90-107.

15: Bokma BH.
Role of import and export regulatory animal health officials in international control and surveillance for animal diseases.
Ann N Y Acad Sci. 2006 Oct;1081:84-9.

16: Yamane I.
Epidemics of emerging animal diseases and food-borne infection problems over the last 5 years in Japan.
Ann N Y Acad Sci. 2006 Oct;1081:30-8.

17: Harmsen MM, van Solt CB, Fijten HP, van Keulen L, Rosalia RA, Weerdmeester K, Cornelissen AH, De Bruin MG, Eble PL, Dekker A.
Passive immunization of guinea pigs with llama single-domain antibody fragments against foot-and-mouth disease.
Vet Microbiol. 2006 Oct 28; [Epub ahead of print]

18: Kitching P, Hammond J, Jeggo M, Charleston B, Paton D, Rodriguez L, Heckert R.
Global FMD control-Is it an option?
Vaccine. 2006 Nov 9; [Epub ahead of print]

19: Tufan M.
Animal health authorities and transboundary animal diseases in Turkey.
J Vet Med B Infect Dis Vet Public Health. 2006 Dec;53 Suppl 1:35-7.

20: Guo H, Liu X, Liu Z, Yin H, Ma J, Wang Y, Shang Y, Zhang Q, Li D, Guo J, Lu Z, Xie Q.
Recent Outbreaks of Foot-and-Mouth Disease Type Asia 1 in China.
J Vet Med B Infect Dis Vet Public Health. 2006 Dec;53(s1):29-33.

Annex 4. RECOMMENDATIONS FROM THE WRL ON FMD VIRUS STRAINS TO BE INCLUDED IN FMDV ANTIGEN BANKS – December 2006

High Priority

O Manisa (*covers panasian topotype)*
O BFS or Campos
A24 Cruzeiro
Asia 1 Shamir
A Iran ’96
A22 Iraq
SAT 2 Saudi Arabia *(or equivalent)*
(not in order of importance)

Medium Priority

A Eritrea
SAT 2 Zimbabwe
AIran 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)