FAO/OIE Reference Laboratory Contract Report
October-December 2007

Foot-and-Mouth Disease

FMD Trends

Summary

During this reporting period, there were no new FMD outbreaks in the **United Kingdom**. The last outbreak [IP8] associated with the previously reported outbreaks in Surrey was recognised on 29th September. Trade restrictions with the EU were lifted in December following 3 months without any subsequent outbreaks of disease. Documentation to support the reinstatement of FMD free-without vaccination status has been submitted to OIE.

Elsewhere in Europe, serological evidence of FMD infection has been uncovered in small ruminants near the southern coast of **Cyprus**. The initial case was identified on the 22nd October 2007 following investigation of a flock of 25 sheep which were exhibiting clinical signs suspicious of bluetongue or contagious ecthyma. FMD testing was carried out as a precaution revealing that 8/25 animals were serologically positive for FMDV non-structural proteins (NSP). In light of these results, movement restrictions and investigations of neighbouring farms were undertaken. Samples sent to the Community Reference Laboratory (CRL: IAH-Pirbright), confirmed the initial NSP serological findings, but were unable to conclusively detect antibodies against structural proteins of FMDV, or detect the virus in "probang" samples collected from the sheep. Although the suspicion was lifted on this first farm in Dromolaxia near Larnaca, samples collected from neighbouring farms revealed 3 further flocks with serological evidence of FMD infection using an NSP assay. These findings were also confirmed by the CRL on the following day (1st November). Furthermore, FMDV structural protein-specific antibodies were also detected indicative of infection by serotype O. Based upon this serological data and clinical evidence of vesicular lesions in some of the animals, an FMD outbreak was declared to the OIE on the 5th November 2007. Prior to these cases, FMD had not been present on Cyprus since 1964. Control measures to cull the affected sheep and goats were employed on these farms and on some additional flocks which were also found to contain type O seropositive sheep. Subsequent laboratory analyses were unable to detect FMD virus in any of the material collected from the suspect vesicular lesions. Furthermore, despite collection of approximately 250 samples (blood or "probang") from the affected herds, no virus has been detected in any samples from these cases. In addition, all paired serology conducted has failed to substantiate concurrent FMDV circulation. Taken together with the age profile of the seropositive animals, the data indicate in-situ infection by FMD virus in the past (approximately 3 years ago). Further surveillance in the affected area and other parts of the island is underway.

In the Middle East, vaccination programmes have been implemented in response to earlier FMD outbreaks. In Kirklareli, **Turkey**, 327 cattle and 3841 sheep were vaccinated in November, while in Az Zarka, and Al Karak, **Jordan**, 27,000 cattle and 150,000 sheep have been vaccinated in response to outbreaks of serotype O. In Amman, Jordan, 2500 cattle were vaccinated in response to earlier outbreaks caused by serotype A.

In Asia, a further outbreak of FMD (due to Asia 1) has been reported in **China** (Qinghai Province) in November 2007. 58 cattle in the affected herd in Yushu County have been culled. During December, cases of FMD were reported to the OIE in **The People's Democratic Republic of Laos**.

In Africa, new FMD outbreaks have been reported in **Botswana** and **Namibia**. In October 2007, cases of FMD were recognised in cattle in Habu, Maun, Botswana. These outbreaks were located near to the Okavango Delta in the north west of the country and are thought to have arisen via contact of domesticated cattle with wildlife due to flood damage to control fencing. Initial reports to the OIE indicated serotype SAT1 as the cause: however subsequent analyses of material received at the World Reference Laboratory (IAH-Pirbright) have typed the virus as SAT2. Control measures include control of wildlife reservoirs, livestock movement restrictions and vaccination of susceptible animals. In Namibia, FMD cases also due to serotype SAT2 have been reported in the Caprivi Strip in December 2007. These represent the first cases in Namibia since 2001. Control measures employed in response to these outbreaks include movement restrictions, and vaccination of approximately 30,000 susceptible animals. The genetic relationships of the viruses causing these outbreaks in Namibia, Botswana as well as **Zambia** are described elsewhere in this report (see Annex 2, Figure 6).

In South America, outbreaks of type O have been reported in **Venezuela** where both serotypes O and A remain endemic. An outbreak of FMD (serotype O) was reported in Tenguel, Guayaquil in **Ecuador**. Cattle in the region were vaccinated and livestock movements, except those to slaughterhouse, have been restricted. 1,750 cattle from the area around the outbreak and 2,500 cattle from the areas near Tenguel belonging to Naranjal and Ponce Enriquez cantons were vaccinated. In Ecuador and elsewhere in South America, mass vaccination

programmes continue to be employed; in Bolivia, Colombia, Uruguay, Venezuela, and in several Brazilian states, including Rio Grande do Sul and the border region with Paraguay.

WRL vaccine recommendations are unchanged. Viruses of the A Iran 96 strain that were previously dominant in the Middle East have not been received at WRL since June 2005 (a single isolate from Iran). The strain has been superseded by A Iran 05 and all of the many subsequent isolates from Iran (n=33; 2005, 2006, 2007), as well as from Turkey (n=32; 2005, 2006, 2007), Pakistan (n=9; 2006, 2007), Saudi Arabia (n=2; 2006), Jordan (n=3; 2006) and Afghanistan (n=3; 2007) have been of the A Iran 05 strain. Therefore, the importance of A Iran 96 as a vaccine strain is reduced and the strain may be moved to medium priority later this year. It has been noted that O Manisa appears to have only a moderate match against some isolates of the currently circulating O PanAsia strain and that some recent isolates of the strain A Iran 05 are also only moderately matched against A22 Iraq, indicating that highly potent O Manisa and A22 Iraq vaccines should be used to ensure good effect against strains currently circulating in the Middle East and western Asia.

Results from samples received at WRL (status of samples being testing is shown in Table 1)

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/2007.htm

Table 1: Status of sequencing of samples received recently to WRLFMD

Batch	Country	Serotype	No. of samples	Status
WRLFMD-2007-00019	Pakistan	O	43	In-progress
WRLFMD-2007-00045	Yemen	O	3	completed
WRLFMD-2007-00140	Bhutan	O	3	completed
WRLFMD-2007-00144	Egypt	O-GD*	7	completed
WRLFMD-2007-00156	Iran	O	9	completed
WRLFMD-2007-00156	Iran	A	4	completed
WRLFMD-2007-00158	Ethiopia	O	3	completed
WRLFMD-2007-00160	Botswana	SAT 2	4	completed
WRLFMD-2007-00165	Malaysia	A	2	completed
WRLFMD-2007-00165	Malaysia	O	5	completed
WRLFMD-2007-00167	Zambia	SAT 2	3	completed
WRLFMD-2007-00168	Namibia	SAT 2	2	completed

* samples positive by real-time RT-PCR only [negative by VI and Ag-ELISA]

Middle East and Asia

FMDV serotype O

Three FMDV isolates from Bhutan and 9 isolates from Iran have been characterised in this reporting period. All these isolates are closely related to other viruses in the new PanAsia II lineage (see Annex 2, Figure 1). Five serotype O viruses isolated from material sent from Malaysia were also sequenced (see Annex2, figure 3). All belong to the Mya-98 lineage within the SEA topotype, sharing closest nucleotide identity to an isolate from Thailand.

FMDV serotype A

Four serotype A viruses have also been characterised from Iran. All belong to the IRN-05 lineage (see Annex 2, Figure 2). Interestingly, these viruses fall in two separate lineages: one of these, comprising viruses collected in Sistan in the east of the country, is rooted some distance from the majority of recent isolates collected from Iran. Further characterisation of strains from this region is warranted in order to better understand the molecular changes that occur within this lineage. Two serotype A viruses from Malaysia were sequenced: the phylogenetic tree (see Annex 2, Figure 4) indicates separate introductions of these viruses into the country.

Africa

FMDV serotype O

Samples were sent to the WRL from the recent FMD outbreaks in Egypt. Although virus isolation failed to recover FMDV from the material sent, real-time RT-PCR was able to confirm FMDV. Partial sequencing (~ 141 nucleotides) was performed directly on these samples. Analysis (data not shown) showed that the virus responsible for these outbreaks belongs to the PanAsia II and was closely related to other viruses sampled in the Middle East. Three serotype O isolates collected in 2006 in Ethiopia were shown to be of the East Africa-3 topotype (see Annex 2, Figure 5).

FMDV serotype SAT2

The phylogenetic tree presented in Annex 2, Figure 6, shows the relationships between the recently characterised isolates recovered from material sent from Botswana, Zambia and Namibia. The isolates from Zambia and Namibia are closely related to each other (share ~ 99.2 % nucleotide identity) and to a buffalo virus collected in Botswana (Muchenje, Kasane) in 2006. However, the samples from Botswana (from Maun in 2007) are more distantly related to these isolates.

Vaccine matching

Six FMDV type O isolates (O IRN 34/2006; O ISR 09/2007; O JOR 06/2006; O PAK 20/2007; O TUR 13/2007 and O UAE 02/2007) from Iran, Israel, Jordan, Pakistan, Turkey and United Arab Emirates collected in 2006 and 2007 were further characterised by two dimensional virus neutralisation test and LPBE (Annex 1; TABLE C), showing that most of these isolates were closest matched with O1 Manisa and O IND R2/75 vaccine strains. O JOR 06/2007 was also a close match with O Campos indicating that the currently predominant type O virus can be covered by a vaccine present in many vaccine banks. Nevertheless, two field isolates received from Yemen (O YEM 4, 29/2006) have showed no antigenic matching with either O Manisa or O Ind R2/75 vaccines.

Seven FMDV type A isolates (A EGY 6, 7 and 9/2006; A TUR 2, 8, 24 and 25/2007) from Egypt and Turkey have been antigenically analysed by two dimensional VNT. The results showed that three isolates from Egypt provide some match to A SAU95 vaccine strain; and four isolates from Turkey showed antigenic close matching to A 22 vaccine strain (Annex 1; TABLE C).

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. Dicara D, Burman A, Clark S, Berryman S, Howard MJ, Hart IR, Marshall JF, Jackson T. Foot-and-mouth-disease virus forms a highly stable, EDTA-resistant complex with its principal receptor, integrin {alpha}v{beta}6: implications for infectiousness? J Virol. 2007 Nov 28; [Epub ahead of print]

2. Ryan E, Wright C, Gloster J. Measurement of airborne foot-and-mouth disease virus: Preliminary evaluation of two portable air sampling devices. Vet J. 2007 Nov 16; [Epub ahead of print]

3. Zhang Z, Ahmed R, Paton D, Bashiruddin JB. Cytokine mRNA responses in bovine epithelia during foot-and-mouth disease virus infection.Vet J. 2007 Oct 5; [Epub ahead of print]

4. Doel, C., Gloster, J., Valarcher, J-F. Airborne transmission of foot-and-mouth disease in pigs: Evaluation and optimisation of instrumentation and techniques.Vet J. 2007 Oct 29; [Epub ahead of print]

Annex 1.

Table A: Summary of clinical sample diagnostics made by the WRL between October - December 2007

Country	WRL for FMD Sample Identification	Animal	Date of Collection	Results VI/ELISA	Results RT-PCR	Final report
BHUTAN	BHU 1/2007	Cattle	29.05.07	NVD	Positive	FMDV GD
	BHU 2/2007	Cattle	29.05.07	NVD	Positive	FMDV GD
	BHU 3/2007	Cattle	05.06.07	NVD	Positive	FMDV GD
	BHU 4/2007	Cattle	05.06.07	NVD	Positive	FMDV GD
	BHU 5/2007	Cattle	05.06.07	NVD	Positive	FMDV GD
	BHU 6/2007	Cattle	06.06.07	NVD	Positive	FMDV GD
	BHU 7/2007	Cattle	27.06.07	NVD	Positive	FMDV GD
	BHU 8/2007	Cattle	27.06.07	NVD	Positive	FMDV GD
	BHU 9/2007	Cattle	27.06.07	NVD	Positive	FMDV GD
	BHU 10/2007	Cattle	27.06.07	NVD	Positive	FMDV GD
	BHU 11/2007	Cattle	25.07.07	O	Positive	O
	BHU 12/2007	Cattle	25.07.07	O	Positive	O
	BHU 13/2007	Cattle	25.07.07	O	Positive	O
	BHU 14/2007	Cattle	01.08.07	O	Positive	O
	BHU 15/2007	Cattle	01.08.07	NVD	Positive	FMDV GD
	BHU 16/2007	Cattle	01.08.07	NVD	Negative	Negative
	BHU 17/2007	Cattle	01.08.07	O	Positive	O
	BHU 18/2007	Cattle	10.08.07	O	Positive	O
	BHU 19/2007	Cattle	13.08.07	NVD	Positive	FMDV GD
	BHU 20/2007	Cattle	13.08.07	NVD	Positive	FMDV GD
	BHU 21/2007	Cattle	26.08.07	NVD	Negative	NVD
	BHU 22/2007	Cattle	27.08.07	NVD	Positive	FMDV GD
	BHU 23/2007	Cattle	27.08.07	NVD	Positive	FMDV GD
	BHU 24/2007	Cattle	28.08.07	NVD	Negative	NVD
	BHU 25/2007	Cattle	28.08.07	NVD	Positive	FMDV GD
	BHU 26/2007	Cattle	28.08.07	O	Positive	O
	BHU 27/2007	Cattle	28.08.07	NVD	Positive	FMDV GD
	BHU 28/2007	Cattle	28.08.07	NVD	Negative	NVD
	BHU 29/2007	Cattle	31.08.07	NVD	Negative	NVD
	BHU 30/2007	Cattle	31.08.07	NVD	Positive	FMDV GD
	BHU 31/2007	Cattle	02.09.07	NVD	Positive	FMDV GD
	BHU 32/2007	Cattle	11.09.07	NVD	Positive	FMDV GD
	BHU 33/2007	Cattle	11.09.07	NVD	Positive	FMDV GD
EGYPT	EGY 1/2007	Cattle/Buffalo	19.09.07	NVD	Negative	NVD
	EGY 2/2007	Cattle/Buffalo	19.09.07	NVD	Negative	NVD
	EGY 3-24/2007	Cattle/Buffalo	19.09.07	NVD	Negative	NVD
	EGY 25-31/2007**	Cattle/Buffalo	19.09.07	NVD	Positive	FMDV GD
	EGY 32-37/2007	Cattle/Buffalo	19.09.07	NVD	Negative	NVD
ETHIOPIA	ETH 1/98	Pig	11.11.98	NVD	Positive	FMDV GD
	ETH 16/2000	Cattle	27.12.2000	NVD	Positive	FMDV GD
	ETH 1/2001	Cattle	00.00.01	NVD	Negative	NVD
	ETH 2/2001	Cattle	00.00.01	NVD	Negative	NVD
	ETH 3/2001	Cattle	00.00.01	NVD	Negative	NVD
	ETH 4/2001	Cattle	00.00.01	NVD	Negative	NVD
	ETH 5/2001	Cattle	00.00.01	NVD	Positive	FMDV GD

	ETH 6/2001	Cattle	00.00.01	NVD	Positive	FMDV GD
	ETH 7/2001	Cattle	00.00.01	NVD	Negative	NVD
	ETH 8/2001	Cattle	00.00.01	NVD	Positive	FMDV GD
	ETH 9/2001	Cattle	00.00.01	NVD	Positive	FMDV GD
	ETH 1/2004	Cattle	00.00.04	NVD	Positive	FMDV GD
	ETH 2/2004	Cattle	00.00.04	NVD	Negative	NVD
	ETH 3/2004	Cattle	00.00.04	O	Positive	O
	ETH 4/2004	Cattle	00.00.04	NVD	Positive	FMDV GD
	ETH 5/2004	Cattle	00.00.04	NVD	Positive	FMDV GD
	ETH 6/2004	Cattle	00.00.04	NVD	Negative	NVD
	ETH 7/2004	Cattle	00.00.04	NVD	Negative	NVD
	ETH 8/2004	Cattle	00.00.04	NVD	Positive	FMDV GD
	ETH 73/2005	Cattle	00.00.05	NVD	Positive	FMDV GD
	ETH 74/2005	Cattle	00.00.05	NVD	Positive	FMDV GD
	ETH 75/2005	Cattle	00.00.05	NVD	Negative	NVD
	ETH 49/2006	Cattle	00.00.06	NVD	Positive	FMDV GD
	ETH 50/2006	Cattle	00.00.06	NVD	Negative	NVD
	ETH 51/2006	Cattle	00.00.06	NVD	Negative	NVD
	ETH 52/2006	Cattle	00.00.06	NVD	Negative	NVD
	ERH 53/2006	Cattle	00.00.06	NVD	Negative	NVD
	ETH 54/2006	Cattle	00.00.06	O	Positive	O
	ETH 55/2006	Cattle	00.00.06	NVD	Negative	NVD
	ETH 56/2006	Cattle	00.00.06	NVD	Negative	NVD
	ETH 57/2006	Cattle	00.00.06	NVD	Positive	FMDV GD
	ETH 58/2006	Cattle	00.00.06	NVD	Positive	FMDV GD
	ETH 59/2006	Cattle	00.00.06	NVD	Positive	FMDV GD
	ETH 60/2006	Cattle	00.00.06	NVD	Positive	FMDV GD
	ETH 61/2006	Cattle	00.12.2006	NVD	Positive	FMDV GD
	ETH 62/2006	Cattle	00.12.2006	O	Positive	O
	ETH 63/2006	Cattle	NK	NVD	Negative	NVD
	ETH 64/2006	Cattle	NK	NVD	Negative	NVD
IRAN	IRN 26/2007	Cattle	10.09.07	O	Positive	O
	IRN 27/2007	Cattle	10.09.07	O	Positive	O
	IRN 28/2007	Cattle	18.09.07	O	Positive	O
	IRN 29/2007	Cattle	18.09.07	O	Positive	O
	IRN 30/2007	Cattle	23.09.07	O	Positive	O
	IRN 31/2007	Cattle	27.09.07	O	Positive	O
	IRN 32/2007	Cattle	27.09.07	O	Positive	O
	IRN 33/2007	Cattle	27.09.07	O	Positive	O
	IRN 34/2007	Cattle	29.09.07	O	Positive	O
	IRN 35/2007	Cattle	00.00.07	NVD	Positive	FMDV GD
	IRN 36/2007	Cattle	00.00.07	A	Positive	A
	IRN 37/2007	Cattle	00.00.07	A	Positive	A
	IRN 38/2007	Cattle	00.00.07	A	Positive	A
	IRN 39/2007	Cattle	00.00.07	A	Positive	A
	IRN 40/2007	Cattle	00.00.07	NVD	Positive	FMDV GD
UNITED	UKG 2422-2438/2007	Cattle	30.09.07	NT	Negative	NVD
KINGDOM	UKG 2439-2502/2007	Cattle	30.09.07	NT	Negative	NVD
	UKG 2503-2517/2007	Sheep	30.09.07	NT	Negative	NVD
	UKG 2518/2007	Goat	30.09.07	NVD	Negative	NVD
	UKG 2519/2007	Cattle	30.09.07	NVD	Negative	NVD

UKG 2520-2525/2007	Cattle	30.09.07	NT	Negative	NVD
UKG 2526-2559/2007	Cattle	30.09.07	NT	Negative	NVD
UKG 2560-2562/2007	Cattle	30.09.07	NT	Negative	NVD
UKG 2563-2595/2007	Cattle	30.09.07	NT	Negative	NVD
UKG 2596-2628/2007	Cattle	01.10.07	NT	Negative	NVD
UKG 2629-2747/2007	Cattle	01.10.07	NT	Negative	NVD
UKG 2748-2749/2007	Sheep	01.10.07	NVD	Negative	NVD
UKG 2750-2759/2007	Sheep	01.10.07	NVD	Negative	NVD
UKG 2760-2762/2007	Cattle	01.10.07	NT	Negative	NVD
UKG 2763-2768/2007	Cattle	01.10.07	NT	Negative	NVD
UKG 2769-2852/2007	Cattle	01.10.07	NT	Negative	NVD
UKG 2853-2894/2007	Cattle	01.10.07	NT	Negative	NVD
UKG 2895-2909/2007	Cattle	01.10.07	NT	Negative	NVD
UKG 2910-2917/2007	Cattle	02.10.07	NT	Negative	NVD
UKG 2918-2950/2007	Cattle	02.10.07	NT	Negative	NVD
UKG 2951/2007	Deer	02.10.07	NVD	Negative	NVD
UKG 2952-2966/2007	Sheep	03.10.07	NVD	Negative	NVD
UKG 2967-3050/2007	Cattle	03.10.07	NT	Negative	NVD
UKG 3051-3089/2007	Cattle	03.10.07	NT	Negative	NVD
UKG 3090-3157/2007	Cattle	03.10.07	NT	Negative	NVD
UKG 3158-3165/2007	Cattle	04.10.07	NT	Negative	NVD
UKG 3166-3198/2007	Cattle	04.10.07	NT	Negative	NVD
UKG 3199-3203/2007	Human	04, 05.10.97	NVD	Negative	NVD
UKG 3204-3272/2007	Cattle	05.10.07	NT	Negative	NVD
UKG 3273-3312/2007	Cattle	05.10.07	NT	Negative	NVD
UKG 3313-3327/2007	Sheep	05.10.07	NT	Negative	NVD
UKG 3328-3330/2007	Cattle	05.10.07	NT	Negative	NVD
UKG 3331/2007	Sheep	05.10.07	NT	Negative	NVD
UKG 3332/2007	Goat	05.10.07	NT	Negative	NVD
UKG 3333-3335/2007	Goat	05.10.07	NT	Negative	NVD
UKG 3336-3369/2007	Cattle	06.10.07	NT	Negative	NVD
UKG 3370-3375/2007	Cattle	06.10.07	NT	Negative	NVD

	UKG 3376-3404/2007	Cattle	06.10.07	NT	Negative	NVD
	UKG 3405-3412/2007	Cattle	06.10.07	NT	Negative	NVD
	UKG 3413-3414/2007	Cattle	06.10.07	NT	Negative	NVD
	UKG 3415-3456/2007	Cattle	08.10.07	NT	Negative	NVD
	UKG 3457-3460/2007	Sheep	10.10.07	NVD	Negative	NVD
	UKG 3461-3462/2007	Sheep	11.10.07	NVD	Negative	NVD
	UKG 3463-3478/2007	Cattle	11.10.07	NT	NT	NT
	UKG 3479-3480/2007	Cattle	12.10.07	NVD	Negative	NVD
	UKG 3481-3482/2007	Cattle	12.10.07	NVD	Negative	NVD
	UKG 3483-3500/2007	Sheep	13.10.07	NT	NT	NT
	UKG 3501-3510/2007	Goat	13.10.07	NT	NT	NT
	UKG 3511-3524/2007	Sheep	14.10.07	NVD	Negative	NVD
	UKG 3525-3594/2007	Cattle	15.10.07	NVD	Negative	NVD
	UKG 3595-3678/2007	Cattle	15.10.07	NT	Negative	NVD
	UKG 3679-3680/2007	Cattle	15.10.07	NT	Negative	NVD
	UKG 3681-3688/2007	Cattle	15.10.07	NT	Negative	NVD
	UKG 3689-3691/2007	Cattle	15.10.07	NT	Negative	NVD
	UKG 3692-3697/2007	Cattle	15.10.07	NT	Negative	NVD
	UKG 3698-3731/2007	Cattle	15.10.07	NT	Negative	NVD
	UKG 3732-3774/2007	Cattle	15.10.07	NT	Negative	NVD
BOTSWANA	BOT 1/2007	Buffalo	00.09.07	NVD	Negative	NVD
	BOT 2/2007	Cattle	00.10.07	SAT 2	Positive	SAT 2
	BOT 3/2007	Cattle	00.10.07	SAT 2	Positive	SAT 2
	BOT 4/2007	Cattle	00.10.07	NVD	Positive	FMDV GD
	BOT 5/2007	Cattle	00.10.07	SAT 2	Positive	SAT 2
	BOT 6/2007	Cattle	00.11.07	SAT 2	Positive	SAT 2
CYPRUS	CYP 1-20/2007	Sheep	00.10.07	NVD	Negative	NVD
	CYP 21-55/2007	Sheep	05.11.07	NVD	Negative	NVD
	CYP 56/2007	Sheep	05.11.07	NVD	Negative	NVD
	CYP 57/2007	Sheep	05.11.07	NVD	Negative	NVD
	CYP 58/2007	Sheep	05.11.07	NVD	Negative	NVD
	CYP 59/2007	Sheep	05.11.07	NVD	Negative	NVD
	CYP 60/2007	Sheep	05.11.07	NVD	Negative	NVD
	CYP 61/2007	Sheep	05.11.07	NVD	Negative	NVD
	CYP 62/2007	Sheep	05.11.07	NVD	Negative	NVD
	CYP 63/2007	Sheep	05.11.07	NVD	Negative	NVD
	CYP 64-68/2007	Sheep	00.11.07	NVD	Negative	NVD

	CYP 69/2007	Sheep	00.11.07	NVD	Negative	NVD
	CYP 70-74/2007	Sheep	00.11.07	NVD	Negative	NVD
	CYP 75-78/2007	Sheep	00.11.07	NVD	Negative	NVD
	CYP 79/2007	Sheep	00.11.07	NVD	Negative	NVD
	CYP 80/2007	Sheep	00.11.07	NVD	Negative	NVD
	CYP 81/2007	Sheep	00.11.07	NVD	Negative	NVD
	CYP 82/2007	Sheep	00.11.07	NVD	Negative	NVD
	CYP 83/2007	Sheep	09.11.07	NVD	Negative	NVD
	CYP 84/2007	Sheep	09.11.07	NVD	Negative	NVD
	CYP 85/2007	Sheep	09.11.07	NVD	Negative	NVD
	CYP 86/2007	Sheep	09.11.07	NVD	Negative	NVD
	CYP 87/2007	Sheep	09.11.07	NVD	Negative	NVD
	CYP 88/2007	Sheep	09.11.07	NVD	Negative	NVD
	CYP 89/2007	Sheep	09.11.07	NVD	Negative	NVD
	CYP 90/2007	Sheep	09.11.07	NVD	Negative	NVD
	CYP 91/2007	Sheep	09.11.07	NVD	Negative	NVD
	CYP 92/2007	Sheep	09.11.07	NVD	Negative	NVD
	CYP 93/2007	Sheep	09.11.07	NVD	Negative	NVD
	CYP 94/2007	Sheep	00.11.07	NVD	Negative	NVD
	CYP 95/2007	Sheep	00.11.07	NVD	Negative	NVD
	CYP 96-140/2007	Sheep	00.11.07	NVD	Negative	NVD
	CYP 141-142/2007	Sheep	00.11.07	NVD	Negative	NVD
	CYP 143-145/2007	Sheep	13.11.07	NVD	Negative	NVD
	CYP 146-161/2007	Sheep	15.11.07	NVD	Negative	NVD
	CYP 162-165/2007	Sheep	15.11.07	NVD	Negative	NVD
	CYP 166-186/2007	Sheep	15.11.07	NVD	Negative	NVD
	CYP 187/2007	Sheep	15.11.07	NVD	Negative	NVD
	CYP 188-223/2007	Sheep	16.11.07	NVD	Negative	NVD
	CYP 224-225/2007	Sheep	16.11.07	NVD	Negative	NVD
	CYP 226/2007	Sheep	18.11.07	NVD	Negative	NVD
	CYP 227/2007	Sheep	18.11.07	NVD	Negative	NVD
	VYP 228/2007	Sheep	18.11.07	NVD	Negative	NVD
	CYP 229/2007	Sheep	18.11.07	NVD	Negative	NVD
	CYP 230/2007	Sheep	18.11.07	NVD	Negative	NVD
	CYP 231-234/2007	Sheep	18.11.07	NVD	Negative	NVD
	CYP 235/2007	Sheep	19.11.07	NVD	Negative	NVD
	CYP 236/2007	Goat	19.11.07	NVD	Negative	NVD
	CYP 237-238/2007	Sheep	19.11.07	NVD	Negative	NVD
	CYP 239/2007	Goat	19.11.07	NVD	Negative	NVD
	CYP 240/2007	Sheep	19.11.07	NVD	Negative	NVD
	CYP 241-243/2007	Goat	19.11.07	NVD	Negative	NVD
	CYP 244-246/2007	Sheep	19.11.07	NVD	Negative	NVD
	CYP 247/2007	Goat	19.11.07	NVD	Negative	NVD
	CYP 248-253/2007	Sheep	19.11.07	NVD	Negative	NVD
	CYP 254/2007	Goat	19.11.07	NVD	Negative	NVD
	CYP 255/2007	Sheep	19.11.07	NVD	Negative	NVD
	CYP 256/2007	Sheep	19.11.07	NVD	Negative	NVD
	CYP 257-259/2007	Sheep	21.11.07	NVD	Negative	NVD
	CYP 260-268/2007	Sheep	21.11.07	NVD	Negative	NVD
	CYP 269/2007	Sheep	27.11.07	NVD	Negative	NVD
	CYP 270/2007	Sheep	27.11.07	NVD	Negative	NVD
MALAYSIA	MAY 1/2007	Pig	22.01.07	A	Positive	A
	MAY 2/2007	Cattle	30.01.07	NVD	Positive	FMDV GD
	MAY 3/2007	Cattle	23.07.07	A	Positive	A

	MAY 4/2007	Cattle	30.09.07	O	Positive	O
	MAY 5/2007	Cattle	04.10.07	O	Positive	O
	MAY 6/2007	Cattle	10.10.07	O	Positive	O
	MAY 7/2007	Cattle	20.10.07	O	Positive	O
	MAY 8/2007	Cattle	22.10.07	O	Positive	O
	MAY 9/2007	Cattle	07.11.07	O	Positive	O
NAMIBIA	NMB 1/2007	NK	00.11.07	SAT 2	Positive	SAT 2
	NMB 2/2007	NK	00.11.07	SAT 2	Positive	SAT 2
	NMB 3/2007	NK	00.11.07	NVD	Positive	FMDV GD
	NMB 4/2007	NK	00.11.07	SAT 2	Positive	SAT 2
	NMB 5/2007	NK	00.11.07	NVD	Positive	FMDV GD
ZAMBIA	ZAM 1/2007	NK	00.11.07	SAT 2	Positive	SAT 2
	ZAM 2/2007	NK	00.11.07	SAT 2	Positive	SAT 2
	ZAM 3/2007	NK	00.11.07	SAT 2	Positive	SAT 2

TOTAL : 1769

*	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 ELISA
RT-PCR	reverse transcription polymerase chain reaction on epithelial suspension for FMD viral genome
NVD	no foot-and-mouth disease, swine vesicular disease or vesicular stomatitis virus detected
**	FMDV type O diagnosed from sequencing studies

NPF, 2 January 2008

TABLE B: Summary of samples collected and received to IAH-Pirbright (October – December 2007)

Country	No. of samples	Virus isolation in cell culture/ELISA FMD virus serotypes									RT-PCR for FMD (or SVD) virus (where appropriate)		
		O	A	C	SAT 1 or 3	SAT 2	Asia 1	SVD virus	NVD	NT	Positive	Negative	NT
BHUTAN	33	7	-	-	-	-	-	-	26	-	28	5	-
BOTSWANA	6	-	-	-	-	4	-	-	2	-	5	1	-
CYPRUS	270	-	-	-	-	-	-	-	270	-	-	270	-
EGYPT	37	-	-	-	-	-	-	-	37	-	7**	30	-
ETHIOPIA	38	3	-	-	-	-	-	-	35	-	21	17	-
IRAN	15	9	4	-	-	-	-	-	2	-	15	-	-
MALAYSIA	9	6	2	-	-	-	-	-	1	-	9	-	-
NAMIBIA	5	-	-	-	-	3	-	-	2	-	5	-	-
UNITED KINGDOM	1353	-	-	-	-	-	-	-	129	1224	-	1309	44
ZAMBIA	3	-	-	-	-	3	-	-	-	-	3	-	-
TOTAL	**1769**	**25**	**6**	**-**	**-**	**10**	**-**	**-**	**504**	**1224**	**93**	**1632**	**44**

*	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
NT	not tested
RT-PCR	reverse transcription polymerase chain reaction for FMD (or SVD) viral genome
**	samples from Egypt characterised as FMDV type O from sequencing studies

NPF, 2 January 2008

TABLE C: Antigenic characterisation of FMD field isolates by matching with vaccine strains by ELISA and/or VNT – r1 value data from 1st October to 31st December 2007

Field Isolates	Test	r1 values by 2dm VNT and LPBE for type O vaccine strains				
		O Manisa	O Ind R2/75	O 4174	O Campos	O Phi 95
O IRN 34/2006	VNT	0.56	0.66			
O ISR 09/2007	VNT	0.49	0.45			
O JOR 06/2006	VNT	0.66	0.58			
	ELISA			0.17	0.76	1.0
O PAK 20/2007	VNT	0.33	0.46			
O TUR 13/2007	VNT	0.50	0.62			
O UAE 02/2007	VNT	0.83	1.0			
O YEM 29/2006	VNT	0.10	0.25			
O YEM 4/2006	VNT	0.16				

Field Isolate:	r1 Values by 2dm VNT for type A vaccine strains	
	A22	A Sau95
A Egy 6/2006		0.31
A Egy 7/2006		0.32
A Egy 9/2006		0.29
A Tur 2/2007	0.66	
A Tur 8/2007	>0.82	
A Tur 24/2007	0.81	
A Tur 25/2007	0.61	

Interpretation of r_1 values

In the case of VNT:

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.
r_1 = < 0.3. Suggests that the field isolate is so different from the vaccine strain that the vaccine is unlikely to protec

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 FMDV serotype O viruses characterised from Bhutan and recent isolates received from Iran

Report on FMD type O viruses from Bhutan and Iran in 2007

No. of Taxa : 187
Data File : n:\evd\meg\db\fmdv\o\IRN2007d.meg
Data Title : Iran & Bhutan 2007
Data Type : Nucleotide (Coding)
Analysis : Phylogeny reconstruction
Tree Inference : ==========
  Method : Neighbor-Joining
  Phylogeny Test and options : Bootstrap (1000 replicates; seed=64238)
Include Sites : ==========
  Gaps/Missing Data : Pairwise Deletion
  Codon Positions : 1st+2nd+3rd+Noncoding
Substitution Model : ==========
  Model : Nucleotide: Kimura 2-parameter
  Substitutions to Include : d: Transitions + Transversions
  Pattern among Lineages : Same (Homogeneous)
  Rates among sites : Uniform rates
No. of Sites : 639
No Of Bootstrap Reps = 1000
Only bootstrap values of 70% and above are shown

*, not a WRLFMD Ref. No.

N.J. Knowles & J. Wadsworth, 26 November 2007

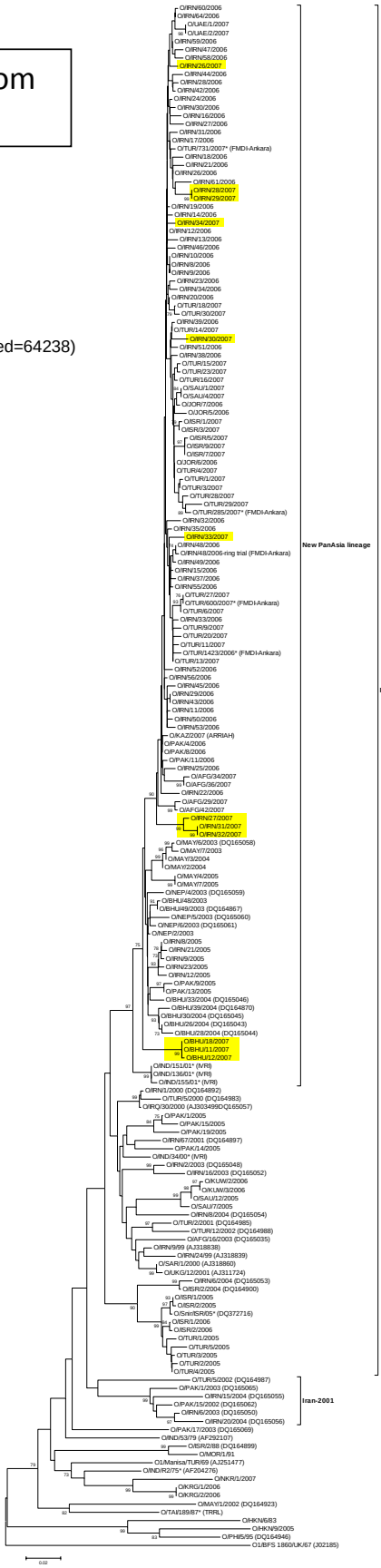


Fig 2: Recent serotype A viruses characterised from Iran

Report on FMD type A viruses from Iran in 2007

No. of Taxa : 142
Data File : n:\evd\meg\db\fmdv\a\IRN2007c.meg
Data Title : Iran 2007
Data Type : Nucleotide (Coding)
Analysis : Phylogeny reconstruction
Tree Inference : ==========
  Method : Neighbor-Joining
  Phylogeny Test and options : Bootstrap (1000 replicates; seed=64238)
Include Sites : ==========
  Gaps/Missing Data : Pairwise Deletion
  Codon Positions : 1st+2nd+3rd+Noncoding
Substitution Model : ==========
  Model : Nucleotide: Kimura 2-parameter
  Substitutions to Include : d: Transitions + Transversions
  Pattern among Lineages : Same (Homogeneous)
  Rates among sites : Uniform rates
No. of Sites : 645
No Of Bootstrap Reps = 1000
Only bootstrap values of 70% and above are shown

*, not a WRLFMD Reference Number

N.J. Knowles & J. Wadsworth, 22 November 2007

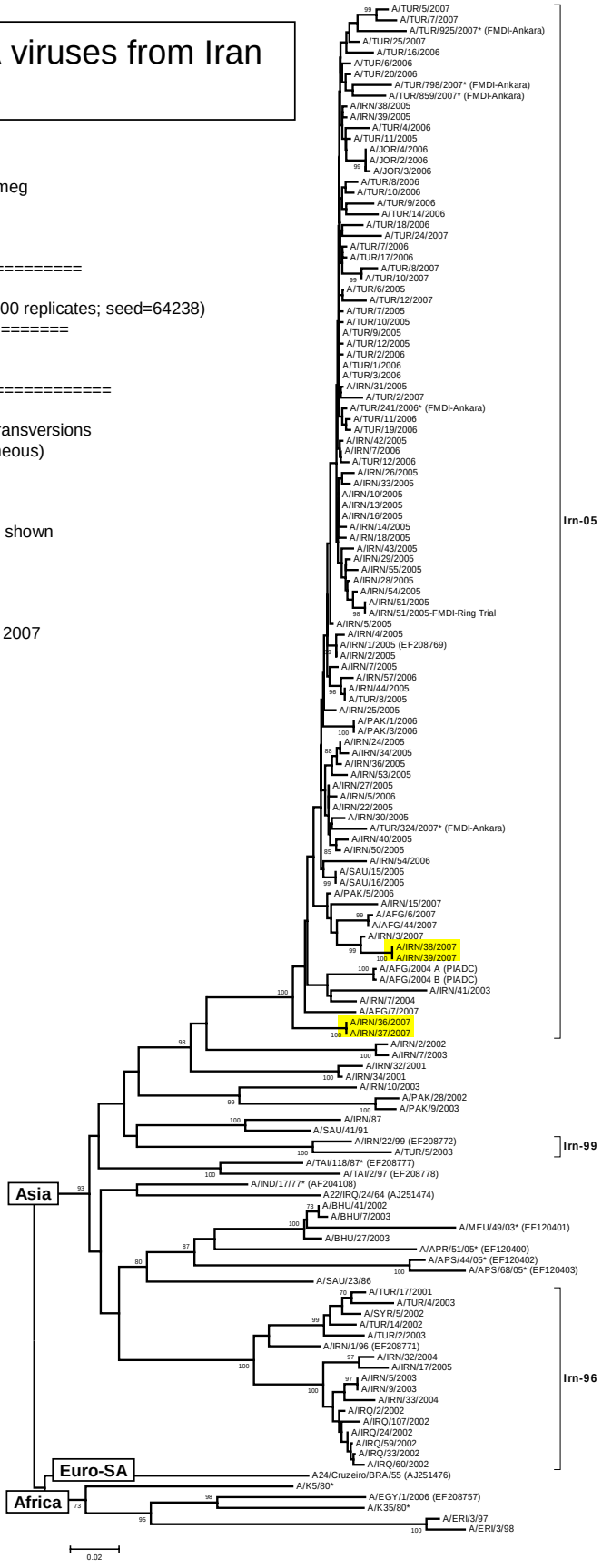


Fig 3: Serotype O from Malaysia

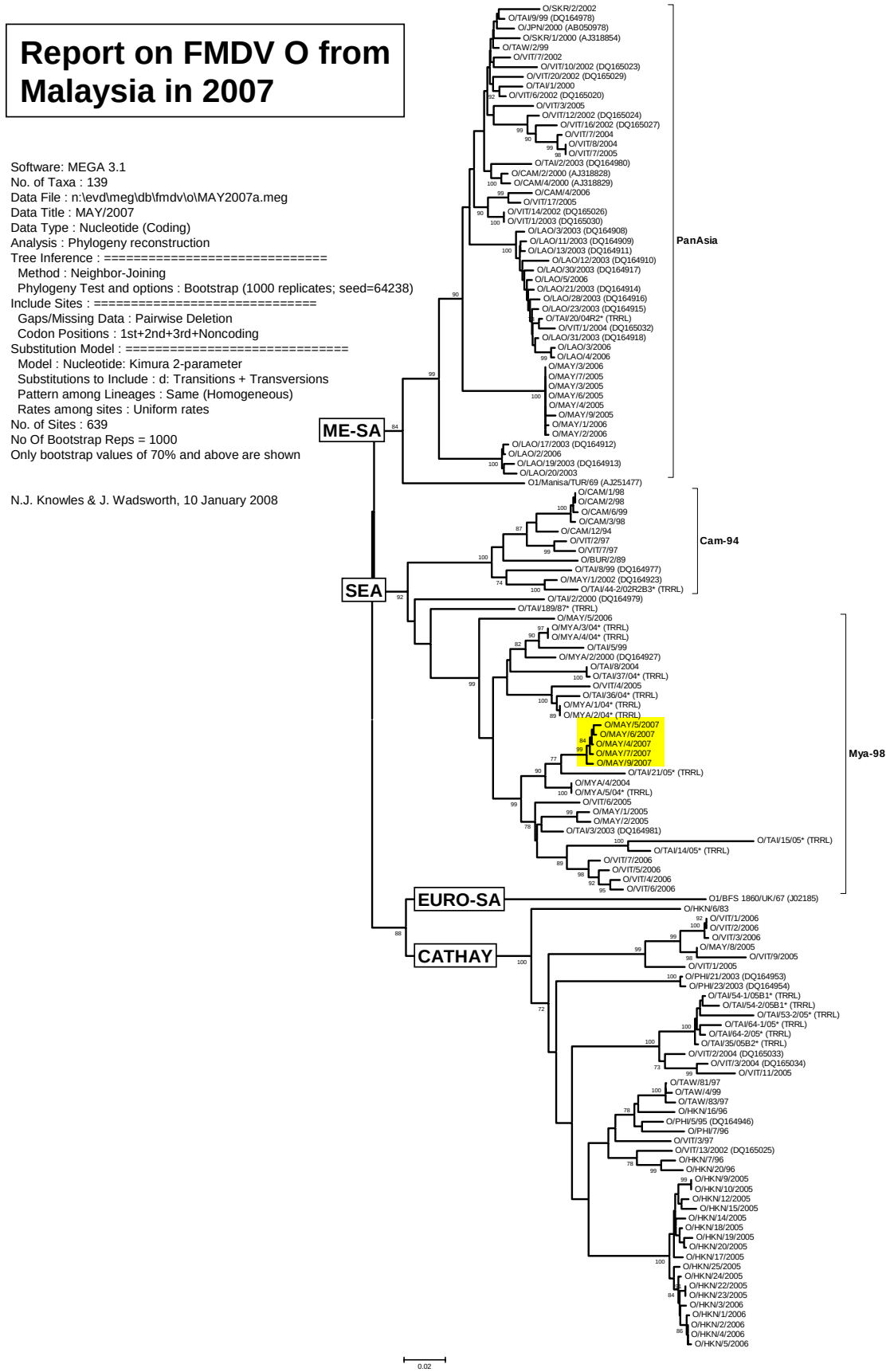


Fig 4: Serotype A from Malaysia

Report on FMDV A from Malaysia in 2007

Software: MEGA 3.1
No. of Taxa : 120
Data File : n:\evd\meg\db\fmdv\a\MAY2007a.meg
Data Title : MAY/2007
Data Type : Nucleotide (Coding)
Analysis : Phylogeny reconstruction
Tree Inference : ==========
  Method : Neighbor-Joining
  Phylogeny Test and options : Bootstrap (1000 replicates; seed=64238)
Include Sites : ==========
  Gaps/Missing Data : Pairwise Deletion
  Codon Positions : 1st+2nd+3rd+Noncoding
Substitution Model : ==========
  Model : Nucleotide: Kimura 2-parameter
  Substitutions to Include : d: Transitions + Transversions
  Pattern among Lineages : Same (Homogeneous)
  Rates among sites : Uniform rates
No. of Sites : 642
No Of Bootstrap Reps = 1000
Only bootstrap values of 70% and above are shown

N.J. Knowles & J. Wadsworth, 10 January 2008

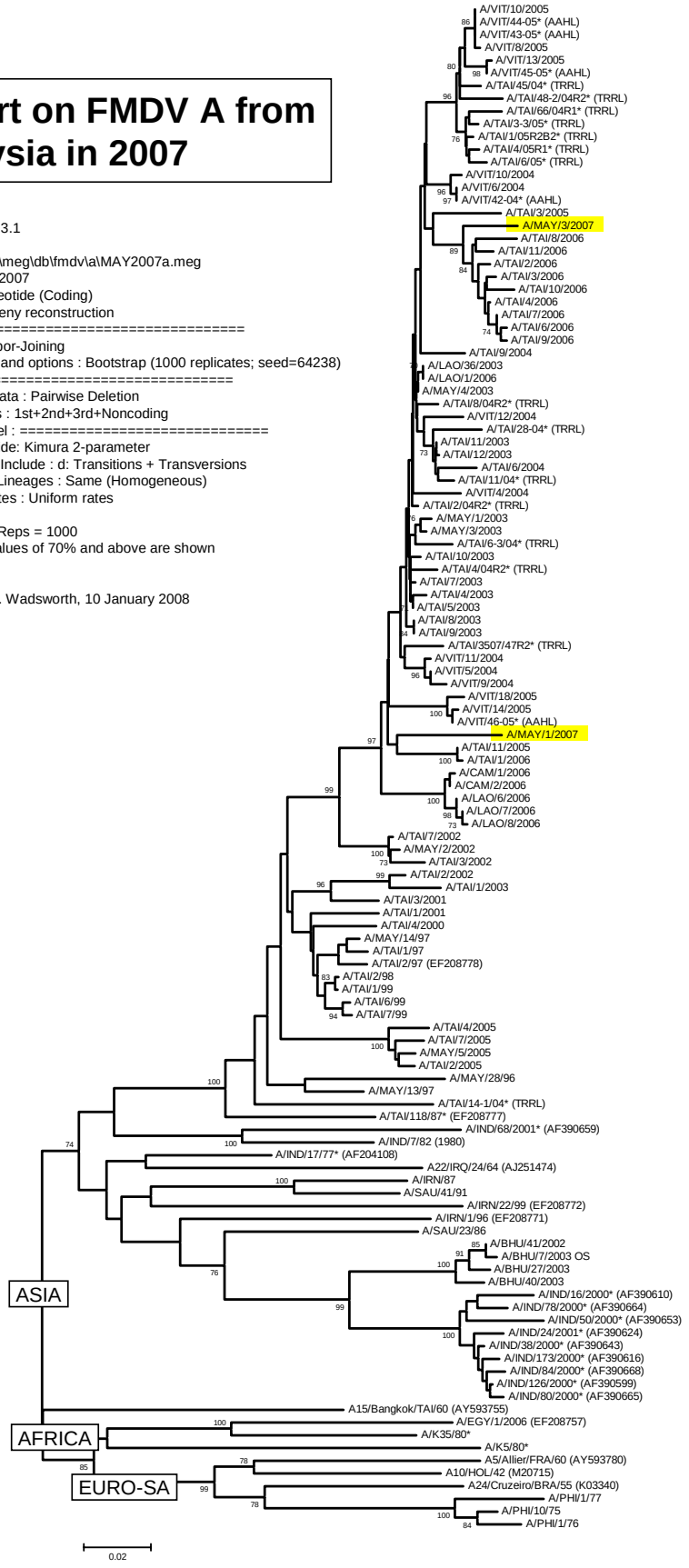


Fig 5: Serotype O viruses characterised from Ethiopia

Report on FMDV O/Ethiopia/2004-2006

No. of Taxa : 133
Data File : n:\evd\meg\db\fmdv\o\ETH2006c.meg
Data Title : Ethiopia 2004 & 2006
Data Type : Nucleotide (Coding)
Analysis : Phylogeny reconstruction
Tree Inference : ==========
  Method : Neighbor-Joining
  Phylogeny Test and options : Bootstrap (1000 replicates; seed=90035)
Include Sites : ==========
  Gaps/Missing Data : Pairwise Deletion
  Codon Positions : 1st+2nd+3rd+Noncoding
Substitution Model : ==========
  Model : Nucleotide: Kimura 2-parameter
  Substitutions to Include : d: Transitions + Transversions
  Pattern among Lineages : Same (Homogeneous)
  Rates among sites : Uniform rates
No. of Sites : 642
No Of Bootstrap Reps = 1000
Only bootstrap values of 70% and above are shown

*, not a WRLFMD Ref. No.

N.J. Knowles & J. Wadsworth, 26 November 2007

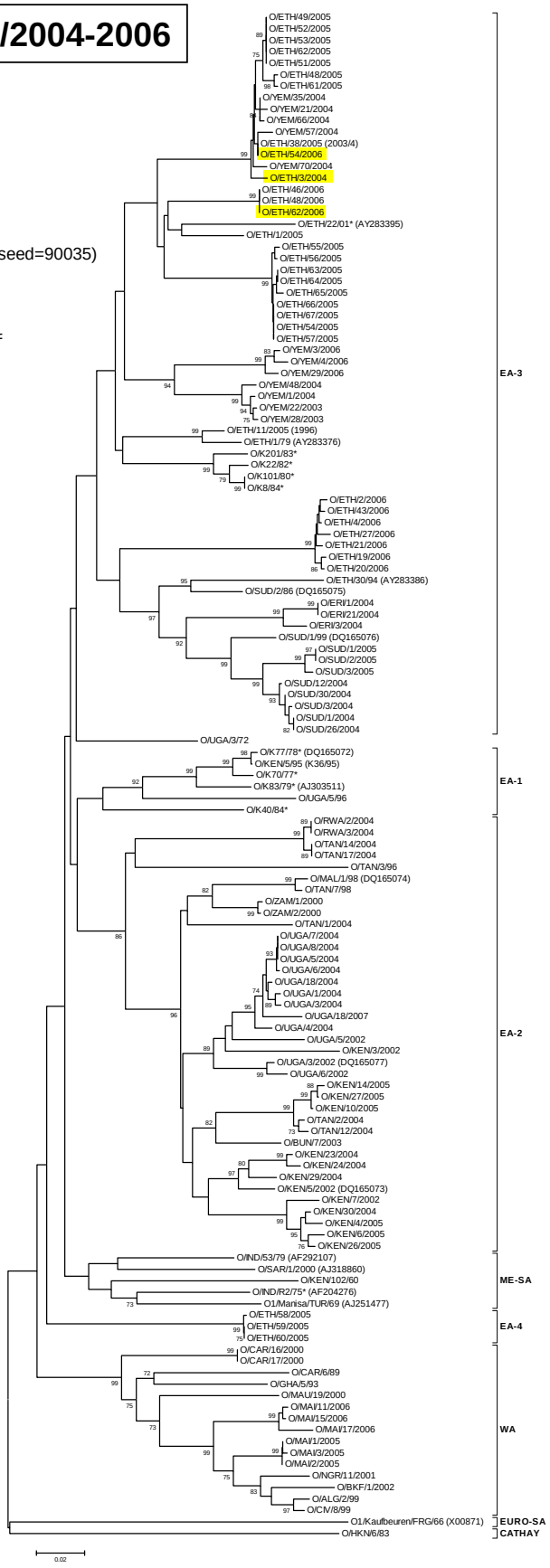
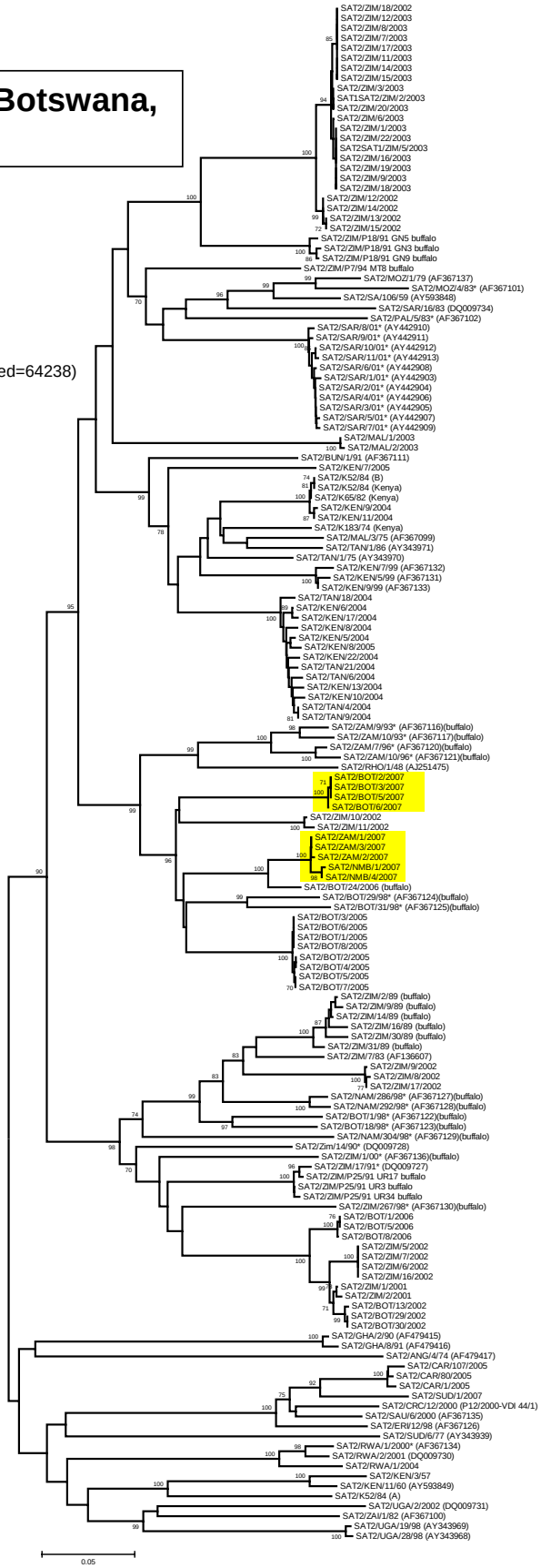


Fig 6: SAT 2 viruses characterised from Southern Africa

Report on FMDV SAT2 from Botswana, Namibia and Zambia in 2007

Software: MEGA 3.1
No. of Taxa : 154
Data File : n:\evd\meg\db\fmdv\sat2\ZAM2007a.meg
Data Title : Zambia & Namibia 2007
Data Type : Nucleotide (Coding)
Analysis : Phylogeny reconstruction
Tree Inference : ==========
  Method : Neighbor-Joining
  Phylogeny Test and options : Bootstrap (1000 replicates; seed=64238)
Include Sites : ==========
  Gaps/Missing Data : Pairwise Deletion
  Codon Positions : 1st+2nd+3rd+Noncoding
Substitution Model : ==========
  Model : Nucleotide: Kimura 2-parameter
  Substitutions to Include : d: Transitions + Transversions
  Pattern among Lineages : Same (Homogeneous)
  Rates among sites : Uniform rates
No. of Sites : 648
No Of Bootstrap Reps = 1000
Only bootstrap values of 70% or greater are shown

N.J. Knowles & Jemma Wadsworth, 15 January 2008



Annex 3. RECOMMENDATIONS FROM THE WRL ON FMD VIRUS STRAINS TO BE INCLUDED IN FMDV ANTIGEN BANKS – December 2007

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)