WRLFMD Quarterly Report
October-December 2014

Reference Laboratory Contract Report

Foot-and-Mouth Disease
Summary of samples tested and reported FMD outbreaks

**ASIA**

**Bahrain**

Three samples were received by the WRLFMD from the Northern Governorate of Bahrain, collected from cattle during October 2014. Viruses isolated from all three samples were identified as FMD type O virus. Genotyping showed them to belong to the ME-SA topotype, PanAsia-2<sup>ANT-10</sup> lineage (see below).

**Hong Kong SAR, P.R. China**

Two samples submitted to the WRLFMD from Sheung Shui, New Territories, collected from pigs on 25<sup>th</sup> November 2014. One was found to contain FMD type O virus but only FMDV genome could be detected in the other. Genotyping showed the former to belong to the CATHAY topotype and to be closely related to viruses present in Hong Kong SAR since 2010 (see below).

**People’s Republic of China**

Two outbreaks due to FMD type A were reported on 08/10/2014 and 15/12/2014 at Shannan, Tibet and Lasa, Tibet, respectively, both in cattle. On 18/11/2014 a single outbreak of FMD type O was reported in pigs in Dongdai, JiangSu Province. No genotyping has been reported for any of these outbreaks.

**Republic of Korea (South Korea)**

In December three outbreaks of FMD type O were reported in pigs in Chungcheongbuk-do (two outbreaks) and Chungcheongnam-do (one outbreak). VP1 sequencing at the Animal and Plant Quarantine Agency (ROK) showed that the virus from the first outbreak belonged to the SEA topotype, Mya-98 lineage (see below). The results of 10 samples received by the WRLFMD on 22<sup>nd</sup> December 2014 are pending.

**Vietnam**

Thirty two samples were submitted to the WRLFMD. These had been collected from cattle, water buffalo and pigs between December 2013 and July 2014. FMD type O virus was isolated from 12 samples, type A from 13 samples and FMDV genome was detected by real-time RT-PCR in the remaining seven samples. VP1 genotyping revealed seven of the type O viruses belonged to the ME-SA topotype, PanAsia lineage and five to the SEA topotype, Mya-98 lineages. All the type A viruses belonged to the ASIA topotype, Sea-97 lineage (see below).

**AFRICA**

**Algeria**

Two outbreaks of FMD type O were reported to have occurred in cattle in late September 2014 in the M’Sila and Ain Defla provinces.

**Botswana**

On 27/10/2014 an outbreak due to FMD type SAT 1 was reported in cattle at Tjaa crush, Tubu, Gumare, Ngamiland. No genotyping has been reported. Four samples were received
from the BVI collected from cattle on 26/06/2014 at Mohembo East, Shakawe, Ngamiland. FMD type SAT 1 was identified in three samples and genotyping showed them to belong to topotype III (WZ) (see below).

Six samples were received from the BVI collected from cattle between February and June 2013 in the Maun area of Ngamiland. FMD type SAT 2 was identified in two of these (from 20/02/2013). VP1 genotyping showed these to belong to topotype III (see below).

**Egypt**

Twenty eight samples were received by the WRLFMD from cattle and water buffalo collected in various locations in the country between May 2012 and October 2014. FMD type O was isolated from nine samples collected between April and October 2014 and VP1 genotyping showed them all to belong to the EA-3 topotype (see below). FMD type A was isolated from four samples; one collected in May 2012 and two in March 2013 and one in May 2014. VP1 genotyping showed the virus from 2012 to belong to the AFRICA topotype, G-IV lineage while to other three viruses belonged to the ASIA topotype, Iran-05BAR-08 lineage (see below). FMD type SAT 2 was isolated from two samples collected in May 2012 and April 2014. VP1 genotype showed them to belong to topotype VII, the former falling within the Ghb-12 lineage and the latter in the Alx-12 lineage (see below).

**Ethiopia**

Sixteen samples were received by the WRLFMD. Half were sera collected from sheep and half tissue suspensions from samples collected from cattle. No virus was detected in any of the sheep sera. FMDV genome was detected in seven of the tissue suspensions, but no viruses could be typed by ELISA or isolated in cell cultures. RT-PCR amplification of the VP1-coding region was successful in two samples (ETH/6/2014 and ETH/10/2014), although only a faint band was present in the latter sample. Both samples were identified as FMD type O. Phylogenetic analysis of ETH/6/2014 showed it to belong to the EA-3 topotype; insufficient sequence data was obtained to conclusively identify the genotype of ETH/10/2014.

**Mali**

A partial VP1 sequence was received to WRLFMD from RRLSSA - BVI (Botswana) for a virus collected during 2014. Phylogenetic analysis showed that this sequence was derived from a SAT 2 serotype FMD virus (within topotype VII) most closely related to FMD viruses previously recovered from Nigeria in 2012.

**Mozambique**

Four samples were received from the BVI (Botswana) collected from outbreaks in cattle in Maputo on 24/07/2014. All were identified as FMD type SAT 2. VP1 genotyping showed them to belong to topotype I as previously described by the BVI (see below).

**Namibia**

On 01/12/2014 an outbreak due to FMD type SAT 2 was reported at in cattle at Linyati, Caprivi. Genotyping by the BVI (two VP1 sequences were received on 11/12/2014) showed viruses from Kikiya Crush, East Caprivi to belong to topotype III (see below).

**South Africa**

Two outbreaks of FMD type SAT 2 were reported to have occurred in June 2014 in cattle in Bushbuckridge, Mpumalanga within South Africa’s FMD protection zone where routine
vaccination is practised. There have been a number of outbreaks in this area since August 2013.

Tunisia
Sixteen new outbreaks of FMD type O were reported to have occurred between June and September 2014 in cattle, sheep and goats in eight provinces (Ariana, Beja, Ben Arous, Jendouba, Kasserine, Mannouba, Nabeul and Zaghouan).

Zimbabwe
Thirteen samples were received from the BVI which had been collected from cattle between July 2010 and September 2014 at various locations. FMD type SAT 2 was isolated from six of the samples, three from 2010 and three from 2014. VP1 genotyping showed five of these to belong to toptype I (at least two distinct unnamed lineages), but one sample from Mwenezi District, Masvingo Province (collected in May 2014) belonged to toptype II (see below).

SOUTH AMERICA
No new outbreaks of FMD were reported in the region.

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

An up-to-date list and reports of FMD viruses characterised by sequencing can be found at the following website: http://www.wrlfmd.org/fmd_genotyping/2014.htm.
Results from samples received at WRLFMD (status of samples being tested) are shown in Table 1 (below) and a complete list of clinical sample diagnostics made by the WRLFMD between October and December 2014 is shown in Table 2 (Annex 1). A record of all samples received by WRLFMD (October and December 2014) is shown in Table 3 (Annex 1).

Table 1: Status of sequencing of samples received by the WRLFMD from October to December 2014.

<table>
<thead>
<tr>
<th>WRLFMD Batch No.</th>
<th>Date received</th>
<th>Country</th>
<th>Serotype</th>
<th>No. of samples</th>
<th>No. of sequences</th>
<th>Sequencing status</th>
</tr>
</thead>
<tbody>
<tr>
<td>WRLFMD/2014/0031</td>
<td>13-Oct-14</td>
<td>Botswana</td>
<td>SAT 1</td>
<td>3</td>
<td>3</td>
<td>Completed</td>
</tr>
<tr>
<td>WRLFMD/2014/0031</td>
<td>13-Oct-14</td>
<td>Botswana</td>
<td>SAT 2</td>
<td>2</td>
<td>2</td>
<td>Completed</td>
</tr>
<tr>
<td>WRLFMD/2014/0032</td>
<td>13-Oct-14</td>
<td>Mozambique</td>
<td>SAT 2</td>
<td>4</td>
<td>4</td>
<td>Completed</td>
</tr>
<tr>
<td>WRLFMD/2014/0033</td>
<td>13-Oct-14</td>
<td>Zimbabwe</td>
<td>SAT 2</td>
<td>6</td>
<td>6</td>
<td>Completed</td>
</tr>
<tr>
<td>WRLFMD/2014/0035</td>
<td>28-Oct-14</td>
<td>Vietnam</td>
<td>A</td>
<td>13</td>
<td>13</td>
<td>Completed</td>
</tr>
<tr>
<td>WRLFMD/2014/0035</td>
<td>28-Oct-14</td>
<td>Vietnam</td>
<td>O</td>
<td>12</td>
<td>12</td>
<td>Completed</td>
</tr>
<tr>
<td>WRLFMD/2014/0036</td>
<td>4-Nov-14</td>
<td>Bahrain</td>
<td>O</td>
<td>3</td>
<td>3</td>
<td>Completed</td>
</tr>
<tr>
<td>WRLFMD/2014/0037</td>
<td>4-Nov-14</td>
<td>Egypt</td>
<td>A</td>
<td>4</td>
<td>4</td>
<td>Completed</td>
</tr>
<tr>
<td>WRLFMD/2014/0037</td>
<td>4-Nov-14</td>
<td>Egypt</td>
<td>O</td>
<td>9</td>
<td>9</td>
<td>Completed</td>
</tr>
<tr>
<td>WRLFMD/2014/0037</td>
<td>4-Nov-14</td>
<td>Egypt</td>
<td>SAT 2</td>
<td>2</td>
<td>2</td>
<td>Completed</td>
</tr>
<tr>
<td>WRLFMD/2014/0038</td>
<td>27-Nov-14</td>
<td>Ethiopia</td>
<td>O</td>
<td>2</td>
<td>2</td>
<td>Completed</td>
</tr>
<tr>
<td>WRLFMD/2014/0039</td>
<td>11-Dec-14</td>
<td>Hong Kong SAR</td>
<td>O</td>
<td>1</td>
<td>1</td>
<td>Completed</td>
</tr>
<tr>
<td>WRLFMD/2014/0040</td>
<td>22-Dec-14</td>
<td>South Korea</td>
<td>Pending</td>
<td>10</td>
<td></td>
<td>Pending</td>
</tr>
</tbody>
</table>

71  61

During this reporting period, additional sequences were received to WRLFMD via RRLSSA-BVI (Botswana) for samples collected in Namibia and Mali.
Figure 1: Bahrain

Detailed Analysis

ASIA

WRLFMD/2014/00036
Date received: 04/11/2014
No. of samples: 3
O (ME-SA/PanAsia-2**ANT-10**): 3

1. Capital Governorate
2. Central Governorate
3. Muharraq Governorate
4. Northern Governorate
5. Southern Governorate

The content of this report is the property of WRLFMD®, The Pirbright Institute.
Copies of all the individual reports cited herein can be obtained from The Pirbright Institute and prior to presentation, publication or any other public use of these data, please contact Dr Donald King, The Pirbright Institute, donald.king@pirbright.ac.uk.
Figure 2: Hong Kong SAR

WRLFMD/2014/00039
Date received: 11/12/2014
No. of samples: 2
O (CATHAY/unnamed): 1
FMDV-GD: 1

The content of this report is the property of WRLFMD®, The Pirbright Institute.

Copies of all the individual reports cited herein can be obtained from The Pirbright Institute and prior to presentation, publication or any other public use of these data, please contact Dr Donald King, The Pirbright Institute, donald.king@pirbright.ac.uk.
Figure 3: Republic of Korea (South Korea)

VP1 sequence received from Animal and Plant Quarantine Agency
Date received: 04/12/2014
No. of sequences: 1
O (SEA/Mya-98): 1

WRLMEG/2014/00038
O/SKR/5/2010 (JQ070321)
O/SKR/6/2010
O/Andong 1/SKR/2010 (NVRQS)
O/SKR/7/2010
O/SKR/8/2010
O/SKR/9/2010 (JQ070304)
O/SKR/10/2010
O/SKR/12/2010 (KC438373)
O/RUS/Jul 2010 (JQ070329)
O/SKR/13/2010
O/SKR/01/2014* (APQA)
O/MYA/7/98 (DQ164925)
O/TZ/CHA/2010 (HQ652081)
O/33-P/CHA/2010 (JQ973889)
O/SKR/4/2010 (JQ070320)
O/KOR/1/2010* (HM143846)
O/GZ-MT/CHA/2013 (KJ646655)
O/SKR/6/2014

The content of this report is the property of WRLFMD®, The Pirbright Institute.

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

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

Figure 5: Botswana

WRLFMD/2014/00031
Date received: 13/10/2014
No. of samples: 10
SAT 1 (III-WZ): 3
SAT 2 (III): 2
FMDV-GD: 3
NVD: 2

The content of this report is the property of WRLFMD®. The Pirbright Institute.

Copies of all the individual reports cited herein can be obtained from The Pirbright Institute and prior to presentation, publication or any other public use of these data, please contact Dr Donald King, The Pirbright Institute, donald.king@pirbright.ac.uk.
Figure 6a: Egypt

WRLFMD/2014/00037

Date received: 04/11/2014

No. of samples: 28

O (EA-3): 9
A (AFRICA/G-IV): 1
A (Iran-05BAR-08): 3
SAT 2 (VII/ Ghb-12): 1
SAT 2 (VII/Alx-12): 1
FMDV-GD: 3

No FMDV GD: 10

O/ERI/16/2011
O/ETH/59/2011
O/ERI/13/2011
O/ERI/12/2011
O/ERI/11/2011
O/ERI/10/2011
O/ERI/9/2011
O/ERI/8/2011
O/ERI/7/2011
O/ERI/6/2011
O/ERI/5/2011
O/ERI/4/2011
O/ERI/3/2011
O/ERI/2/2011
O/ERI/1/2011
O/ERI/15/2011
O/EGY/25/2012
O/LIB/54/2012
O/ETH/59/2011

O/SUD/2/2008 (GU566061)
O/SUD/6/2008 (GU566062)
O/SUD/4/2008 (GU566063)
O/SUD/9/2008 (GU566064)
O/SUD/11/2008 (GU566065)
O/SUD/20/2008 (GU566066)
O/SUD/17/2008 (GU566067)
O/SUD/12/2004 (GU566049)
O/SUD/25/2004 (GU566052)
O/SUD/30/2004 (GU566055)
O/SUD/3/2004 (GU566047)
O/SUD/14/2004 (GU566050)
O/SUD/15/2004 (GU566051)
O/SUD/16/2004 (GU566052)
O/SUD/2/2004 (GU566046)
O/SUD/1/2004 (GU566045)
O/SUD/26/2004 (GU566054)
O/SUD/8/2008 (GU566053)
O/SUD/10/2011
O/SUD/3/2008 (GU566059)
O/SUD/4/2008 (GU566060)
O/SUD/1/2008 (GU566068)
O/SUD/2/2004 (GU566048)
O/SUD/2/1999 (DQ165076)
O/SUD/2/2004 (GU566049)

© Daniel Dalet / d-maps.com

Monufia
North Sinai
Port Said
Sharqia
Matrouh
Minya
Qalyubia
South Sinai
Suez
Luxor
New Valley
Qena
...
Figure 6b: Egypt (continued)
Figure 7: Ethiopia

WRLFMD/2014/00038
Date received: 27/11/2014
No. of samples: 16
O (genome only) (EA-3): 2
FMDV-GD: 5
NVD: 9

The content of this report is the property of WRLFMD®, The Pirbright Institute.

Copies of all the individual reports cited herein can be obtained from The Pirbright Institute and prior to presentation, publication or any other public use of these data, please contact Dr Donald King, The Pirbright Institute, donald.king@pirbright.ac.uk.
Figure 8: Mozabique

WRLFMD/2014/00032
Date received: 13/10/2014
No. of samples: 4
SAT2 (I): 4

The content of this report is the property of WRLFMD®, The Pirbright Institute.
Copies of all the individual reports cited herein can be obtained from The Pirbright Institute and prior to presentation, publication or any other public use of these data, please contact Dr Donald King, The Pirbright Institute, donald.king@pirbright.ac.uk.
Figure 9: Namibia

WRLMEG/2014/00039
VP1 sequences received from the BVI, Botswana
Date received: 11/12/2014
No. of sequences: 2
SAT2 (III): 2

The content of this report is the property of WRLFMD®, The Pirbright Institute.

Copies of all the individual reports cited herein can be obtained from The Pirbright Institute and prior to presentation, publication or any other public use of these data, please contact Dr Donald King, The Pirbright Institute, donald.king@pirbright.ac.uk.
Figure 10: Zimbabwe

WRLFMD/2014/00033
Date received: 13/10/2014
No. of samples:
SAT 2 (I): 5
SAT 2 (II): 1

The content of this report is the property of WRLFMD®, The Pirbright Institute.

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

For individual data see Table 4 (Annex 1).

Serotype O

Two serotype O/ME-SA/Ind-2001 isolates were tested from the batch of samples received from Sri Lanka. These were both a vaccine match to O 3039 and O TAW/98. However only one strain was a vaccine match with O/TUR/5/2009 (the other was borderline) and neither of these two isolates generated a positive matching result against O BFS and O Manisa.

Two further serotype isolates from Malaysia (MAY/2/2014 and MAY 3/2014) from the SEA topotype were tested and were both matched to O 3039. One isolate (MAY/3/2014) also matched O Manisa, O TAW/98 and O/TUR/5/09 antigens, while the other (MAY/2/2014) generated borderline values for O Manisa and O TAW/98 and a poor in-vitro match for O/TUR/5/2009.

Serotype A

Three field viruses from Malaysia and two field viruses from Cameroon were tested by VNT against serotype A. For Malaysia the isolates gave a good vaccine match to A22 IRQ, A MAY/97 and A TUR/06; however, one isolate (MAY/23/2013) did not match against A TUR/06.

For Cameroon there was a good match against A TUR/06 and there was a poor vaccine match against A22 IRQ.

All five serotype O strains did not match in this in-vitro test against A IRN/05

Serotype SAT 2

One sample from Cameroon was tested against SAT 2 ERI and SAT 2 ZIM by VNT. Both of these vaccine viruses were a match against this field isolate.
Annex 1

Table 2: Clinical sample diagnostics made by the WRLFMD® between October-December 2014

<table>
<thead>
<tr>
<th>Country</th>
<th>WRL for FMD Sample Identification</th>
<th>Species</th>
<th>Date of Collection</th>
<th>Results VI/ELISA</th>
<th>RT-PCR</th>
<th>Final report</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAHRAIN</td>
<td>BAR 1/2014 CATTLE</td>
<td>CATTLE</td>
<td>16-Oct-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>BAR 2/2014 CATTLE</td>
<td>CATTLE</td>
<td>16-Oct-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>BAR 3/2014 CATTLE</td>
<td>CATTLE</td>
<td>27-Oct-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td>EGYPT</td>
<td>EGY 42/2012 CATTLE</td>
<td>CATTLE</td>
<td>20-May-12</td>
<td>A</td>
<td>POS</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>EGY 43/2012 CATTLE</td>
<td>CATTLE</td>
<td>21-May-12</td>
<td>SAT 2</td>
<td>POS</td>
<td>SAT 2</td>
</tr>
<tr>
<td></td>
<td>EGY 30/2013 CATTLE</td>
<td>CATTLE</td>
<td>20-Mar-13</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>EGY 31/2013 CATTLE</td>
<td>CATTLE</td>
<td>20-Mar-13</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>EGY 23/2014 CATTLE</td>
<td>CATTLE</td>
<td>07-Apr-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>EGY 24/2014 CATTLE</td>
<td>CATTLE</td>
<td>17-Apr-14</td>
<td>SAT 2</td>
<td>POS</td>
<td>SAT 2</td>
</tr>
<tr>
<td></td>
<td>EGY 25/2014 CATTLE</td>
<td>CATTLE</td>
<td>22-Apr-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>EGY 26/2014 CATTLE</td>
<td>CATTLE</td>
<td>22-Apr-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>EGY 27/2014 CATTLE</td>
<td>CATTLE</td>
<td>05-May-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>EGY 28/2014 CATTLE</td>
<td>CATTLE</td>
<td>06-May-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>EGY 29/2014 CATTLE</td>
<td>CATTLE</td>
<td>09-May-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>EGY 30/2014 CATTLE</td>
<td>CATTLE</td>
<td>17-May-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>EGY 31/2014 CATTLE</td>
<td>CATTLE</td>
<td>28-May-14</td>
<td>A</td>
<td>POS</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>EGY 32/2014 BUFFALO</td>
<td>BUFFALO</td>
<td>14-Jun-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>EGY 33/2014 BUFFALO</td>
<td>BUFFALO</td>
<td>14-Jun-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>EGY 34/2014 CATTLE</td>
<td>CATTLE</td>
<td>18-Aug-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>EGY 35/2014 BUFFALO</td>
<td>BUFFALO</td>
<td>08-Sep-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>EGY 36/2014 CATTLE</td>
<td>CATTLE</td>
<td>09-Oct-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>EGY 37/2014 CATTLE</td>
<td>CATTLE</td>
<td>11-Oct-14</td>
<td>NT</td>
<td>NEG</td>
<td>FMDV NGD</td>
</tr>
<tr>
<td></td>
<td>EGY 38/2014 CATTLE</td>
<td>CATTLE</td>
<td>11-Oct-14</td>
<td>NT</td>
<td>NEG</td>
<td>FMDV NGD</td>
</tr>
<tr>
<td></td>
<td>EGY 39/2014 CATTLE</td>
<td>CATTLE</td>
<td>11-Oct-14</td>
<td>NT</td>
<td>NEG</td>
<td>FMDV NGD</td>
</tr>
<tr>
<td></td>
<td>EGY 40/2014 CATTLE</td>
<td>CATTLE</td>
<td>11-Oct-14</td>
<td>NT</td>
<td>NEG</td>
<td>FMDV NGD</td>
</tr>
<tr>
<td></td>
<td>EGY 41/2014 CATTLE</td>
<td>CATTLE</td>
<td>11-Oct-14</td>
<td>NT</td>
<td>NEG</td>
<td>FMDV NGD</td>
</tr>
<tr>
<td></td>
<td>EGY 42/2014 CATTLE</td>
<td>CATTLE</td>
<td>11-Oct-14</td>
<td>NT</td>
<td>NEG</td>
<td>FMDV NGD</td>
</tr>
<tr>
<td></td>
<td>EGY 43/2014 CATTLE</td>
<td>CATTLE</td>
<td>11-Oct-14</td>
<td>NT</td>
<td>NEG</td>
<td>FMDV NGD</td>
</tr>
<tr>
<td></td>
<td>EGY 44/2014 CATTLE</td>
<td>CATTLE</td>
<td>11-Oct-14</td>
<td>NT</td>
<td>NEG</td>
<td>FMDV NGD</td>
</tr>
<tr>
<td></td>
<td>EGY 45/2014 CATTLE</td>
<td>CATTLE</td>
<td>11-Oct-14</td>
<td>NT</td>
<td>NEG</td>
<td>FMDV NGD</td>
</tr>
<tr>
<td></td>
<td>EGY 46/2014 CATTLE</td>
<td>CATTLE</td>
<td>11-Oct-14</td>
<td>NT</td>
<td>NEG</td>
<td>FMDV NGD</td>
</tr>
<tr>
<td>ETHIOPIA</td>
<td>ETH 3/2014 BOVINE</td>
<td>BOVINE</td>
<td>13-Feb-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>ETH 4/2014 BOVINE</td>
<td>BOVINE</td>
<td>13-Feb-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>ETH 5/2014 BOVINE</td>
<td>BOVINE</td>
<td>13-Feb-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>ETH 6/2014 BOVINE</td>
<td>BOVINE</td>
<td>13-Feb-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>ETH 7/2014 BOVINE</td>
<td>BOVINE</td>
<td>07-Sep-14</td>
<td>NEG</td>
<td>NEG</td>
<td>NVD</td>
</tr>
<tr>
<td></td>
<td>ETH 8/2014 BOVINE</td>
<td>BOVINE</td>
<td>07-Oct-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>ETH 9/2014 BOVINE</td>
<td>BOVINE</td>
<td>07-Oct-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>ETH 10/2014 BOVINE</td>
<td>BOVINE</td>
<td>07-Oct-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>ETH 11/2014 OVINE</td>
<td>OVINE</td>
<td>29-Oct-14</td>
<td>NEG</td>
<td>NEG</td>
<td>NVD</td>
</tr>
<tr>
<td></td>
<td>ETH 12/2014 OVINE</td>
<td>OVINE</td>
<td>29-Oct-14</td>
<td>NEG</td>
<td>NEG</td>
<td>NVD</td>
</tr>
<tr>
<td></td>
<td>ETH 13/2014 OVINE</td>
<td>OVINE</td>
<td>29-Oct-14</td>
<td>NEG</td>
<td>NEG</td>
<td>NVD</td>
</tr>
<tr>
<td></td>
<td>ETH 14/2014 OVINE</td>
<td>OVINE</td>
<td>29-Oct-14</td>
<td>NEG</td>
<td>NEG</td>
<td>NVD</td>
</tr>
<tr>
<td></td>
<td>ETH 15/2014 OVINE</td>
<td>OVINE</td>
<td>29-Oct-14</td>
<td>NEG</td>
<td>NEG</td>
<td>NVD</td>
</tr>
<tr>
<td></td>
<td>ETH 16/2014 OVINE</td>
<td>OVINE</td>
<td>29-Oct-14</td>
<td>NEG</td>
<td>NEG</td>
<td>NVD</td>
</tr>
</tbody>
</table>

The content of this report is the property of WRLFMD®, The Pirbright Institute.

Copies of all the individual reports cited herein can be obtained from The Pirbright Institute and prior to presentation, publication or any other public use of these data, please contact Dr Donald King, The Pirbright Institute, donald.king@pirbright.ac.uk.
### Country WRL for FMD Sample Identification | Species | Date of Collection | VI/ELISA | RT-PCR | Final report
---|---|---|---|---|---
ETH 17/2014 | OVINE | 29-Oct-14 | NEG | NEG | NVD
ETH 18/2014 | OVINE | 29-Oct-14 | NEG | NEG | NVD
HONG KONG | PIG | 25-Nov-14 | NEG | POS | FMDV GD
HKN 14/2014 | PIG | 25-Nov-14 | O | POS | O
SKR 11/2014 | PIG | 03-Dec-14 | Pending | Pending | Pending
SKR 12/2014 | PIG | 03-Dec-14 | Pending | Pending | Pending
SKR 13/2015 | PIG | 03-Dec-14 | Pending | Pending | Pending
SKR 14/2015 | PIG | 03-Dec-14 | Pending | Pending | Pending
SKR 15/2016 | PIG | 03-Dec-14 | Pending | Pending | Pending
SKR 16/2016 | PIG | 03-Dec-14 | Pending | Pending | Pending
SKR 17/2017 | PIG | 03-Dec-14 | Pending | Pending | Pending
SKR 18/2017 | PIG | 03-Dec-14 | Pending | Pending | Pending
SKR 19/2017 | PIG | 03-Dec-14 | Pending | Pending | Pending
SKR 20/2017 | PIG | 03-Dec-14 | Pending | Pending | Pending
VIETNAM | VIT 62/2013 | CATTLE | 17-Dec-13 | A | POS | A
VIT 63/2013 | CATTLE | 17-Dec-13 | A | POS | A
VIT 64/2013 | CATTLE | 21-Dec-13 | A | POS | A
VIT 1/2014 | CATTLE | 20-Jan-14 | A | POS | A
VIT 2/2014 | BUFFALO | 24-Apr-14 | A | POS | A
VIT 3/2014 | CATTLE | 24-Apr-14 | A | POS | A
VIT 4/2014 | BUFFALO | 24-Apr-14 | NEG | POS | FMDV GD
VIT 5/2014 | BUFFALO | 24-Apr-14 | NEG | POS | FMDV GD
VIT 6/2014 | PIG | 24-Apr-14 | A | POS | A
VIT 7/2014 | PIG | 24-Apr-14 | A | POS | A
VIT 8/2014 | CATTLE | 24-Apr-14 | A | POS | A
VIT 9/2014 | CATTLE | 24-Apr-14 | O | POS | O
VIT 10/2014 | CATTLE | 24-Apr-14 | NEG | POS | FMDV GD
VIT 11/2014 | CATTLE | 24-Apr-14 | O | POS | O
VIT 12/2014 | CATTLE | 24-Apr-14 | O | POS | O
VIT 13/2014 | CATTLE | 26-Apr-14 | O | POS | O
VIT 14/2014 | CATTLE | 26-Apr-14 | A | POS | A
VIT 15/2014 | CATTLE | 26-Apr-14 | A | POS | A
VIT 16/2014 | PIG | 30-Apr-14 | O | POS | O
VIT 17/2014 | CATTLE | 19-May-14 | NEG | POS | FMDV GD
VIT 18/2014 | CATTLE | 19-May-14 | O | POS | O
VIT 19/2014 | CATTLE | 05-Jun-14 | A | POS | A
VIT 20/2014 | CATTLE | 05-Jun-14 | A | POS | A
VIT 21/2014 | CATTLE | 20-Jun-14 | O | POS | O
VIT 22/2014 | CATTLE | 09-Jul-14 | NEG | POS | FMDV GD
VIT 23/2014 | PIG | 10-Jul-14 | O | POS | O
VIT 24/2014 | PIG | 10-Jul-14 | O | POS | O
VIT 25/2014 | CATTLE | 16-Jul-14 | NEG | POS | FMDV GD
VIT 26/2014 | CATTLE | 17-Jul-14 | O | POS | O
VIT 27/2014 | CATTLE | 17-Jul-14 | O | POS | O
VIT 28/2014 | PIG | 24-Jul-14 | O | POS | O
VIT 29/2014 | PIG | 24-Jul-14 | NEG | POS | FMDV GD

**TOTAL:** 91

Sample results pending from previous report
<table>
<thead>
<tr>
<th>Country</th>
<th>WRL for FMD Sample Identification</th>
<th>Species</th>
<th>Date of Collection</th>
<th>Results</th>
<th>RT-PCR</th>
<th>Final report</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRI LANKA</td>
<td>SRL 18/2014</td>
<td>BOVINE</td>
<td>02-Mar-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>SRL 19/2014</td>
<td>BOVINE</td>
<td>04-Apr-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>SRL 20/2014</td>
<td>BOVINE</td>
<td>06-Apr-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>SRL 21/2014</td>
<td>BOVINE</td>
<td>06-Apr-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>SRL 22/2014</td>
<td>BOVINE</td>
<td>18-Jun-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>SRL 23/2014</td>
<td>BOVINE</td>
<td>10-Jul-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>SRL 24/2014</td>
<td>BOVINE</td>
<td>14-Jul-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>SRL 25/2014</td>
<td>BOVINE</td>
<td>14-Jul-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>SRL 26/2014</td>
<td>BOVINE</td>
<td>16-Jul-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>SRL 27/2014</td>
<td>BOVINE</td>
<td>05-Aug-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>SRL 28/2014</td>
<td>BOVINE</td>
<td>01-Sep-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>SRL 29/2014</td>
<td>BUFFALO</td>
<td>10-Sep-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>SRL 30/2014</td>
<td>BUFFALO</td>
<td>10-Sep-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>SRL 31/2014</td>
<td>BUFFALO</td>
<td>10-Sep-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>SRL 32/2014</td>
<td>BUFFALO</td>
<td>10-Sep-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>SRL 33/2014</td>
<td>BOVINE</td>
<td>11-Sep-14</td>
<td>NEG</td>
<td>POS</td>
<td>FMDV GD</td>
</tr>
<tr>
<td></td>
<td>SRL 34/2014</td>
<td>BOVINE</td>
<td>15-Sep-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>SRL 35/2014</td>
<td>BOVINE</td>
<td>18-Sep-14</td>
<td>O</td>
<td>POS</td>
<td>O</td>
</tr>
</tbody>
</table>

**TOTAL:** 18

**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
- **RT-PCR:** Reverse transcription polymerase chain reaction on epithelial suspension for FMD (or SVD) viral genome
- **NVD:** No foot-and-mouth disease, swine vesicular disease or vesicular stomatitis virus detected
- **NT:** Not tested
Table 3: Summary of samples collected and received to WRLFMD (October-December 2014)

<table>
<thead>
<tr>
<th>Country</th>
<th>N° of samples</th>
<th>Virus isolation in cell culture/ELISA</th>
<th>FMD virus serotypes</th>
<th>RT-PCR for FMD (or SVD) virus (where appropriate)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>O</td>
<td>A</td>
</tr>
<tr>
<td>BAHRAIN</td>
<td>3</td>
<td></td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>EGYPT</td>
<td>28</td>
<td></td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>ETHIOPIA</td>
<td>16</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HONG KONG</td>
<td>2</td>
<td></td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>SOUTH KOREA</td>
<td>10</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>VIETNAM</td>
<td>32</td>
<td></td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>TOTAL</td>
<td>91</td>
<td></td>
<td>25</td>
<td>15</td>
</tr>
</tbody>
</table>

Sample results pending from previous report

<table>
<thead>
<tr>
<th>Country</th>
<th>N° of samples</th>
<th>Virus isolation in cell culture/ELISA</th>
<th>FMD virus serotypes</th>
<th>RT-PCR for FMD (or SVD) virus (where appropriate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRI LANKA</td>
<td>18</td>
<td></td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>18</td>
<td></td>
<td>8</td>
<td>-</td>
</tr>
</tbody>
</table>

**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
- RT-PCR: reverse transcription polymerase chain reaction for FMD (or SVD) viral genome
Table 4: Antigenic characterisation of FMD field isolates by matching with vaccine strains by 2dmVNT from October to December 2014

<table>
<thead>
<tr>
<th>Vaccine Matching Studies for Serotype O FMDV by VNT</th>
<th>Sample Reference</th>
<th>O 3039</th>
<th>O BFS</th>
<th>O Manisa</th>
<th>O TAW/98</th>
<th>O TUR/5/09</th>
</tr>
</thead>
<tbody>
<tr>
<td>O/SRL/28/2014</td>
<td>M</td>
<td>N</td>
<td>N</td>
<td>M</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>O/SRL/30/2014</td>
<td>M</td>
<td>N</td>
<td>N</td>
<td>M</td>
<td>Borderline</td>
<td></td>
</tr>
<tr>
<td>O/MAY/2/2014</td>
<td>M</td>
<td>NT</td>
<td>Borderline</td>
<td>Borderline</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>O/MAY/3/2014</td>
<td>M</td>
<td>NT</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td></td>
</tr>
</tbody>
</table>

Vaccine Matching Studies for Serotype A FMDV by VNT

<table>
<thead>
<tr>
<th>Sample Reference</th>
<th>A IRN/05</th>
<th>A22 IRQ</th>
<th>A MAY/97</th>
<th>A TUR/06</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/MAY/12/2013</td>
<td>N</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>A/MAY/20/2013</td>
<td>N</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>A/MAY/23/2013</td>
<td>N</td>
<td>M</td>
<td>M</td>
<td>N</td>
</tr>
<tr>
<td>A/CAR/4/2013</td>
<td>N</td>
<td>N</td>
<td>NT</td>
<td>M</td>
</tr>
<tr>
<td>A/CAR/10/2013</td>
<td>N</td>
<td>N</td>
<td>NT</td>
<td>M</td>
</tr>
</tbody>
</table>

Vaccine Matching Studies for Serotype SAT 2 FMDV by VNT

<table>
<thead>
<tr>
<th>Sample Reference</th>
<th>SAT 2 ERI</th>
<th>SAT 2 ZIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAT 2/CAR/16/2013</td>
<td>M</td>
<td>M</td>
</tr>
</tbody>
</table>

Abbreviations used in table:

- **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
Annex 2

Recent FMD Publications (October-December 2014) cited by Web of Science (Pirbright Institute papers and authors are highlighted in BOLD)


The content of this report is the property of WRLFMD®, The Pirbright Institute.

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


The content of this report is the property of WRLFMD®, The Pirbright Institute.

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


The content of this report is the property of WRLFMD®, The Pirbright Institute.

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


# Annex 3

**RECOMMENDATIONS FROM WRLFMD® ON FMD VIRUS STRAINS TO BE INCLUDED IN FMDV ANTIGEN BANKS – December 2014**

*Note: Virus strains are NOT listed in order of importance*

<table>
<thead>
<tr>
<th>High Priority</th>
<th>Medium Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>O Manisa</td>
<td>A Eritrea</td>
</tr>
<tr>
<td>O PanAsia-2 (or equivalent)</td>
<td>SAT 2 Zimbabwe</td>
</tr>
<tr>
<td>O BFS or Campos</td>
<td>SAT 1 South Africa</td>
</tr>
<tr>
<td>A24 Cruzeiro</td>
<td>A Malaysia 97 (or Thai equivalent such as A/NPT/TAI/86)</td>
</tr>
<tr>
<td>Asia 1 Shamir</td>
<td>A Argentina 2001</td>
</tr>
<tr>
<td>A Iran-05 (or A TUR 06)</td>
<td>O Taiwan 97 (pig-adapted strain or Philippine equivalent)</td>
</tr>
<tr>
<td>A22 Iraq</td>
<td></td>
</tr>
<tr>
<td>SAT 2 Saudi Arabia (or equivalent i.e. SAT 2 Eritrea)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Low Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Iran ‘96</td>
</tr>
<tr>
<td>A Iran ‘99</td>
</tr>
<tr>
<td>A Iran 87 or A Saudi Arabia 23/86 (or equivalent)</td>
</tr>
<tr>
<td>A15 Bangkok related strain</td>
</tr>
<tr>
<td>A87 Argentina related strain</td>
</tr>
<tr>
<td>C Noville</td>
</tr>
<tr>
<td>SAT 2 Kenya</td>
</tr>
<tr>
<td>SAT 1 Kenya</td>
</tr>
<tr>
<td>SAT 3 Zimbabwe</td>
</tr>
</tbody>
</table>

*Note: new risk-based priorities for FMD-free countries are currently being discussed.*