1. Background

FMD is an endemic disease in the Middle East, situation reported to OIE by most regional Members (table 1).

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**Legend:**
- Green: No information available
- Yellow: Never reported
- Orange: Disease not reported during this report period
- Pink: Disease suspected but not confirmed
- Red: Confirmed infection but no clinical disease
- Dark Red: Confirmed infection but limited to certain zones

*Table 1: Country report on FMD (OIE six monthly report)*
Periodic devastating epidemics occur that spread rapidly across national and regional borders:

- In 2005 and 2006, the Middle East has been severely affected by two separate type A epidemics, one which emerged in Iran (A Iran 05) in 2005 - 2006, and an incursion of an African type A virus into Egypt, causing widespread outbreaks in 2006. The serotype A Iran 2005 was first observed in Iran and moved westwards into Turkey (including the European part of Thrace). It has continued to spread in 2006, circulating in Turkey and Iran, and has been also detected in Pakistan, Saudi Arabia, Jordan and in the first months of 2009 in Iraq, Kuwait and Bahrain, and was recently identified in samples send by Lebanon and Libya to the WRL. This strain matches with A Iraq 22.

Since August 2007, a new sublineage of this strain (named A-Iran-05ARD-07) has been found in Turkey, for which A Iraq 22 is not protective. This new sublineage matches with A Turkey 2006.

The type A which affected Egypt in 2006, was diagnosed in 8 governorates in this country. Genetically, this new serotype A differs considerably from the Middle Eastern viruses and was closely related to FMD viruses reported in East Africa. The same strain was again identified in February 2009 in this country. The detection in outbreaks in 2009 suggests establishment of this East African strain in the Mediterranean region.

- In 2007, a new type O, the type O PanAsia 2, appears in the Middle East. This new strain in the region is probably originated from a strain circulating in India in 2001 and the pandemic dispersal of O PanAsia 2 lineage affected Pakistan, Iran, Jordan, Turkey, Israel, the Palestinian Autonomous Territories, UAE, Kuwait, Bahrain, KSA, probably Lebanon and also Egypt. This strain was responsible of high mortalities on lamb and calves during the winter, and notably in 2007. Vaccines with O Manisa offer a good immune protection against this strain.

2. General situation in 2008 - 2009 – Notification to OIE

Map 1: FMD distribution in the Middle East in 2008 (WAHID – Six monthly reports: January-July 2008)

3. Countries specific situation reported to the OIE in 2008 - 2009

**Egypt** reported 2 outbreaks in March 2008. The first one started in November 2007 and the second in January 2008. 50 cases were observed in cattle and 5 animals died. The causal agent identified was O PanAsia 2. This event was resolved in March 2008. One new outbreak due to the same serotype was observed in January 2009, with 4 cattle and 1 buffalo infected.

In January - February 2009, 2 other outbreaks due to serotype A were observed and reported, affecting 280 animals.

**Israel** reported one outbreak, due to the type O, in February 2008, affecting 7 animals and 7 other ones due to the same serotype in February – March 2009 affecting 69 cattle, 141 goat and 85 sheep, 1 cattle, 140 goats and 70 sheep died.

**Lebanon** notified in February 2008 one outbreak in a dairy farm linked with the introduction of infected animals. No sampling was made. In February 2009, 11 outbreaks were reported mainly linked to introduction of unvaccinated animals in herds. Samples were sent to the WRL. The serotype is still pending.

**Bahrain** reported in April 2008 an unexpected increase in morbidity or mortality of FMD on cattle that were vaccinated against the disease just 3 weeks before. Misvaccination and uncontrolled movement of animals were put as responsible of the spread of the disease in three of five governorates.

**Iran** reported, in the first OIE six monthly report, 258 outbreaks from January to June 2008 in the 20 administrative subdivisions of the country. 1869 cattle and 3072 small ruminants were infected. 91 cattle and 316 small ruminants died. Samples were sent to the WRL of Pirbright which identify the A serotype in April 2008.
378 outbreaks were observed in 2008 in the cattle population affecting 12723 animals and 158 in the sheep and goats population affecting 5773 animals.

The source of the infection, to some extend, is related to virus circulation in the population and due to illegal or legal importation of diseases animals. Since 2006, there is no any evidence or re-emergence of older strains.

**Kuwait** reported 6 outbreaks during the first semester 2008 affecting exclusively sheep and goats, 398 animals were infected and 23 died.

**Oman** reported 85 outbreaks during the first six month of 2008 affecting 385 cattle, 1428 goats and 272 sheep. 7 cattle and 37 goats died.

**Qatar** suspected the presence of the disease during the first semester 2008.

**KSA** reported the disease present during the first semester 2008 but without providing quantitative data.

**Sudan** reported 7 outbreaks on cattle, 353 animals were affected with the serotype O and 32 died.

**Turkey** reported 251 outbreaks in 2008 involving the serotypes A Iran 05 and O PanAsia 2. 7 579 cattle, 1 buffalo, 21 goats and 2204 sheep were infected and 233 cattle, the buffalo, 4 goats and 62 sheep died.

The Delegate of Turkey provides the specific following comment:

"The disease is endemic in Anatolia Region, two serotypes O and A type have been circulating in Anatolia Region. Outbreaks due to type Asia 1 has not been reported since April 2002 in Turkey. There is no outbreak recorded in Thrace region since November 2007. In 2005 majority of outbreaks occurred with type O1 Manisa until a new A type was introduced into the country in November. Laboratory analysis of these viruses showed that they were genetically quite distant from both A Iran 96 and A Iran 99 virus topotypes, both of which have been circulating in Turkey recently. The sequence data which was obtained in Ankara Sap Institute was sent to WRL Pirbright Laboratory and these viruses were closely matched with viruses isolated in Iran in 2005. The viruses which were isolated from Iran were antigenically matched with A 22 Iraq vaccine strain. The antigenic relationship of these viruses with A Iran 96 and A Iran 99 vaccine strains were very weak. These findings of Pirbright Laboratory were confirmed in Sap Institute as well and A 22 Mahmatli vaccine strain was determined as the best vaccine strain against these new viruses. However, a new type O strain, O Pan-Asia substrain has been introduced to Turkey up to October 2006, beside existed domestic strains O Manisa / O Alfa 05 topotype, which were caused a few outbreaks before the October 2006. When type A outbreak was occurred the first time in 2006, the vaccine strain A 22 Iraq was used against the virus for vaccination. During this type A outbreak periods (2006-2008), laboratory analysis showed that viruses were changed antigenically and current A22 Iraq vaccine strain was not protecting well for field isolates. So vaccine strain has been changed as type A TUR 2006".

See also chapter 4 for further details.

**Iraq** reported in 2008 to the OIE the occurrence of 148 outbreaks affecting 1612 sheep and goats, 779 cattle, 19 buffalos and 19 animals died.
4. Reports of the WRL of Pirbright


In the Middle East, FMD outbreaks have been reported (February 2008) in cattle in northern Israel (due to serotype O) and Lebanon (no serotype reported). In Lebanon, movement of infected animals via a local market (in Bekkaa province) has been proposed to be the likely route of infection. An un-expected increase in mortality due to FMD (serotype O) in Bahrain has been reported to the OIE and there have also been recent reports of FMD cases in Kuwait. Phylogenetic analysis shows a close relationship between FMD viruses recovered from these outbreaks in Bahrain and Kuwait and other members of the PanAsia II lineage.

In Africa, the FMD virus causing outbreaks in northern Egypt (Alexandria and Al Buhayrah) from September 2007 and January 2008 has been characterised as belonging to the new PanAsia II lineage of Serotype O. Introduction of infected animals via movement and contact via grazing and watering points has been implicated as the routes by which the virus has spread. To-date, these cases represent the most southerly extension of this new lineage that has recently spread through the Middle East.

Fifteen recent FMDV isolates from the Middle East (2, 3 and 10 from Saudi Arabia, Bahrain and Kuwait respectively) have been characterised by VP1 sequencing. All viruses belong to the PanAsia II lineage of serotype O. The majority of these viruses (9/10 of the viruses from Kuwait and all the isolates from Saudi Arabia and Bahrain) were clustered as a single group also containing 3 Iranian viruses from 2007. Within this group, there appear to be 3 separate sub-clusters ([i] SAU and BAH [ii] KUW 3-5/2008 and [iii] KUW 1, 2, 6-7, 8 and 10/200) indicating that although these viruses share a common ancestor, they have different epidemiological histories prior to their detection. Interestingly, the final isolate from Kuwait (KUW 9/2008) appeared to be more distantly related to viruses in this cluster.

Vaccine matching

Six FMDV type O isolates (O IRN 26/2007; O IRN 30/2007; O BAR 2/2008; O KUW 4/2008; O YEM 4/2006 and O YEM 29/2006) from Iran, Bahrain, Kuwait and Yemen collected in 2006, 2007 and 2008 were further characterised by two dimensional virus neutralisation tests. These results showed that most of these isolates were antigenically matched with O1 Manisa vaccine strains. Four of these field isolates (O YEM 4/2006 and 29/2006; O BAR 2/2008 and O KUW 4/2008) were also closely matched with O BFS 1860 and O Ind R2/75 indicating that these serotype O viruses can be covered by a vaccine present in many vaccine banks.

Two FMDV type A isolates (A IRN 36/2007; A IRN 39/2007) from Iran have been analysed by two dimensional VNT. The 2 isolates from Iran showed antigenic matching with A Turkey/06 vaccine strain (and not A22).

4.2. April – June 2008

In the Middle East, an FMD outbreak was reported in cattle in Bahrain (due to serotype O) in April. Poor vaccination and uncontrolled animal movement were proposed as the cause of the outbreak.

VP1 sequencing of 25 FMDV O viruses isolated from samples received from Pakistan during the last reporting period was completed. They represented viruses collected in 2005 (n=6), 2006 (n=11), 2007 (n=6) and 2008 (n=2). All belonged to the ME-SA topotype and all but one to the PanAsia-2 lineage (O/PAK/68/2006 was related to PanAsia viruses isolated in Pakistan in 2005). Those within the PanAsia-2 lineage fell on multiple sub-lineages, some

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2 http://www.wrlfmd.org/ref_labs/ref_lab_reports/FAO-OIE%20FMD%20Ref%20Lab%20Report%20Jan-Mar%202008.pdf
3 http://www.wrlfmd.org/ref_labs/ref_lab_reports/FAO-OIE%20FMD%20Ref%20Lab%20Report%20Apr-Jun%202008.pdf
which included representatives from other countries, indicating a complex epidemiological situation. One sample O/PAK/66/2007 contained two distinct PanAsia-2 viruses (labelled A and B) which were differentially amplified by the two RT-PCR primer sets used.

VP1 sequencing was completed on five type O viruses received from Saudi Arabia during the last reporting period. All belonged to ME-SA PanAsia-2 and were closely related to Saudi Arabian viruses received earlier in the year.

Ten VP1 sequences of viruses isolated in Turkey in 2008 were received from the FMD Institute-Ankara. Three type O sequences belonged to the PanAsia-2 lineage and seven type A viruses belonged to the A-Iran-05 lineage. One type O sequence appeared most closely related to sequences of viruses from Jordan (2006) and Israel (2007), however, sequences of the VP1 gene may not contain enough resolution to give an accurate phylogeny of very closely related viruses. The seven type A virus sequences clustered together (along with four sequences from 2007 previously sent from FMDI-Ankara) within the A-Iran-05 lineage; however, they appeared to form a new sub-lineage.

**Vaccine matching**

Five FMDV type O isolates (O SAU 1/2008; O PAK 1 and 2/2008 and O PAK 68 and 71/2007) from Saudi Arabia and Pakistan collected in 2007 and 2008 were further characterised by two dimensional virus neutralisation test. These results showed that all of these isolates were antigenically matched with all of O1 Manisa, O IND R2/75 and O BFS 1860 vaccine strains except that isolate O PAK 71/2007 was not antigenically close to O BFS 1860 strain. These results indicated that these serotype O viruses could be covered by more than one vaccine present in many vaccine banks.

**4.3. July – September**

The O-PanAsia-2 strain (ME-SA topotype) continues to dominate in the Middle East region (Pakistan, Iran, Turkey, and Saudi Arabia). In the Middle East (Pakistan, Afghanistan, Iran, Turkey, Jordan, Saudi Arabia), the A-Iran-05 (ASIA topotype) has dominated for the last three years. However, since August 2007, a new sublineage of this strain (named A-Iran-05ARD-07) has been found in Turkey.

WRL vaccine recommendations have been changed to reflect the variation in FMDV serotype A activity in the Middle East and western Asia. A Iran 96 has been reduced from high to medium priority reflecting continued dominance of the A Iran 05 strain. A22 Iraq vaccine remains at high priority to cover against A Iran 05, although it has been noted that recent Turkish isolates of the A Iran 05 strain (named A-Iran-05ARD-07) showed a poor antigenic match to A22 Iraq vaccine.

VP1 sequencing was completed on three type A viruses received from Iran during the previous reporting period. Two were collected in 2007 and one in 2008. They all belonged to the ASIA topotype, Iran-05 strain.

VP1 sequencing of 6 type O viruses isolated from samples received from Pakistan during the last reporting period was completed. They represented viruses collected in 2007. All belonged to the ME-SA topotype, PanAsia-2 lineage. Those within the PanAsia-2 lineage fell on multiple sub-lineages, some of which included representatives from other countries, indicating a complex epidemiological situation.

VP1 sequencing was completed on one type O virus received from Saudi Arabia which belonged to the ME-SA topotype, PanAsia-2 lineage. This virus was closely related to Saudi Arabian viruses received earlier in the year.

Nine type O and 23 type A viruses, collected in 2008, were received during the previous reporting period from Turkey.

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Complete VP1 sequences of three of the type O and seven of the type A viruses were provided by the FMDI Ankara and the remainder were sequenced in the WRLFMD. All the type O viruses belonged to the ME-SA topotype, PanAsia-2 lineage, while all the type A viruses belonged to a sub-lineage of Iran-05 (called Iran-05ARD-07), which is unique to Turkey.

**Vaccine matching**

Three FMDV type A isolates (A TUR 24/2007; A TUR 7 and 11/2008) from Turkey collected in 2007 and 2008 were further characterised by two dimensional virus neutralisation test. The results showed that A TUR 24/2007 and A TUR 11/2008 were antigenically matched with A22 Iraq 24/64 and A 5925, respectively while A TUR 7/2008 failed to match with A 5925.

**4.4. October - December**

Two FMD type A viruses were isolated from samples received in November. The last known occurrence of type A in Bahrain was in 1965. Both virus isolates belonged to the A-Iran-05 lineage (ASIA topotype).

WRL vaccine recommendations remain unchanged from the previous report. However, the continued dominance of the FMDV serotype A Iran 05 strain and the poor antigenic match to A22 Iraq vaccine demonstrated against recent Turkish isolates of the A Iran 05 strain (named A-Iran-05ARD-07) necessitate further investigation of alternative vaccine strains.

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5 http://www.wrlfmd.org/ref_labs/ref_lab_reports/FAO-OIE%20FMD%20Ref%20Lab%20Report%20Oct-Dec%202008.pdf
5. Conclusions

FMD is endemic in the Middle East and new epidemic strains can be devastating despite using modern and effective vaccines, which create a loss of confidence in the vaccination by animal owners.

FMD still a barrier to internal movement and export.

In the Middle East, the main risks are linked to:
- Live animal trade from areas which are not fully free of FMD (South America, Africa..)
- Permeable borders - Live animal trade in west Asia through to Turkey
- Vaccination programs not appropriate to the emerging strains
- Lack of contingency plans appropriate to risk impact
- Lack of vaccine reserves for exotic strains
- Lack of seromapping

And the major failures are:
- lack of emergency management plans - for new situations (exotic strains)
- lack of effective control on animal movement
- lack of reporting (early warning) which has the result that disease is widespread before detected, excluding any possibility of efficient rapid response
- lack of communication, information exchange and collaboration between neighboring countries which results on a deficient surveillance and monitoring of animal movement in common borders.

6. Usefull references

- OIE – World Animal Health Information Database
- FMD World Reference Laboratory – Pirbright – Middle East reports
  http://www.wrlfmd.org/fmd_genotyping/middle_east.html
- OIE FMD portal
  http://www.oie.int/eng/info_ev/en_FMDHome.htm
- OIE Regional Representation for the Middle East – FMD specific information
  http://www.rr-middleeast.oie.int/viewpage.asp?ID=356
- The European Commission for the control of Foot-and-Mouth disease (EUFMD)