Food and Agriculture Organization of the United Nations

eufmd
european commission for the control of foot-and-mouth disease

GLOBAL Monthly Report

Foot-and-Mouth Disease

Foot-and-Mouth Disease Situation | 2019 | October

Foot-and-Mouth Disease Situation
Food and Agriculture Organization of the United Nations
Monthly Report

October 2019

MAININFORMATION SOURCES USED:

Databases:
OIE WAHIS World Animal Health Information Database
FAO World Reference Laboratory for FMD (WRLFMD)
FAO Global Animal Disease Information System (EMPRES-i)

Other sources:
FAO/EuFMD supported FMD networks
FAO/EuFMD projects and field officers

The sources for information are referenced by using superscripts.
The key to the superscripts is in references.

Please note that the use of information and boundaries of territories should not be considered to be the view of the U.N. Please, always refer to the OIE for official information on reported outbreaks and country status.

Required citation:
FAO/eufmd. 2019. *Global Monthly Report. Foot-and-Mouth Disease Situation - October 2019*. Rome, FAO.

CONTENTS

Please note that the report contains hyperlinks

I. HIGHLIGHTS

This report provides an up-to date summary of the FMD situation in different parts of the world.

During the past few months the WRLFMD has reported test results for samples submitted from Ethiopia, Guinea, Hong Kong SAR, Israel, Nepal, Mauritania, Morocco, Myanmar, Palestinian Autonomous Territories, Pakistan, Tunisia, Turkey, Thailand and Uganda. New sequence data submitted from Namibia (SSARRL, Botswana) and Libya (from IZSLER, Italy) were also analysed. Reports for these samples can be retrieved from the WRLFMD website. Despite the availability of enhanced tools for surveillance highlighted at the recent GFRA meeting in Bangkok, there are still important gaps in our understanding of the way that FMDV lineages are maintained in endemic countries. The OIE/FAO FMD Laboratory Network encourages countries to submit appropriate clinical samples for laboratory analyses including sequencing and vaccine matching (testing is free-of-charge), for further information or assistance with shipments, please contact donald.king@pirbright.ac.uk.

Another important gap is the lack of robust evidence to demonstrate that FMD vaccines can adequately protect against circulating field viruses. The genetic diversity of field viruses circulating in Africa is particularly variable and a paucity of empirical data to define the performance of vaccines has contributed to poor trust in FMD vaccine quality and a lack of investment in FMD vaccines and vaccination programmes across the continent. The WRLFMD and AU-PANVAC have started a two-year OIE Twinning project that will develop improved methods to assess the suitability of FMDV vaccines for African customers. An important component of the project is to define **reference FMDV antigens** that can be used in VNT (and a new generation of ELISAs) to measure heterologous serological responses to FMDV vaccines supplied into the African market. In addition to their use at AU-PANVAC, we imagine that these viruses (and perhaps recombinant capsids) will be made available to FMD Reference Laboratories for use as common antigens - so that vaccine evaluation work (such as PVM) is more harmonised and comparable across different studies. We propose that the composition of the panel (and regional derivatives) will need to be regularly reviewed and adjusted to accommodate new viral lineages, but as a starting point, **we are now seeking your opinions and views about the viruses that should be included in a panel with an East African focus.** In this region, the full extent of viral topotypes/clades is: O/EA-1, O/EA-2, O/EA-3, O/EA-4, A/AFRICA/G-I, A/AFRICA/G-IV, A/AFRICA/G-VII, SAT 1/I, SAT 1/IX, SAT2/IV and SAT 2/VII, but we may need to start by focussing on the most important and widespread lineages. We are planning that we will discuss this topic in more depth at the OIE/FAO FMD Laboratory Meeting in South Korea in December (kindly hosted by APQA). We welcome your feedback on this work, and we request that you let us know if you have any monovalent sera (O, A, SAT1 or SAT2) that could be used to assess the antigenic phenotypes of these reference viruses (minimum 5ml volumes – we can help support the shipping costs!)

Don King (WRLFMD, Pirbright)
November 2019

II. GENERAL OVERVIEW

Pools represent independently circulating and evolving foot-and-mouth disease virus (FMDV) *genotypes; within the pools, cycles of emergence and spread occur that usually affect multiple countries in the region. In the absence of specific reports, it should be assumed that the serotypes indicated below are continuously circulating in parts of the pool area and would be detected if sufficient surveillance was in place (Table 1).*

Table 1: List of countries representing each virus pool for the period 2014 – 2018 (source EuFMD)

POOL	REGION/COUNTRIES	SEROTYPES
1	**SOUTHEAST ASIA/CENTRAL ASIA/EAST ASIA** Cambodia, China, China (Hong Kong, SAR), Taiwan Province of China, Democratic People's Republic of Korea, Republic of Korea, Lao People's Democratic Republic, Malaysia, Mongolia, Myanmar, Russian Federation, Thailand, Viet Nam	**A, Asia 1 and O**
2	**SOUTH ASIA** Bangladesh, Bhutan, India, Mauritius, Nepal, Sri Lanka	**A, Asia 1 and O**
3	**WEST EURASIA & MIDDLE EAST** Afghanistan, Armenia, Azerbaijan, Bahrain, Georgia, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Oman, Pakistan, Palestine, Qatar, Saudi Arabia, Syrian Arab Republic, Tajikistan, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan	**A, Asia 1 and O (SAT 2)***
	NORTH AFRICA Algeria, Egypt, Libya, Morocco, Tunisia	**A, O and SAT 2**
4	**EASTERN AFRICA** Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, Sudan, South Sudan, United Republic of Tanzania, Uganda, Yemen	**O, A, SAT 1, SAT 2 and SAT 3**
5	**WEST/CENTRAL AFRICA** Benin, Burkina Faso, Cameroon, Cabo Verde, Central Afr. Rep., Chad, Democratic Republic of Congo, Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea-Bissau, Guinea, Liberia, Mali, Mauritania, Niger, Nigeria, Sao Tome & Principe, Senegal, Sierra Leone, Togo	**O, A, SAT 1 and SAT 2**
6	**SOUTHERN AFRICA** Angola, Botswana, Malawi, Mozambique, Namibia, South Africa, Zambia*, Zimbabwe	**{O, A}**, SAT 1, SAT 2 and SAT 3**
7	**SOUTH AMERICA** Colombia, Venezuela (Bolivarian Republic of)	**O and A**

*REPORTED ONLY IN OMAN IN 2017

** ONLY IN NORTH ZAMBIA AS SPILL-OVER FROM POOL 4

III. IN THIS REPORT

POOL 1- SOUTHEAST ASIA/CENTRAL ASIA/EAST ASIA

China (Hong Kong, SAR) [1] **–** The FMDV field isolates detected in porcine samples during 2019 did not obtain good matching results in the FMD vaccine matching strain differentiation (VMSD) tests.

Thailand [1] **–** FMDV serotypes A and O detected in the bovine samples collected between 2018 and 2019 were respectively typed as A/ASIA/Sea-97, O/SEA/Mya-98 and O/ME-SA/Ind-2001e. Field isolates belonging to the three topotypes obtained variable results in the VMSD tests in which they were examined.

POOL 2 - SOUTH ASIA

No FMD outbreaks were notified for this Pool for the reporting month.

POOL 3 - WEST EURASIA & MIDDLE EAST

Afghanistan [2] – FMDV ASIA 1 and O were the serotypes detected for this month among the samples analysed by the Central Veterinary Research and Development Laboratory (CVDRL).

Pakistan [3] **–** During the reporting month, FMDV A, Asia 1 and O were the serotypes detected in the 70 outbreaks notified in four different provinces of the country.

POOL 3 – NORTH AFRICA

No FMD outbreaks were notified for this Pool for the reporting month.

POOL 4 - EASTERN AFRICA

Kenya [4] - FMDV serotypes O, SAT 1 and SAT 2 were detected during October 2019 in bovine and porcine samples analyzed by the FMD National Reference Laboratory (FMDNRL), Embakasi, Kenya.

POOL 5 - WEST/CENTRAL AFRICA

Guinea-Bissau [5] – FMDV serotype O was responsible for the outbreaks which were notified in the country between January and April 2019.

POOL 6 - SOUTHERN AFRICA

No FMD outbreaks were notified for this Pool for the reporting month.

POOL 7 - SOUTH AMERICA [5, 6]

No outbreaks are reported for this Pool. FMD in Latin America was last detected in Colombia in October 2018 with outbreaks due to FMDV serotype O, while PANAFTOSA reported historical outbreaks due to serotype A in Venezuela in 2013.

COUNTER

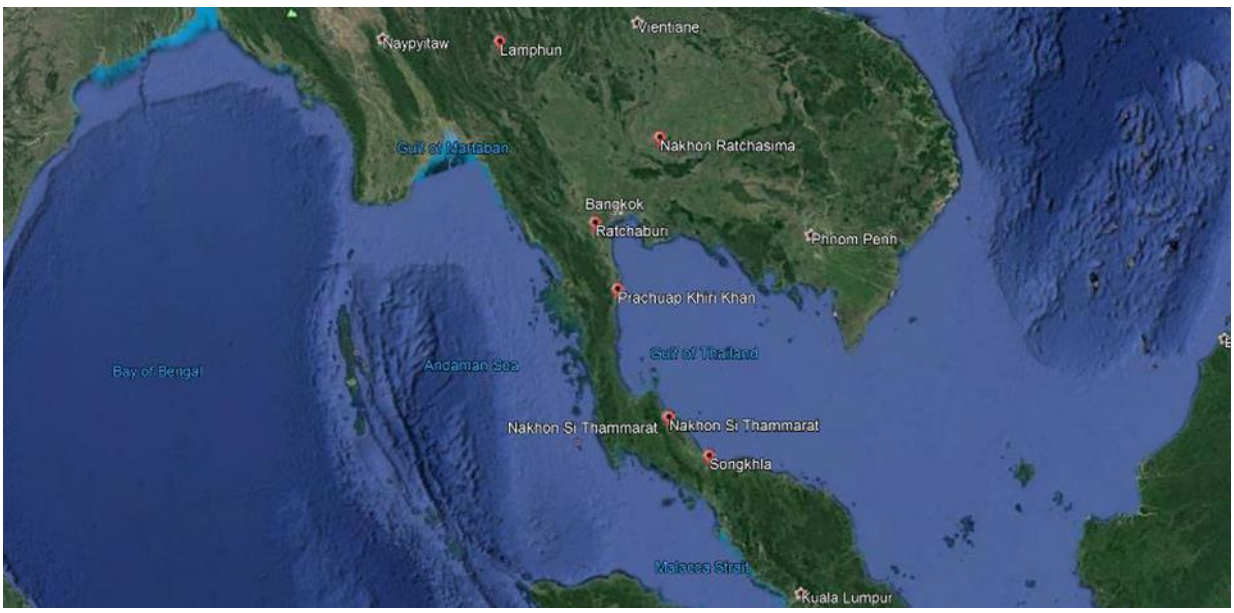
****** 183 MONTHS SINCE THE LAST SEROTYPE C OUTBREAK WAS REPORTED***

IV. DETAILED POOL ANALYSIS

A. POOL 1 – SOUTHEAST ASIA/CENTRAL ASIA/EAST ASIA

SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)		
Country	***Activity***	***Description***
China (Hong Kong, SAR) [1]	***Vacc.***	The field isolates O/HKN/1/2019 and O/HKN/4/2019 detected in the porcine samples collected at Sheung Shui, New Territories between March and May 2019 genotyped as O CATHAY did not obtain good matching results with vaccine strains O 3039, O Manisa and O Tur 5/09. In view of these results, the Special Administrative Region should verify the vaccine strains contained in the vaccine/s used in the country to revaluate its vaccination policies.
Russian Federation [7]	***Surv. & PVM***	The Regional Reference Laboratory for FMD (ARRIAH, Russia) analysed 4 616 sera for post vaccination monitoring purposes and of 7 420 sera from unvaccinated animals to verify their FMD infection status.
Thailand [1]	***Surv.***	The FMDV serotypes A (N° 16 samples) and O (N° 4 samples) detected the twenty bovine samples collected between June 2018 and August 2019 were respectively typed as A/ASIA/Sea-97, O/SEA/Mya-98 and O/ME-SA/Ind-2001e. For A/ASIA/Sea-97, all the field viruses clustered in one group and were closely related with other viruses circulating in the country, suggesting an endemic circulation in this country of this topotype. For O/SEA/Mya-98 topotype, detected in only one sample, this is most closely related to field virus VIT/15/2016 with a % identity of 97.8. While for O/ME-SA/Ind-2001e, detected in three samples, and the viruses belonging to this topotype are most closely related to Zabaikalskiy/3/RUS/2016 isolated in cattle, in the Russian Federation. Location of where the field isolates were collected is reported in Map 1.

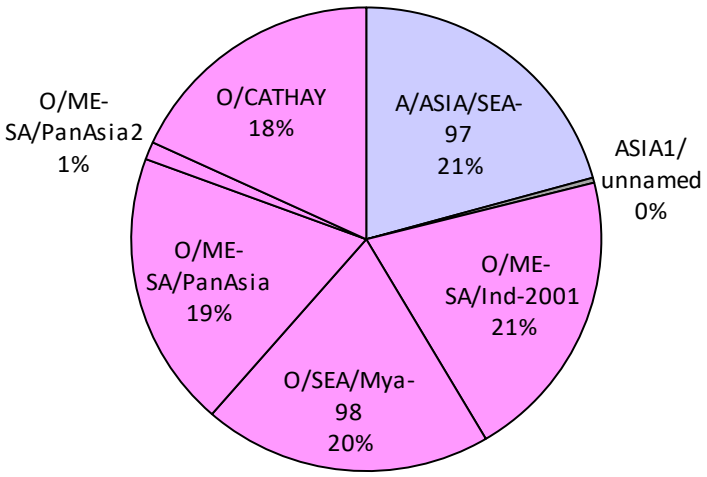
Map 1: location of the areas in Thailand of where the twenty bovine samples were collected between June 2018 and August 2019 which were respectively typed as A/ASIA/Sea-97, O/SEA/Mya-98 and O/ME-SA/Ind-2001e (Source – WRLFMD and Google Earth Pro).



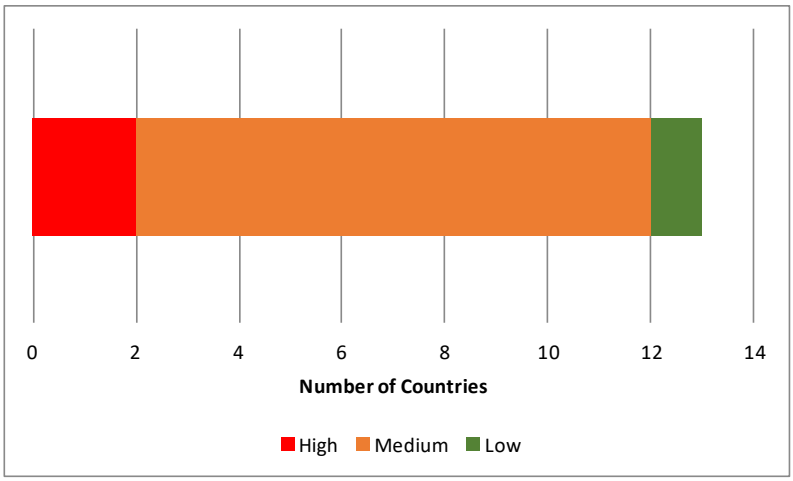
Thailand [1]	***Vacc.***	The field isolates belonging to the three topotypes A/ASIA/Sea-97 and as O/SEA/Mya-98 and O/ME-SA/Ind-2001e were subjected to VMSD tests, with the results: Field isolates A/TAI/7/2019 and A/TAI/8/2019 obtained good matching results with A22 IRQ but not with A Iran 2005 and A/MAY/97 and did not react at all with A TUR 20/06, Field isolate O/TAI/14/2018, genotyped as O/SEA/Mya-98 obtained good matching results with O 3039, and poor good matching results with O Manisa and O Tur 5/09, Field isolate O/TAI/15/2018, genotyped as O/ME-SA/Ind-2001e obtained good matching results with O 3039, O Manisa and O Tur 5/09.

Table 2 and Graph 1: Conjectured circulating FMD viral lineages in Pool 1 (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 13 countries of Pool 1
A	A/ASIA/SEA-97	8
ASIA 1	ASIA1/ unnamed	1
O	O/ME-SA/Ind-2001	8
	O/SEA/Mya-98	6
	O/ME-SA/PanAsia	8
	O/ME-SA/PanAsia2	1
	O/CATHAY	4



Graph 2: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 1 – see Annex for explanation).

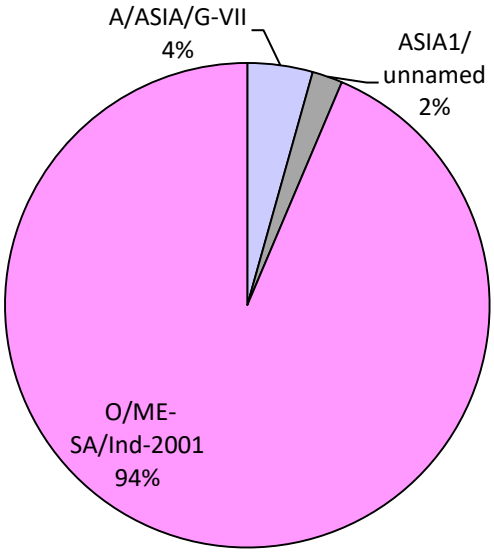


B. POOL 2 – South Asia

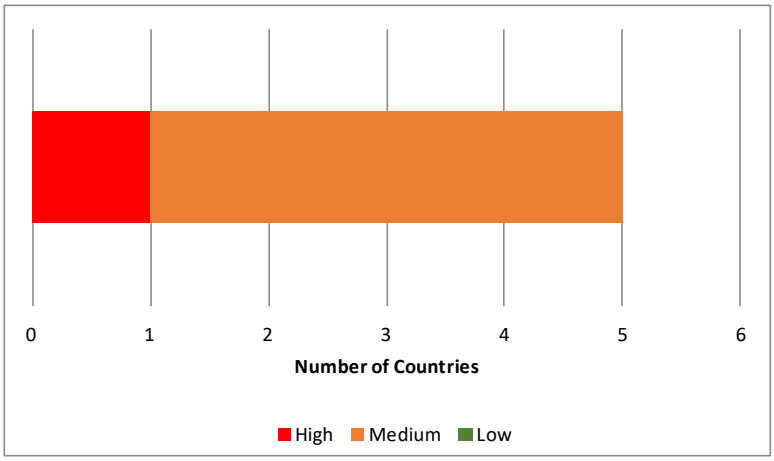
No FMD outbreaks were notified for this Pool for the reporting month.

Table 3 and Graph 3: Conjectured circulating FMD viral lineages in Pool 2 (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 5 countries of Pool 2
A	A/ASIA/G-VII	3
Asia 1	ASIA1/ unnamed	1
O	O/ME-SA/Ind-2001	5



Graph 4: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 2 – see Annex for explanation).



C. POOL 3 – West Eurasia & Middle East

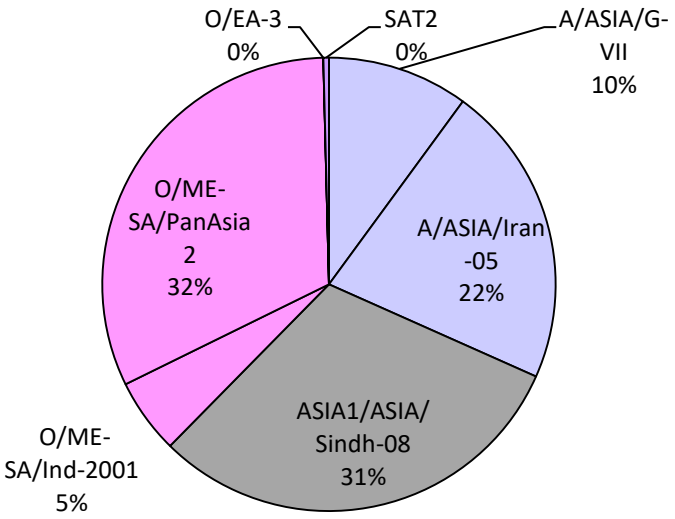
<table>
<tr><th colspan="3">SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)</th></tr>
<tr><th>Country</th><th>Activity</th><th>Description</th></tr>
<tr><td>Afghanistan [2]</td><td>Surv.</td><td>FMDV serotypes ASIA 1 and O were respectively detected in four (31%) and nine (69%) of the 17 samples analysed during October 2019 by the Central Veterinary Research and Development Laboratory (CVDRL).
A/ASIA/Iran-05, Asia 1/ASIA/Sindh-08 and O/ME-SA/PanAsia-2 are the most recent topotypes detected by the WRLFMD in last samples analysed that were collected in the country during 2016 and 2017.</td></tr>
<tr><td>Pakistan [3]</td><td>Surv.</td><td>For the reporting month, FMDV A, Asia 1 and O were the serotypes reported among the 70 outbreaks notified in four different provinces of the country.
A summary of the results of the surveillance conducted under the project “The enhancement of FMD control in Pakistan” funded by Government of Japan and executed by FAO is reported in Table 4 and location of outbreaks is reported in Map 2. FMD training courses were held in Balochistan and Sindh to which 95 veterinarians and 108 veterinary assistants attended and to which sample collection kits were distributed.

Table 4: summary of the outbreaks reported in different provinces of Pakistan during October 2019 (Source – “The enhancement of FMD control in Pakistan” - Dr. Muhammad Afzal, Project Coordinator).
<table>
<tr><th rowspan="2">Province</th><th rowspan="2">District</th><th rowspan="2">Number Outbreaks</th><th colspan="6">Number of Outbreaks due to FMD Virus Serotype(s)</th></tr>
<tr><th>O</th><th>A</th><th>Asia-1</th><th>Mixed</th><th>Not yet typed</th><th>Negative</th></tr>
<tr><td rowspan="7">Punjab</td><td>DG Khan</td><td>1</td><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>-</td></tr>
<tr><td>Layyah</td><td>1</td><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>-</td></tr>
<tr><td>Jhung</td><td>2</td><td>-</td><td>-</td><td>-</td><td>-</td><td>2</td><td>-</td></tr>
<tr><td>Faisalabad</td><td>2</td><td>-</td><td>-</td><td>-</td><td>-</td><td>2</td><td>-</td></tr>
<tr><td>Gujranwala</td><td>3</td><td>-</td><td>1</td><td>-</td><td>-</td><td>-</td><td>2</td></tr>
<tr><td>Sahiwal</td><td>1</td><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>-</td></tr>
<tr><td>Multan</td><td>6</td><td>2</td><td>-</td><td>1</td><td>-</td><td>-</td><td>3</td></tr>
<tr><td>Sindh</td><td>Karachi</td><td>30</td><td>4</td><td>7</td><td>2</td><td>1</td><td>-</td><td>16</td></tr>
<tr><td>Balochistan</td><td>Quetta</td><td>7</td><td>-</td><td>-</td><td>-</td><td>-</td><td>7</td><td>-</td></tr>
<tr><td rowspan="6">Khyber Pakhtunkhwa</td><td>Bannu</td><td>3</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>3</td></tr>
<tr><td>Charsadda</td><td>1</td><td>1</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Noshehra</td><td>1</td><td>-</td><td>-</td><td>1</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Mardan</td><td>2</td><td>-</td><td>-</td><td>--</td><td>-</td><td>-</td><td>2</td></tr>
<tr><td>Swat</td><td>6</td><td>4</td><td>-</td><td>-</td><td>-</td><td>-</td><td>2</td></tr>
<tr><td>Peshawar</td><td>4</td><td>-</td><td>2</td><td>1</td><td>1</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Total</td><td>70</td><td>11</td><td>10</td><td>5</td><td>2</td><td>14</td><td>28</td></tr>
</table>
</td></tr>
</table>

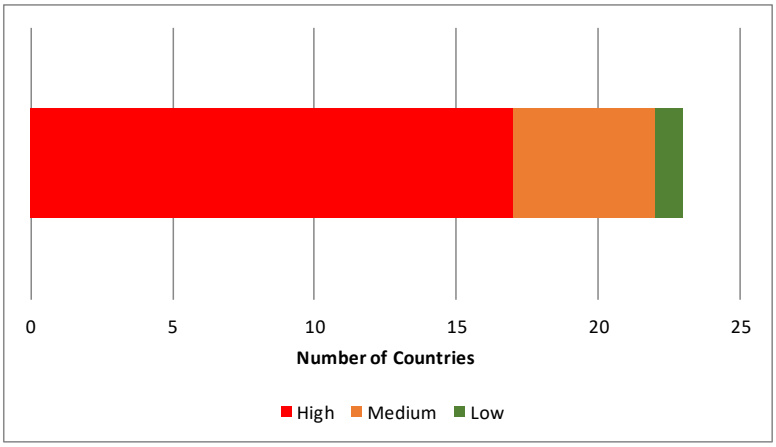
Map 2: location of the areas of the FMD outbreaks that were notified in Pakistan during September 2019 (Source – "The enhancement of FMD control in Pakistan" - *Dr. Muhammad Afzal*, Project Coordinator, Google Earth Pro).

Table 5 and Graph 5: Conjectured circulating FMD viral lineages in Pool 3 - West Eurasia & Middle East (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 24 countries of Pool 3 - West Eurasia
A	A/ASIA/G-VII	17
	A/ASIA/Iran-05	9
ASIA 1	ASIA1/ASIA/Sindh-08	9
O	O/ME-SA/Ind-2001	8
	O/ME-SA/PanAsia2	22
	O/EA-3	2
SAT2	SAT2	1



Graph 6: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 3 – West Eurasia & Middle East (see Annex for explanation).

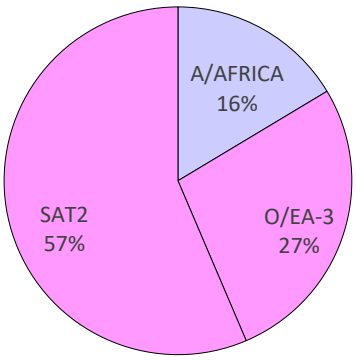


D. POOL 3 – North Africa

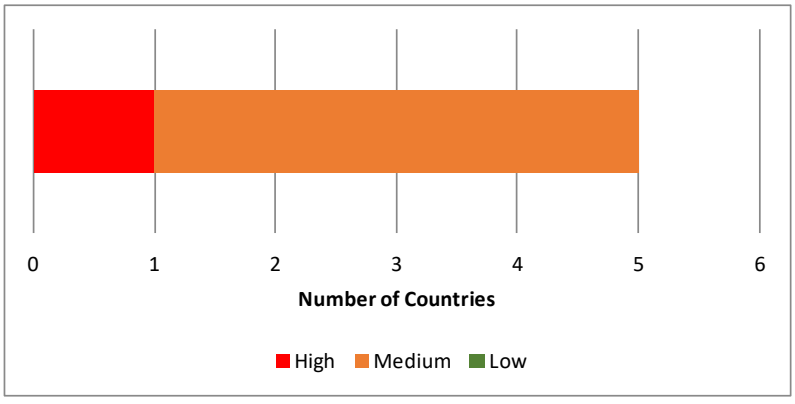
No FMD outbreaks were notified for this Pool for the reporting month.

Table 6 and Graph 7: Conjectured circulating FMD viral lineages in Pool 3 - North Africa (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 5 countries of Pool 3 - North Africa
A	A/AFRICA	4
O	O/EA-3	5
SAT 2	SAT 2	2



Graph 8: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 3 – North Africa (see Annex for explanation).

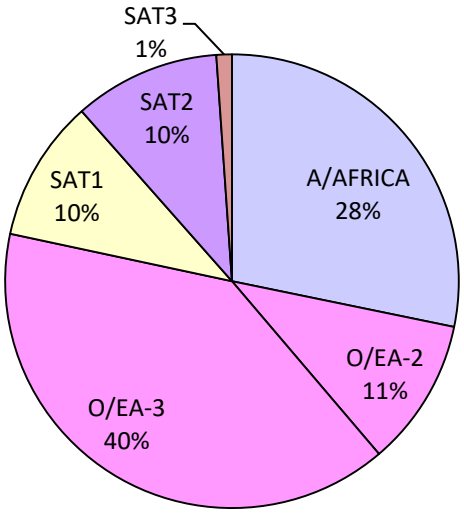


E. POOL 4 – Eastern Africa

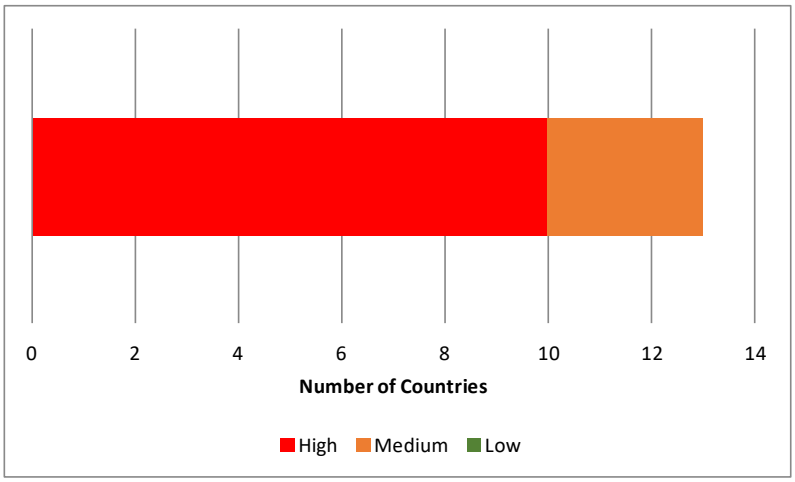
SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)		
Country	*Activity*	*Description*
Kenya [4]	**Surv.**	The FMD NRL, Embakasi, Kenya detected FMDV serotypes O (N°2 samples – 11%), SAT 1 (N° 14 samples – 78%) and SAT 2 (N° 2 samples – 11%) among the 19 samples analysed, of which 17 samples were collected from cattle and two from pigs that were both positive for SAT 1. The diagnostic methods used were virus isolation, antigen ELISA and Real Time RT-PCR. This report is consistent with previous reports. The causative serotypes are believed to circulate endemically in the country. The most recent lineages relative to the above serotypes detected in the country are A/AFRICA/G-I, SAT 1/I (NWZ) and SAT 2/IV/unnamed were in samples collected in 2017.

Table 7 and Graph 9: Conjectured circulating FMD viral lineages in Pool 4 (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 13 countries of Pool 4 -East Africa
A	A/AFRICA	11
O	O/EA-2	4
	O/EA-3	9
SAT1	SAT1	10
SAT2	SAT2	6
SAT3	SAT3	5



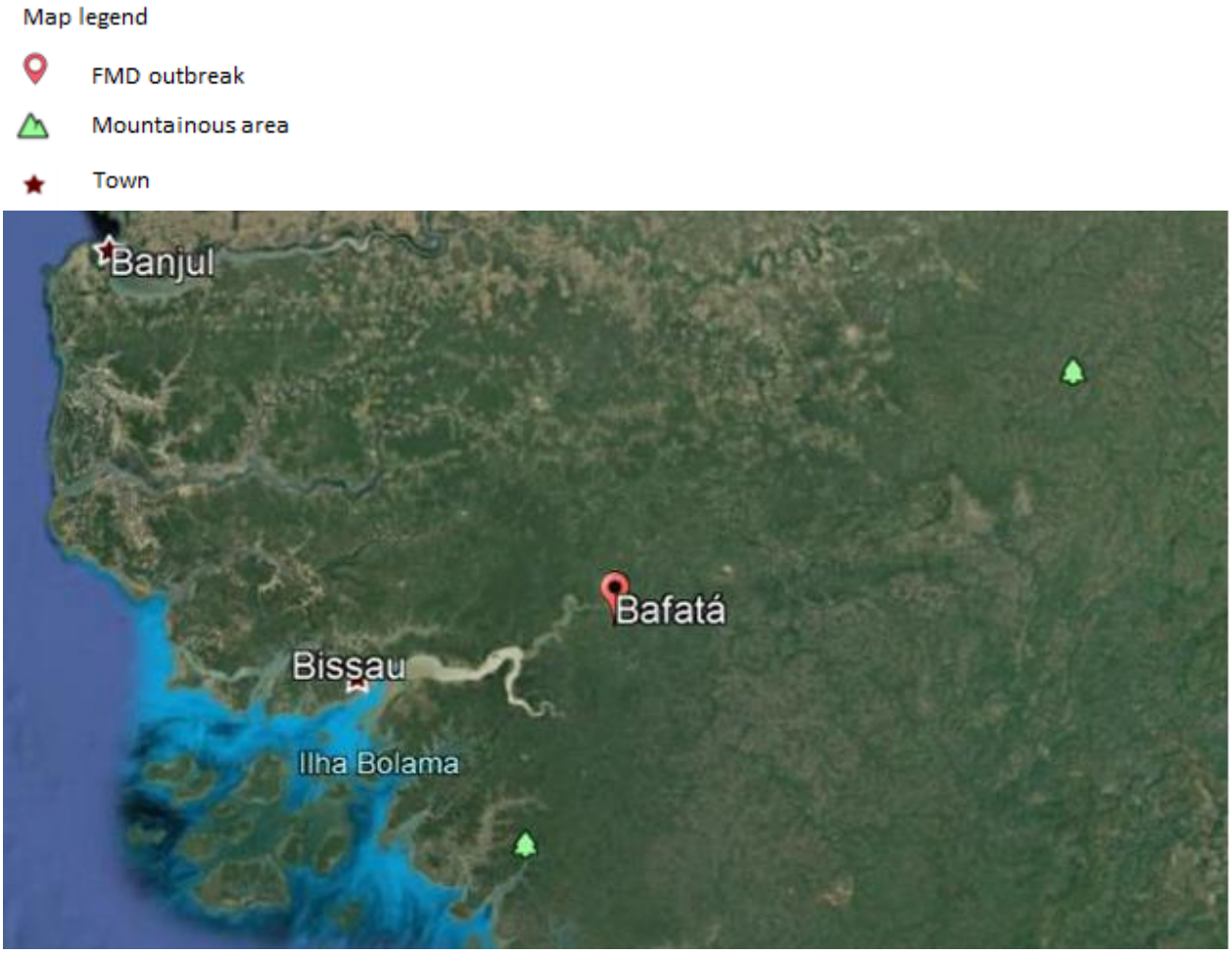
Graph 10: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 4 (see Annex for explanation).



F. POOL 5 – West / Central Africa

OUTBREAKS	
Country	*Description*
Guinea-Bissau [5]	Six FMD outbreaks due to FMD serotype O that were reported as already resolved were notified in cattle of different areas of Bafata between January 2019 and April 2019. The apparent morbidity and mortality rates were both 7.13% in the exposed population consisting of 407 cattle. The source of the outbreaks is unknown and the only preventive measure that will be adopted is vaccination in case a suitable vaccine is available. Location of the outbreaks is reported in Map 3.

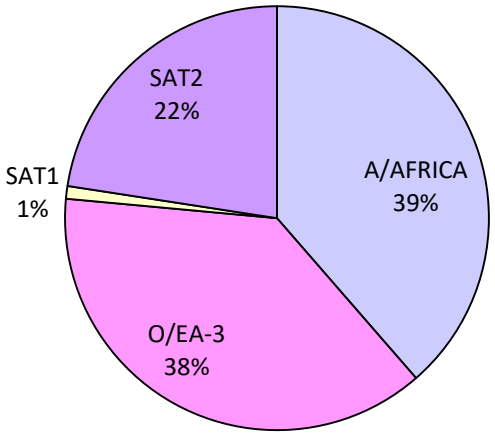
Map 3: location of the FMD outbreaks notified in cattle of different areas of Bafata, Guinea-Bissau between January 2019 and April 2020. (Source – WAHIS and Google Earth Pro).



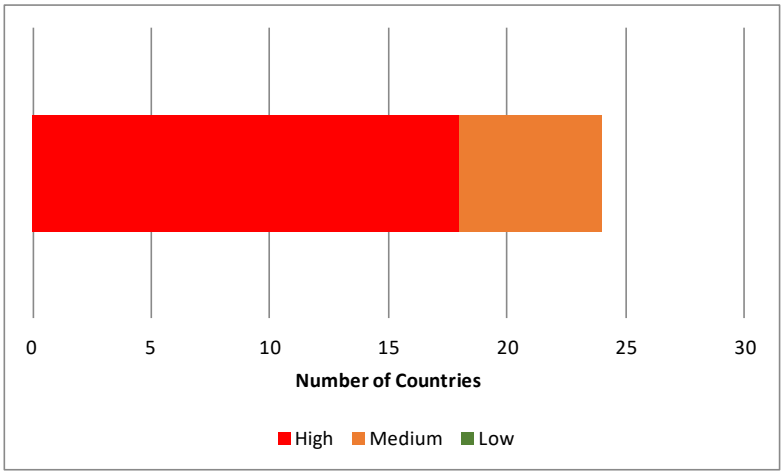
SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)		
Country	*Activity*	*Description*
Cameroon [8]	**Surv.**	The Laboratoire National Vétérinaire (LANAVET), Garoua analysed 450 serum samples using FMD non-structural protein (NSP) ELISA of which 224 (49.7%) were positive while another set of 657 NSP positive sera resulted tested positive for serotype A (N° 332 – 51%%) and for serotype O (N°562 - 86%). The last lineages reported by the WRLFMD as circulating in the country are A/AFRICA/G-IV and SAT 2/VII in samples collected in 2013.

Table 8 and Graph 11: Conjectured circulating FMD viral lineages in Pool 5 (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 24 countries of Pool 5 - West Africa
A	A/AFRICA	13
O	O/EA-3	22
SAT1	SAT1	2
SAT2	SAT2	14



Graph 12: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 5 (see Annex for explanation).

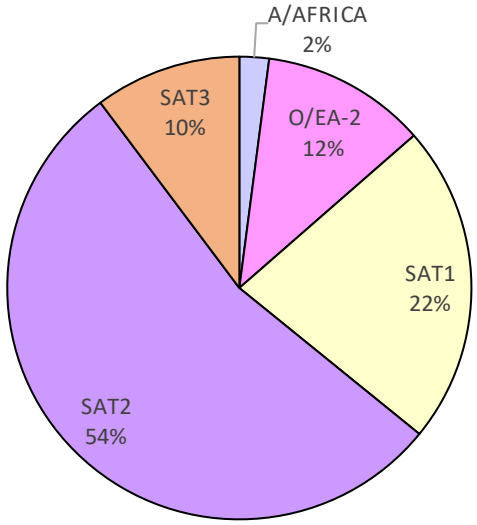


G. POOL 6 – Southern Africa

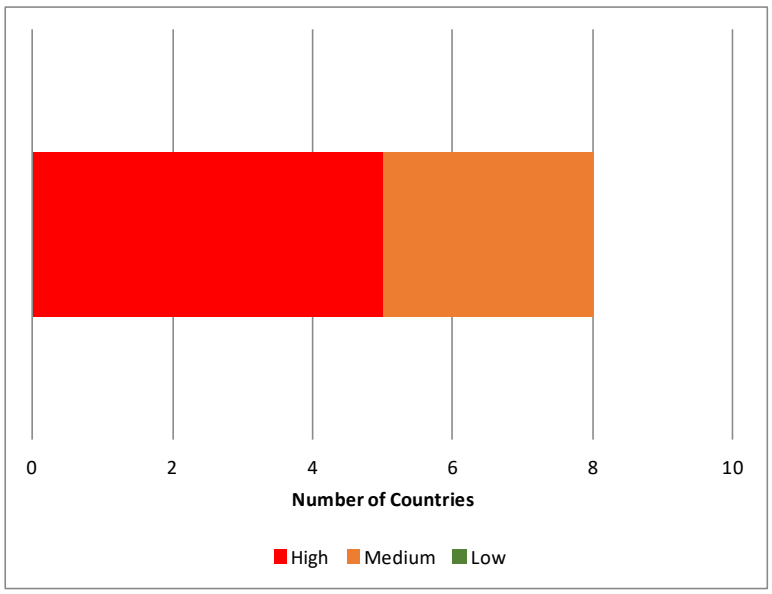
SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)		
Country	**Activity**	**Description**
South Africa [9]	**Surv.**	The Agricultural Research Council, Onderstpoort Veterinary Institute, Transboundary Animal Diseases (OIE Reference Laboratory) tested 48 samples in PCR for research and export purposes were all were negative. The laboratory also analysed 5 922 sera in solid-phase competition ELISA for the detection of antibodies against SAT-1, SAT-2 and SAT-3 and 32 sera in non-structural protein ELISA.
Zimbabwe [5]	**Vacc.**	Following the FMD outbreaks that started in January 2018 for which the serotype that caused the episodes is not known, the country reported that no new cases occurred in the last three months and FMD surveillance and awareness campaigns are on-going even if the episode is considered as resolved. The country also carried out the vaccination of 120 000 and 15 000, cattle respectively in Mashonaland East and West. Details on the vaccine strains used were not reported.

Table 9 and Graph 13: Conjectured circulating FMD viral lineages in Pool 6 (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 8 countries of Pool 6 - Southern Africa
A	A/AFRICA	2
O	O/EA-2	2
SAT1	SAT1	6
SAT2	SAT2	8
SAT3	SAT3	3



Graph 14: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 6 (see Annex for explanation).

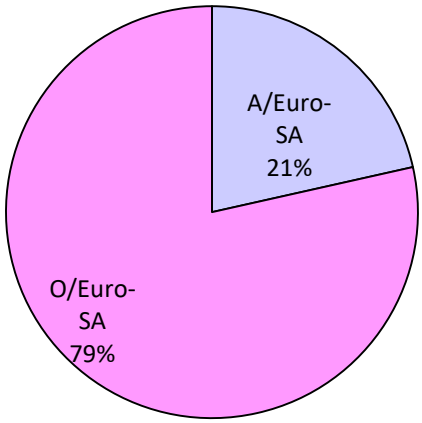


H. POOL 7 – South America

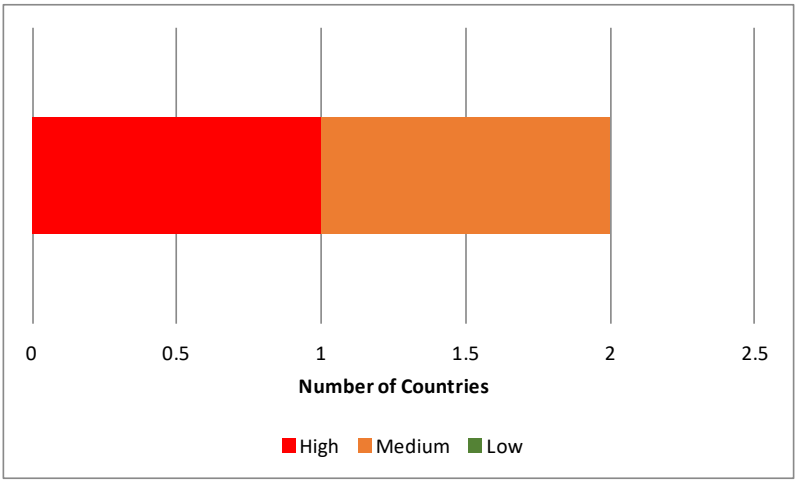
No outbreaks are reported for this Pool during the reporting month.

Table 10 and Graph 15: Conjectured circulating FMD viral lineages in Pool 7 (further detail (country-level) in Annex).

Serotype	Viral lineage	Number of countries where strain is believed to circulate in the 2 countries of Pool 7 -South America
A	A/Euro SA	1
O	O/Euro SA	2



Graph 16: Categorization of the level of uncertainty relative to the prevalence of circulating serotypes/strains defined for each country of Pool 7 (see Annex for explanation).



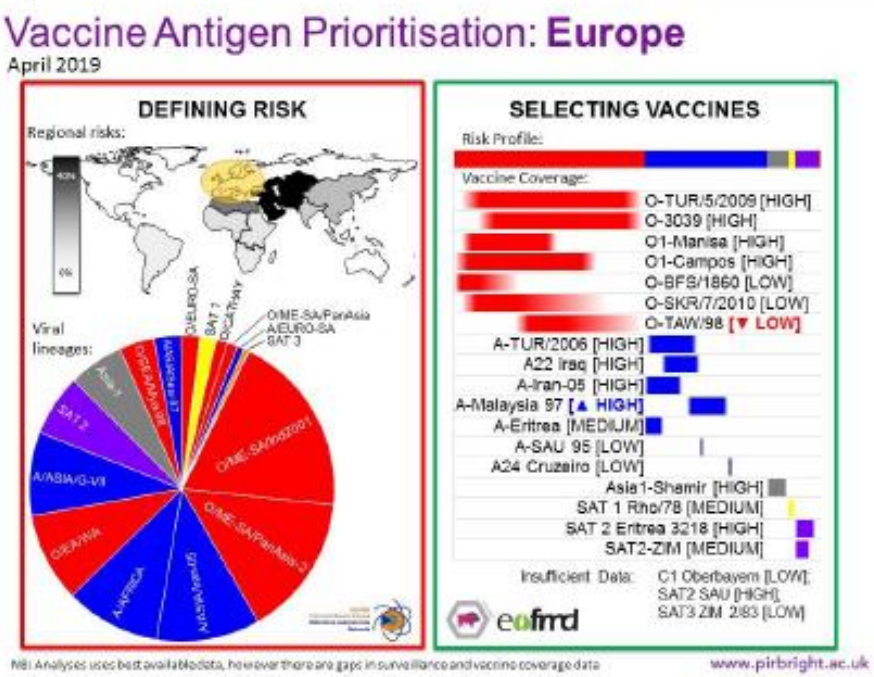
V. OTHER NEWS

[1]The 3rd WRLFMD Quarterly Report for the period July - October 2019 contains the recommendations of FMDV vaccines to be included in antigen banks for Europe. The discussion of Table 10 is contained within the report.

Table 11: Recommendations from WRLFMD® on FMD virus strains to be included in FMDV antigen banks (for Europe) (Source – WRLFMD).

This report provides recommendations of FMDV vaccines to be included in antigen banks. These outputs are generated with a new tool (called PRAGMATIST) that has been developed in partnership between WRLFMD® and EuFMD. These analyses accommodate the latest epidemiological data collected by the OIE FAO FMD Laboratory Network regarding FMDV lineages that are present in different *source regions* (see Table below), as well as available *in vitro, in vivo* and field data to score the ability of vaccines to protect against these FMDV lineages.

Lineage	West Eurasia	East Asia	North Africa	India and Southern Asia	East Africa	West and Central Africa	Southern Africa	South America
O ME-SA PanAsia-2	35	-	-	-	-	-	-	-
O ME-SA PanAsia	-	10	-	-	-	-	-	-
O SEA Mya-98	-	33	-	-	-	-	-	-
O ME-SA Ind2001	6	20	35	80	-	-	-	-
O EA or O WA	3	-	20	-	45	37	-	-
O EURO-SA	-	-	-	-	-	-	-	74
O CATHAY	-	10.5	-	-	-	-	-	-
A ASIA Sea-97	-	25	-	-	-	-	-	-
A ASIA Iran-05	25.5	-	-	-	-	-	-	-
A ASIA G-VII	17.5	-	-	16	-	-	-	-
A AFRICA	-	-	35	-	24	25	-	-
A EURO-SA	-	-	-	-	-	-	-	26
Asia-1	12.5	1.5	-	4	-	-	-	-
SAT 1	-	-	-	-	10	10	27	-
SAT 2	0.5	-	10	-	20	28	57	-
SAT 3	-	-	-	-	1		16	-
C	-	-	-	-	-	-	-	-



The table defines the relative distribution of FMDV lineages in each of the eight *source regions*, while the figure highlights the importance of these *source regions* for **Europe** (using data collected at the EU-RL Workshop); please contact WRLFMD EuFMD for assistance to tailor these outputs to other geographical regions. NB: Vaccine-coverage data presented is based on available data and may under-represent the true performance of individual vaccines.

VI. REFERENCES – Superscripts

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5. http://www.oie.int/animal-health-in-the-world/the-world-animal-health-information-system/data-after-2004-wahis-interface/
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15. ACCRA Veterinary Laboratory (AVL), Ghana - *Dr. Joseph Adongo Awuni*
16. FMD Research Centre, Virology Research Department, National Veterinary Research Institute, Vom, Plateau State, Nigeria - *Dr. Ularamu Hussaini*

VII. Annex

The estimates of the relative prevalence of serotypes and strains presented in the Tables below are based on the best data available to us and we are always trying to improve them. The accuracy of these estimates is only as good as the level of surveillance and reporting permits. Readers with relevant data or information are encouraged to contact EuFMD so that it can be included in the report.

In this report, the N. African countries of Morocco, Algeria, Tunisia and Libya considered together as a separate group, as the epidemiological situation is distinct and of interest to risk managers.

Description of methods

How to interpret the estimates of the relative prevalence of serotypes and strains:

If 100 animals that had been infected with FMD virus in the last 12 months were randomly selected from a country or virus pool:

1. How many animals would be infected with each serotype?
2. Within each serotype, how many would be infected with each virus strain?

Pool-level estimates and assumptions:

As the data required to calculate the relative prevalence of serotypes and strains are not directly available in most countries, they were estimated in 3 steps as follows:

1. First, each country in the pool is assigned a weight according to the number of animals infected with FMD each year:

$$weight_{country\ 1} = \frac{(FMD\ incidence * susceptible\ population)_{country1}}{\sum_{country\ 1}^{country\ n}(FMD\ incidence * susceptible\ population)}$$

   The expected FMD incidence was based on the paper by Sumption *et al* 2008 as follows: i) Low/Sporadic: 0.029 new infections per 1000 animals/year; ii) Medium: 0.458 new infections per 1000 animals/year; iii) High: 1.759 new infections per 1000 animals/year.

   The susceptible livestock population is the sum of sheep, goat, cattle, buffalo and pig populations from FAOStat.

2. For each country, the relative prevalence (RP) of each FMD serotype and strains within serotype is specified for all countries where FMD is believed to circulate endemically. First, the relative prevalence of each serotype is specified by dividing 100 points according to the serotypes that would be represented if 100 animals infected with FMDV in the previous year were randomly selected from the country. Subsequently, the relative prevalence of each serotype is broken down to reflect the distribution of circulating strains within each serotype.

   - If no information is available for a given country, then the circulating serotypes and strains are inferred from the neighbouring countries.
   - If there is only information about presence of serotypes and/or strains, but no data on the relative prevalence, then it is assumed that the serotypes/strains are circulating in equal prevalence.
   - When available, data from the last 24 months are considered, otherwise the most recent data available are used as well as the current situation in the region.
   - In the absence of reporting, a country is considered infected until it (re)gains recognition of freedom from the OIE

3. Data from steps 1 and 2 are combined at pool level according to the following formula:

$$relative\ prevalence_{serotype\ or\ strain} = \sum_{country\ 1}^{country\ n} \left(weight_{country} * RP_{serotype\ or\ strain}\right)$$

Similarly to what is described above are the criteria adopted for the categorization of the level of uncertainty relative to the FMD epidemiological situation defined for each country:

High: There has been little or no reporting of laboratory results (serotype and/or molecular characteristics) from this country within the last 24 months. The serotype/strain distribution is based on inferences from the situation in neighbouring countries;

Medium: There is some information available about the circulating serotypes and/or strains, but from a low number of samples and/or not representative of entire country or different sectors and/or not from the past 24 months;

Low: There is reliable information available about the circulating serotypes and/or strains, obtained from analysis of a large number of samples that represent the country's livestock population.

Legend of icons in the following tables

●	>=95%
◕	>=60%
◑	>=30%
◔	>=5%
○	<5%
	no strain circulating

Table 12: Conjectured circulating FMD viral lineages in each country of Pool 1 (current to October 2019).

			Presumed serotype distribution within country			Presumed viral lineage distribution within country								
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	**A**	**Asia1**	**O**	**A/ASIA/SEA-97**	**ASIA1/ unnamed**	**O/ME-SA/Ind-2001**	**O/SEA/Mya-98**	**O/ME-SA/PanAsia**	**O/ME-SA/PanAsia2**	**O/CATHAY**	**Uncertainty on circulating serotypes**	**Reference**
CAMBODIA	Aug 2018/O, Aug 2016/ A	high	◑		◑	◑				◑			medium	1
CHINA	July 2019/O, May 2017/A	high	◔		◕	◔		◔	◔	◔		◔	medium	1
CHINA (HONG KONG, SAR)	May 2019/O	high			●							●	medium	1
KOREA, DEMOCRATIC PEOPLE'S REPUBLIC OF	Dec 2016/O	high	◑		◕	◑		◕					high	as per REPUBLIC OF KOREA (SOUTH KOREA)
LAO PEOPLE'S DEMOCRATIC REPUBLIC (LAOS)	Dec 2018/A & O	high	◔		◕	◔			◕	◔			medium	1
MALAYSIA	May 2018/O, August 2016/A	medium			●					●			medium	1
MONGOLIA	Jun 2018/O, Sept 2016/A	medium			●			◑	◑	◑			medium	1
MYANMAR	Dec 2018/O, April 2017/Asia 1, Oct 2015/A	high	◔	◔	◕	◔	◔	◑			◑		medium	1, 10
REPUBLIC OF KOREA (SOUTH KOREA)	Jan 2019/O, April 2018/A	low/sporadic	◑		◕	◑		◕					low	1
RUSSIAN FEDERATION	March 2019/O, Oct 2016/Asia 1, Jan 2016/ A	low/sporadic			●			◑	◑	◑			medium	1, 7
TAIWAN PROVINCE OF CHINA	Jun 2015/A	low/sporadic			●							●	high	as per HONG KONG
THAILAND	Jan 2019/A, Dec 2018/O	high	◔		◕	◔		◔	◔	◔			medium	1
VIETNAM	Jan 2019/O, November 2017/A and not typed	high	◑		◕	◑		◔	◑	◔		◔	medium	1

Table 13: Conjectured circulating FMD viral lineages in each country of Pool 2 (current to October 2019).

			Presumed serotype distribution within country			Presumed viral lineage distribution within country				
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	A	Asia1	O	A/ASIA/G-VII	ASIA1/ unnamed	O/ME-SA/Ind-2001	**Uncertainty on circulating serotypes**	**Reference**
BANGLADESH	Jun 2018/A, ASIA 1 and O	high	◔	◔	◕	◔	◔	◕	high	11
BHUTAN	Jan 2019/O, Dec 2017/A	high	◔		◕	◔		◕	medium	1
INDIA	July 2019/O, Apr 2015/A, ASIA 1	high	○		●	○		●	medium	1
NEPAL	June 2019/O, Mar 2018/Asia 1, April 2017/A	high			●			●	medium	1
SRI LANKA	Dec 2018/O	high			●			●	medium	1

Table 14: Conjectured circulating FMD viral lineages in each country of Pool 3 –West Eurasia (current to October 2019).

			Presumed serotype distribution within country			Presumed viral lineage distribution within country									
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	A	Asia1	O	sat2	A/ASIA/G-VII	A/ASIA/Iran-05	ASIA1/ASIA/Sindh-08	O/ME-SA/Ind-2001	O/ME-SA/PanAsia2	O/EA-3	SAT2	**Uncertainty on circulating strains**	**reference**
AFGHANISTAN	Oct 2019/O & Asia 1, Juy 2019/A	high	◑	◔	◑			◑	◔		◑			medium	2
ARMENIA	Dec 2015/A	low/sporadic	◔		◕		◔				◕			high	12
AZERBAIJAN	2007/0	low/sporadic	◑	◔	◑		◔	◑	◔		◑			high	as per Iran
BAHRAIN	Mar 2015/O	low/sporadic	◕		◑		◕			◔	◔			high	as per Saudi Arabia
GEORGIA	2001/ASIA 1	low/sporadic	◔		◕		◔				◕			high	as per Turkey
IRAN, ISLAMIC REPUBLIC OF	Dec 2018/A, Asia 1& O,	high	◑	◔	◑		◔	◑	◔		◑			medium	1
IRAQ	Dec 2018/O, Dec 2016/A	high	◑	◔	◑		◔	◑	◔		◑			high	as per Iran
ISRAEL	May 2019/O, June2017/A	low/sporadic	◔		◕		◔				◑	◔		low	1
JORDAN	Mar 2017/O	low/sporadic	◕		◑		◕			◔	◔			high	1, as per Saudi
KUWAIT	April 2016/O	high	◕		◑		◕			◔	◔			high	1, as per Saudi
KYRGYZSTAN	Sep 2014/A, O	low/sporadic	◔	◕	◔			◔	◕		◔			high	as per Pakistan
LEBANON	2010/not typed	low/sporadic	◔		◕		◔				◕			high	as per Turkey
OMAN	Dec 2018/O, May 2015/SAT 2	high			◑	◑				◔	◔		◑	high	1
PAKISTAN	Oct 2019/A, Asia 1 & O	high	◔	◕	◔			◔	◕	◔	◔			medium	1, 3
PALESTINE	Mar 2019/Untyped, Dec 2017/O, Mar 2013/Sat 2	low/sporadic			●							●		medium	1
QATAR	Dec 2018/O, Oct 2017/A	low/sporadic	◕		◑		◕			◔	◔			high	as per Saudi Arabia
SAUDI ARABIA	Dec 2018/O & Jun 2018/A	high	◕		◑		◕			◔	◔			high	1
SYRIAN ARAB REPUBLIC (SYRIA)	2002/ A & O	high	◔		◕		◔				◕			high	as per Turkey
TAJIKISTAN	Nov 2013/ not typed	low/sporadic	◔	◕	◔			◔	◕		◔			high	as per Pakistan
TURKEY	April 2019/O, Oct 2017/A, May 2015/ Asia 1	high	◔		◕		◔				◕			medium	1
TURKMENISTAN	Not available	low/sporadic	◑	◔	◑		◔	◑	◔		◑			high	as per Iran
UNITED ARAB EMIRATES	Jan 2018/O	low/sporadic	◕		◑		◕			◔	◔			high	as per Saudi Arabia
UZBEKISTAN	Not available	low/sporadic	◑	◔	◑		◔	◑	◔		◑			high	as per Iran

Table 15: Conjectured circulating FMD viral lineages in each country of Pool 3 - North Africa (current to October 2019).

			Presumed serotype distribution within country			Presumed viral lineage distribution within country				
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	**A**	**O**	**SAT 2**	**A/AFRICA**	**O/EA-3**	**SAT 2**	**Uncertainty on circulating serotypes**	**Reference**
ALGERIA	Mar 2019/O, Nov 2016/A, Jun 2016/Sat 2	medium	◑	◕		◑	◕		medium	1
EGYPT	Nov 2018/Sat 2, Feb 2018/A April 2017/O	high	◔	◔	◕	◔	◔	◕	medium	1
LIBYA	June 2019/O	high	◔	◔	◕	◔	◔	◕	high	13, as per egypt
MOROCCO	July 2019/O	low/sporadic		●			●		medium	1
TUNISIA	Feb 2019/O, April 2017/A	low/sporadic	◔	◕		◑	◕		medium	1

Table 16: Conjectured circulating FMD viral lineages in each country of Pool 4 (current to October 2019).

			Presumed serotype distribution within country					Presumed viral lineage distribution within country							
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	**A**	**O**	**sat1**	**sat2**	**sat3**	**A/AFRICA**	**O/EA-2**	**O/EA-3**	**SAT1**	**SAT2**	**SAT3**	**Uncertainty on circulating serotypes**	**Reference**
BURUNDI	Dec 2017 / not available	high	◑	◔	◔	◔		◑		◔	◔	◔		high	as per Tanzania
COMOROS	March 2019/O	high		●					●					high	no data
DJIBOUTI	Not available	high	◔	◕	◔		○	◔		◕	◔		○	high	as per Ethiopia
ERITREA	Oct 2018/not reported	high	◔	◕	◔		○	◔		◕	◔		○	high	as per Ethiopia
ETHIOPIA	Sep 2019/ O, April 2019/A &SAT 2, Feb 2018/SAT 1	high	◔	◕	◔		○	◔		◕	◔		○	medium	1, 15
KENYA	Oct 2019/O, SAT 1 & SAT 2, July 2019/A	high	◔	◕	◔	◔		◔	◕		◔	◔		medium	1
RWANDA	Oct 2018/ A, O , SAT 1 & Sat 2	high	◔	◕	◔	◔		◔	◕		◔	◔		high	as per Kenya
SOMALIA	June 2018/not reported	high	◔	◕	◔		○	◔		◕	◔		○	high	as per Ethiopia
SOUTH SUDAN	June 2017/O & SAT 2, Mar 2018/A Dec 2018/ not sampled	high		●						●				high	1
SUDAN	Dec 2018/ not sampled, May 2017/O	high	◑	◔		◔		◑		◔		◔		medium	1
TANZANIA, UNITED REPUBLIC OF	Dec2018/O, Nov2018/ A & SAT 2, Sep 2018/SAT 1	high	◑	◔	◔	◔		◑		◔	◔	◔		high	1
UGANDA	Feb 2019/A & O, July 2017/SAT1, Jan 2015/SAT 3, July 2015/ SAT 2	high	◑	◑	◔	◔		◑	◑		◔	◔		high	1, as per Kenya
YEMEN	Dec 2016/not sampled	high	◔	◕	◔		○	◔		◕	◔		○	high	as per Ethiopia

Table 17: Conjectured circulating FMD viral lineages in each country of Pool 5 (current to October 2019).

			Presumed serotype distribution within country				Presumed viral lineage distribution within country					
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	**A**	**O**	**sat1**	**sat2**	**A/AFRICA**	**O/EA-3**	**SAT1**	**SAT2**	**Uncertainty on circulating serotypes**	**Reference**
BENIN	Dec 2017/O, SAT 1 &SAT 2, Apr 2017/A	high	◔	◔	◔	◔	◔	◔	◔	◔	high	5
BURKINA FASO	Dec 2018/not sampled, Aug2018/O	high	◑	◑		◑	◑	◑		◑	medium	5, as per Mali
CAMEROON	Dec 2019/untyped, Nov 2014/O, SAT 2, May 2014/SAT 1, Apr 2014/ A	high	◑	◑		◔	◑	◑		◔	high	5, 8
CAPE VERDE	Not available	low/sporadic		●				●			high	as per Senegal
CENTRAL AFRICAN REPUBLIC	Not available	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
CHAD	Dec 2018/Not sampled	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
CONGO	Not available	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
CONGO, DEMOCRATIC REPUBLIC OF	Jun 2018/A, O & Sat 1	high	◑	◑	◑		◑	◑	◑		high	5
COTE D'IVOIRE	Jun 2018/O	high		●				●			high	5, as per Guinea
EQUATORIAL GUINEA	Jun 2015/Disease suspected	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
GABON	Not available	high	◑	◑		◔	◑	◑		◔	high	
GAMBIA	Dec 2018/O	high		●				●			medium	5
GHANA	Dec 2018/SAT 2, Sep 2018/ O	high		◑		◑		◑		◑	high	1,5, 15
GUINEA	Dec 2018/O	high		●				●			medium	5
GUINEA-BISSAU	April 2019/O	high		●				●			high	as per Guinea
LIBERIA	Not available	high		●				●			high	as per Guinea
MALI	Oct 2018/O, Jun 2018/A & SAT	high	◑	◑		◑	◑	◑		◑	high	5
MAURITANIA	Aug 2018/O, Dec 2014/SAT 2	high				●				●	medium	1, 5
NIGER	Dec 2015/O	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
NIGERIA	Sep 2019/untyped, June 2019/A, Sep 2018/O &Sat 2, Sept 2016/ SAT 1	high	◑	◑		◔	◑	◑		◔	high	1, 5, 16
SAO TOME AND PRINCIPE	Not available	0									high	no data available
SENEGAL	Nov 2018/A, O & Sat 2, Jun 2018/ Sat 1	high		●				●			medium	1
SIERRA LEONE	Aug 2018/O	high		●				●			medium	as per Senegal
TOGO	Dec 2017/ not sampled, Dec 2016/ O & Sat 1	high	◑	◑		◔	◑	◑		◔	high	5, as per Nigeria

Table 18: Conjectured circulating FMD viral lineages in each country of Pool 6 (current to October 2019).

			Presumed serotype distribution within country					Presumed viral lineage distribution within country						
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	**A**	O	SAT1	SAT2	SAT3	A/AFRICA	O/EA-2	SAT1	SAT2	SAT3	**Uncertainty on circulating serotypes**	**Reference**
ANGOLA	April 2016/SAT 2	high		◑	◔	○	◔		◑	◔	○	◔	high	as per Zambia
BOTSWANA	June 2018/SAT 2, Aug 2015/SAT 1	medium				●					●		medium	1
MALAWI	Apr 2019/A, SAT 2, June 2016/SAT 1	medium	◔		◔	◔		◔		◔	◔		high	1
MOZAMBIQUE	May 2019/ Typing pending, Oct 2017/SAT 2, May 2015/ SAT 1	high				◕	○				◕	○	high	1
NAMIBIA	Aug 2019/typing pending, Sep 2017/SAT 2, May 2015/SAT 1	medium			◑	◑				◑	◑		high	1
SOUTH AFRICA	Sep 2019/SAT 2, Oct 2017/SAT 1, Dec 2015/SAT 3	medium			○	◕				○	◕		high	1, 9
ZAMBIA	Aug 2019/O, Apr 2019/SAT 2,Feb 2019/ A, May 2017/SAT 3, Jan 2013/SAT 1	medium	○	◑	○	○	◔	○	◑	○	○	◔	medium	1
ZIMBABWE	Jun 2019/SAT 2, April 2019/SAT 1, Jun 2013/SAT 3	high			◑	◑				◑	◑		medium	1, 5

Table 19: Conjectured circulating FMD viral lineages in each country of Pool 7 (current to October 2019).

			Presumed serotype distribution within country		Presumed viral lineage distribution within country			
Country	**Last Outbreak Repoted/Serotype#**	**FMD incidence rate**	A	O	A/Euro SA	O/Euro-SA	**Uncertainty on circulating serotypes**	**Reference**
VENEZUELA	Oct 2018/O	medium	◑	◑	◑	◑	high	2, 6
COLUMBIA	2011/O, 2013/A	medium		●		●	medium	2

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