Food and Agriculture Organization of the United Nations

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

GLOBAL Monthly Report

Foot-and-Mouth Disease

Foot-and-Mouth Disease Situation | 2019 | June

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

June 2019

MAIN INFORMATION 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)

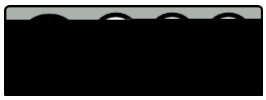
Other sources:

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 June 2019*. Rome, FAO.



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Please note that the report contains hyperlinks

I. HIGHLIGHTS

As the Global intelligence focal point (GIFP) for pool 4, and a Senior livestock health scientist in the progressive control of FMD and other TADs in Uganda, I am profoundly humbled to be the guest editor of the June 2019 Global Monthly report. This report has been instrumental in availing us with the essential information on the FMD situation worldwide, the trends, circulating FMD strains and lineages that are prevailing on the continent.

The GIFP programme involves reviewing and triangulating FMD risk information, not only from our countries but also around the entire region. This programme has enhanced the development of networks and collaborations with field epidemiologists, Heads of diagnostic laboratories and CVOs that are vital in availing information for clarifying interpretations on the reported FMD events. Through this network, the key informants in the region are able to know the FMD strain movements across the entire region. Such in-depth engagements with the different risk managers and stakeholders have stimulated free sharing of information across the different countries. As a result, there is improvement in the risk assessments and response capacity for countries that were previously not collecting and submitting samples. Consequently, the GMR is now able to track the true FMD picture, with its relative information gaps, and serotypes in the individual countries, that allows the regular FMD risk assessments within the regions, improve regional cooperation in information sharing even for other TADS and reduce the risk of their incursions into the geographically defined free areas.

Pool 4 experiences multiple FMD disease outbreaks and harbours the highest number and diversity of FMD virus serotypes, with multiple host species involved. Contrary to findings in Pool 6, there is no evidence of infection from wildlife, and most outbreaks in cattle appear to sweep slowly across the region, through a sequence of dominant serotypes (O, A, SAT1 and SAT2). Since January 2019, virus typing and isolation reports from samples submitted to the WRLFMD laboratory showed predominantly serotypes O (lineages EA-2, 3 and 4; topotype A/AFRICA/G-1/G-VI and recently a SAT 2 from Kenya. However, serotypes O and A have never been isolated from buffalo and wildlife.

In Pool 4, cattle rather than wildlife appear to drive most FMD transmissions due to livestock-related factors such as inadequate control on livestock movements, with pastoralists' animals searching for pastures in the dry seasons, unregulated livestock trade internally and across borders, live animals exchanges for gifts and offers, and backyard slaughters. Effective control measures in this pool are still limited by absence of effective policies and strategies for FMD control, poor livestock identification systems, lack of information on circulating variants and strains in small ruminants as well as lack of quality vaccines tailored to the circulating FMD virus strains and the limited understanding of the role of buffalo in FMD livestock epidemiology.

Active surveillance should cover other susceptible species like small ruminants and pigs. To improve movement control in and across borders, Governments should boost FMD diagnostic capacities at different levels to screen animals before livestock movements, emphasize veterinary certification and raise the penalties for non-compliers. More timely sampling and identification of the epidemic serotypes could allow proactive vaccination ahead of these waves of infection, and free knowledge sharing will assist in mitigating further impacts. Thanks for EU-FMD for the different trainings including real-time trainings held in Uganda (in Masindi and Mbarara so far) to improve knowledge sharing and enhance capacity building.

Thanks again for allowing me to share my knowledge on this comprehensive report
Moses Tefula Dhikusooka
EuFMD Global Intelligence Focal Point for FMD Pool 4, Eastern Africa June 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 – colour pools as in Map	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

Myanmar [1] **–** FMDV serotype O was detected in the cattle samples collected between 2013 and 2018.

POOL 2 - SOUTH ASIA

Nepal [2] **–** FMDV serotype O continues to be the only serotype detected in the country.

POOL 3 - WEST EURASIA & MIDDLE EAST

Afghanistan [3] – The Central Veterinary Research and Development Laboratory (CVDRL) detected FMDV serotypes ASIA 1 and O among the samples analysed during the reporting month.

Israel [1] – Sublineage O/ME-SA/PanAsia-2^{QOM15} was detected among the cattle samples collected between January and May 2019.

Pakistan [14] **–** Twenty eight FMD outbreaks were reported during June in the provinces of Punjub, Sindh and Baluchistan. Serotyping of the FMDVs responsible for these outbreaks is ongoing.

POOL 3 – NORTH AFRICA

Libya [4] **–** Clinical FMD outbreaks were notified for the reporting month in dairy cattle in various regions of the country.

Morocco [4] – Five outbreaks due to FMDV serotype O were reported during May 2019 in sheep and goats at Fès-Meknes.

POOL 4 - EASTERN AFRICA

Kenya [5] - The FMD National Reference Laboratory (FMDNRL), Embakasi, Kenya detected FMDV SAT 2.

Uganda [1] **–** FMDV field isolates belonging to serotypes A and O did not obtain good matching results in the vaccine matching strain differentiation tests (VMSD) conducted.

POOL 5 - WEST/CENTRAL AFRICA

Nigeria [6] – The National Veterinary Research Institute Vom, Nigeria reported a suspect of FMD at Jos South L.G.A Plateau State.

POOL 6 - SOUTHERN AFRICA

No outbreaks were notified in this region for the reporting month.

POOL 7 - SOUTH AMERICA [1, 7]

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

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

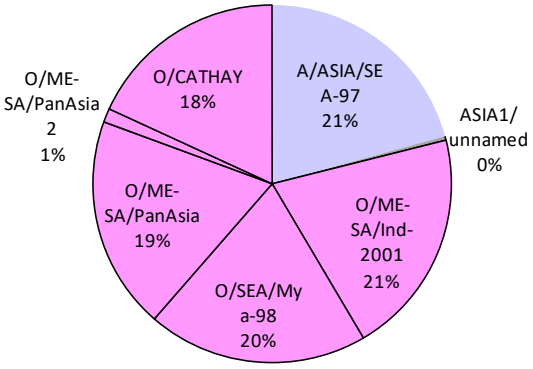
IV. DETAILED POOL ANALYSIS

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

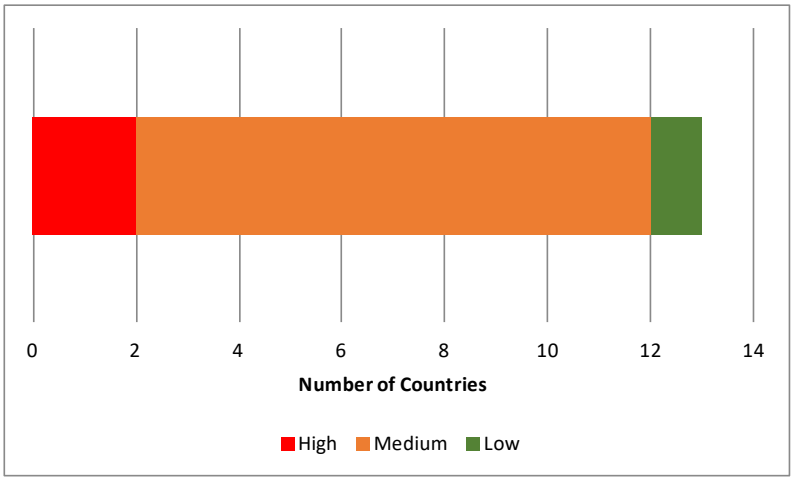
SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)		
Country	*Activity*	*Description*
Myanmar [1]	Surv.	Fifteen bovine samples were collected between November 2013 and December 2018 of which twelve were positive for FMDV genome. Genotyping was possible for only two samples and were identified as O/SEA/Mya-98, from the only sample collected in 2013, and O/ME-SA/Ind2001e from one of the ten samples collected during 2018. For O/SEA/Mya-98 the closest field virus not pertaining to the country is represented by that detected in Vietnam in 2005 (VIT/6/2005), with a sequence identity (seq id) of 93.5%, while for O/ME-SA/Ind2001e the closest field virus not pertaining to the country is Zabaikalskiy/3/RUS/2016, with a seq id of 97.8%. Interpretation: This is the first report of O/ME-SA/Ind2001e in the country which however has been reported in other neighbouring countries of the same virus pool. Location of collection of the genotyped samples is shown in Map 1. **Map 1**: location of collection of samples in which O/SEA/Mya-98 (blue icon) and O/ME-SA/Ind2001e (yellow icon) were detected, respectively at Ayeyarwaddy and Rakhine (Sorce – WRLFMD, Google Earth Pro). 

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).

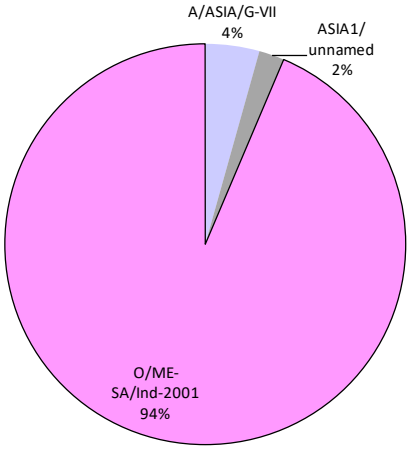


B. POOL 2 – South Asia

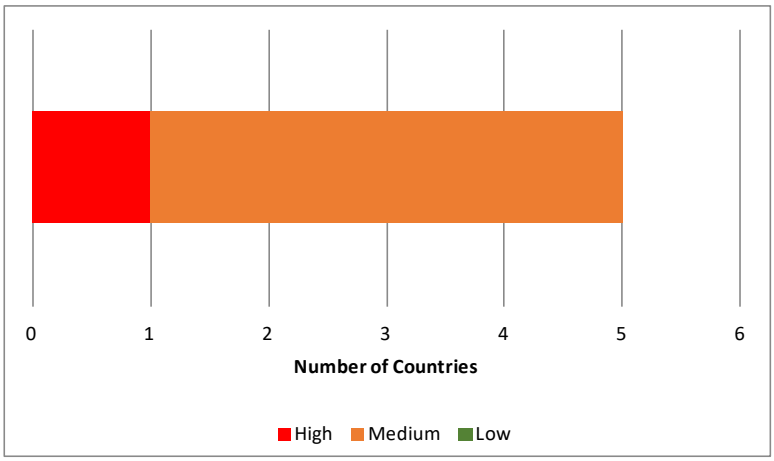
SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)		
Country	*Activity*	*Description*
India [8]	Surv. and PVM	The ICAR-Directorate of Foot and Mouth Disease, Mukteswar, India examined 394 serum samples for FMDV NSP antibodies as part of the National FMD serosurveillance activities while 17,802 serum samples were analysed to assess the antibody levels as part of the National FMD Control Programme. Probang samples were also collected and are undergoing analyses to verify the presence of the carrier state of animals. The sublineages currently circulating in the country are represented by O/ME-SA/2001d and O/ME-SA/2001e as described in the latest issue of the ICAR-DFMD Annual Report of 2017-18.
Nepal [2]	Surv.	The Foot and Mouth Disease and TADS Investigation Laboratory, Nepal continues to detect the circulation in the country of only FMDV serotype O and the lineage belonging to this serotype that was last reported in the 44 samples that were collected from buffaloes, cattle, goats and pigs between April 2018 to March 2019 was exclusively represented by O/ME-SA/2001e.

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

OUTBREAKS

Country | *Description*

Pakistan [14]

Twenty eight FMD outbreaks were reported during June in the provinces of Punjub, Sindh and Baluchistan for which serotyping of the FMDVs responsible for these outbreaks is ongoing.
Number of outbreaks reported for the various provinces and their location are reported in Table 4 and Map 3.
A/ASIA/Iran-05, ASIA 1/ASIA /Sindh-08 and O/ME-SA/PanAsia-2 were lineages last reported in the country by the WRLFMD in samples collected in the country during 2016 and 2017.

Interpretation This report is consistent with previous reports. Different serotypes of FMDV are believed to circulate endemically in the country.

Province	District	Number Outbreaks
Punjab	Muzaffargarh	1
	Rawalpindi	1
	Jhelum	1
	Lahore	2
	Gujrat	1
	Gujranwala	1
	Okara	1
	Jhung	5
	Chiniot	1
Sindh	Karachi	11
Baluchistan	Quetta	3
Total		**28**

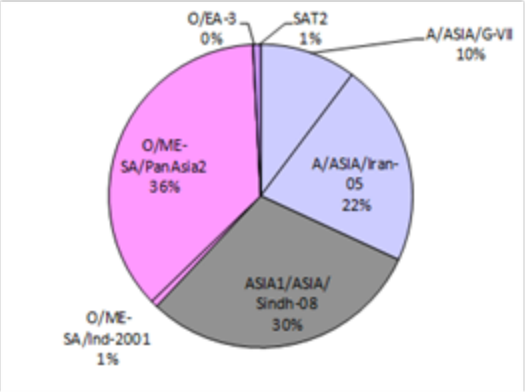
Table 4: number of outbreaks reported in different provinces of Pakistan during June 2019 (Source – Progressive Control of Foot and Mouth Disease in Pakistan, *Dr. Muhammad Afzal*, Project Coordinator).

Map 2: location of outbreaks reported in Pakistan during June 2019 (Source – Progressive Control of Foot and Mouth Disease in Pakistan, *Dr. Muhammad Afzal*, Project Coordinator, Google Earth Pro).

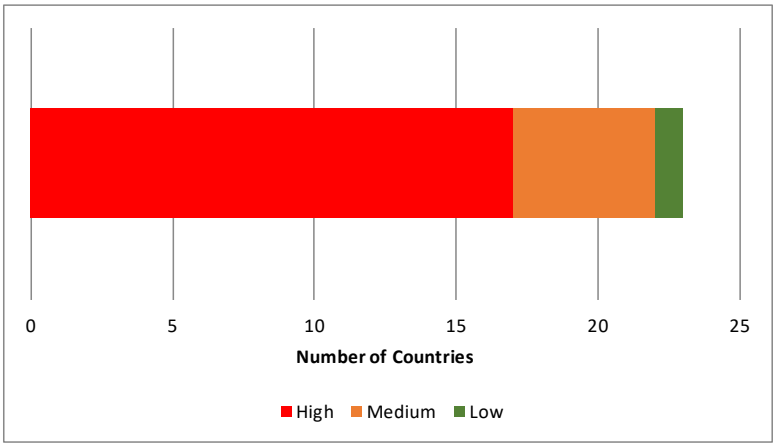
SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)		
Country	*Activity*	*Description*
Afghanistan[3]	Surv.	The CVDRL, Afghanistan detected FMDV serotypes ASIA 1 and O respectively in 22 (62.85%) and six (17.15%) of the samples analysed, while for seven (20%) samples, although these were positive for FMDV, their serotyping was not achieved. A/ASIA/Iran-05 and O/ME-SA/PanAsia-2 are the most recent lineages detected by the WRLFMD in samples collected in the country during 2018.
Israel [1]	Surv.	Of the 27 samples collected from cattle between January and May 2019 that were submitted for genotyping, O/ME-SA/PanAsia2^{Qom15} was detected in 23 of these. All the detected field isolates that formed two distinct genetic groups were closely related to the ones that were lately circulating in the country. Location of where the positive samples were collected is shown in Map 4. Map 4: location of collection of samples in which O/ME-SA/PanAsia2^{Qom15} was detected (Source – WRLFMD, Google Earth Pro) 
Palestine [1, 4]	Surv.	Following the outbreaks that started in October 2018, the country is proceeding with the vaccination of 293 small ruminants with an inactivated bivalent vaccine containing FMDV serotypes A and O. No new FMD cases were reported and for this the event is considered as resolved while various control measures, including control of wildlife reservoirs, are still active. Of the four samples collected in Hebron during February (N° 2 from cattle) and April (N° 2 from goat) 2019, O/ME-SA/PanAsia2^{Qom15} was detected only in the latter species. The field strains with the highest seq id (98.7%) had been detected in Israel during 2018.

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	6
	O/ME-SA/PanAsia2	21
	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

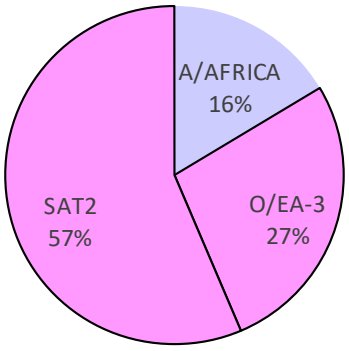
OUTBREAKS	
Country	*Description*
Serotype O in Libya [4]	The country is reporting in different localities the presence of clinical symptoms of FMD in dairy cattle. Samples were collected from these episodes and were forwarded as FTA cards to the Istituto Zooprofilattico Sperimentale della Lombardia dell'Emilia Romagna, Bresca, Italy (OIE/FAO Reference Laboratory) as the necessary diagnostic material is at present unavailable in the country. *Interpretation:* This report is a continuation of that notified in April 2019. More epidemiological data and information on the serotype involved is required to interpret the significance of the event.
Serotype O in Morocco [4]	Five FMDV outbreaks were notified during May 2019 in small ruminants on multispecies farms at Fès-Meknès. FMD diagnosis was confirmed by the Meknes Regional Laboratory for Analysis and Research on May 5th 2019 using real-time reverse transcriptase/polymerase chain reaction. Apparent morbidity and mortality were respectively 16.22% and 3.93% in sheep and 2.29% and 1.43% in goats. Location of outbreaks is available at the following link: https://www.oie.int/wahis_2/public/wahid.php/Reviewreport/Review?page_refer=MapFullEventReport&reportid=30784.

	The source of the outbreaks is unknown and control measures (confinement, isolation, disinfection, destruction of dead animals) are being applied at outbreak level. A vaccination campaign using a bivalent O and A vaccine adapted to the epidemiological context prevailing in the region was launched on 17 June 2019 including all sheep and goats and the six-month booster vaccination of cattle. *Interpretation:* These outbreaks are a continuation of those that were reported in January 2019 after an absence of four years of FMD; serotype O has also been reported in other countries of the same virus pool

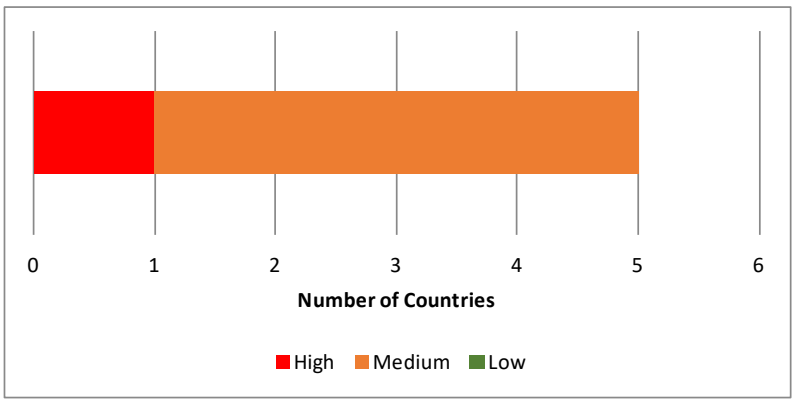
SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)		
Country	*Activity*	*Description*
Algeria [4]	Surv.	No new outbreaks were reported for the current month, however the previous events are still ongoing and the country continues to adopt animal movement control, surveillance inside and outside the containment and the protection zones and vaccination in response to the outbreaks.

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).

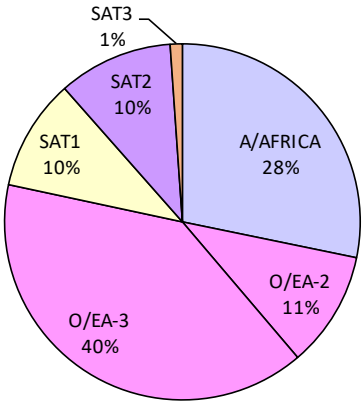


E. POOL 4 – Eastern Africa

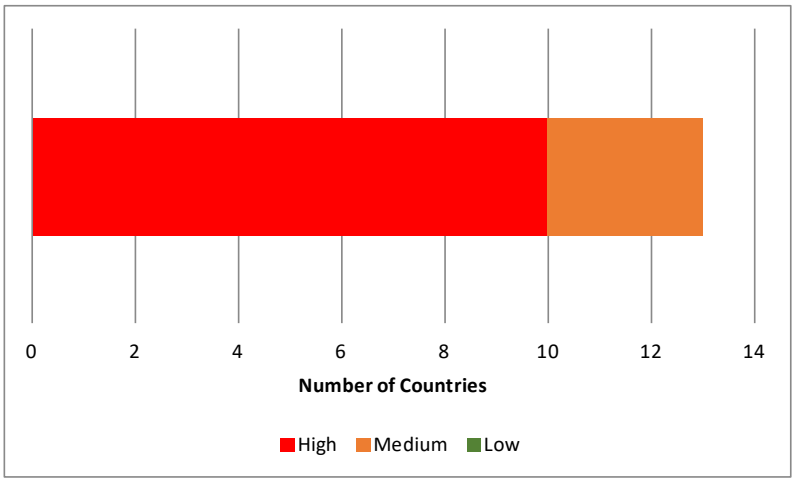
SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)		
Country	*Activity*	*Description*
Kenya [5]	Surv., vacc.	The FMD NRL, Embakasi, Kenya, reported the detection of FMDV serotype SAT 2 in the bovine sample analysed. The most recent lineages detected in the country are A/AFRICA/G-I and SAT 2/IV/unnamed in samples collected in 2017.
Uganda [1]	Vacc.	Field isolates belonging to lineage A/AFRICA/G-I (A/UGA/28/2019 and A/UGA/42/2019), and O/EA-2 (O/UGA/10/2019) did not obtain good matching results with any of the vaccine strains used in the VMSD tests. A Iran 2005, A TUR20/06, A/ERI/3/98 and A/GVII were the vaccines strains used for serotype A, while O 3039, O Manisa and O TUR5/09 were those used for serotype O.

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-EA2	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).

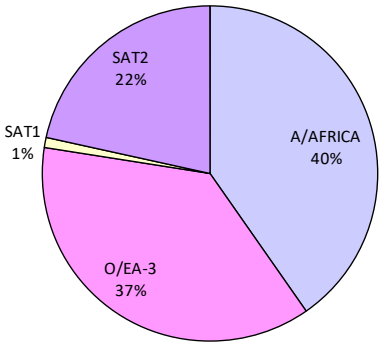


F. POOL 5 – West / Central Africa

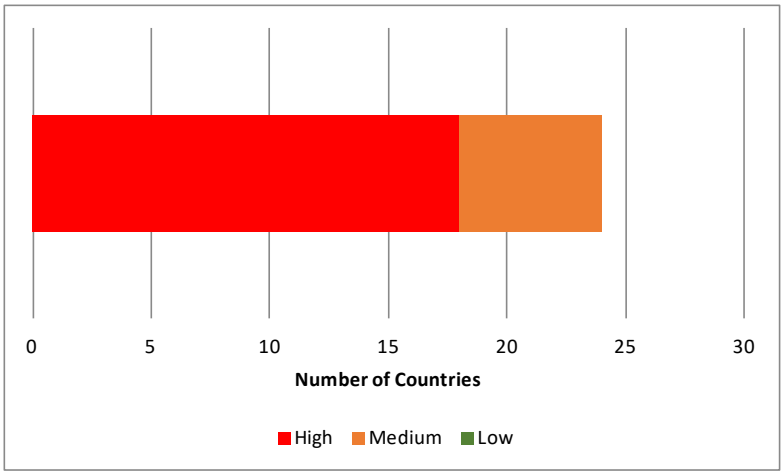
SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)		
Country	*Activity*	*Description*
Nigeria [6]	Surv.	The National Veterinary Research Institute, Vom, Nigeria reported a suspect of an FMD outbreak at Jos South L.G.A Plateau State, from which samples were collected that are undergoing analysis. O/EA-3 and SAT 1/X are the lineages that were detected in the samples, collected in 2015 and 2016, that were last submitted to the WRLFMD. Interpretation: FMD is endemic in Nigeria and is similarly under reported as with other TADs. There is a need to conduct nationwide surveillance for the disease to update the prevalence and the list of stereotypes in circulation, which is also important for vaccination and vaccine production at the central diagnostic laboratory at NVRI Vom. Equally important are awareness creation, risk communication and data collection and cross border collaboration with neighboring countries. Regionally, in West/Central Africa the disease is endemic in several countries and under reported as well. Cross border movements can contribute to its wide spreading due to livestock transhumance.

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	14
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).

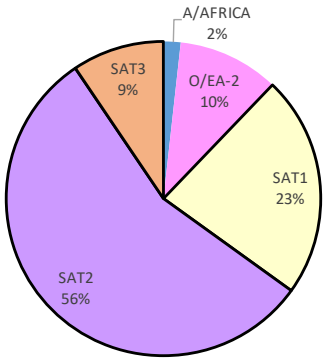


G. POOL 6 – Southern Africa

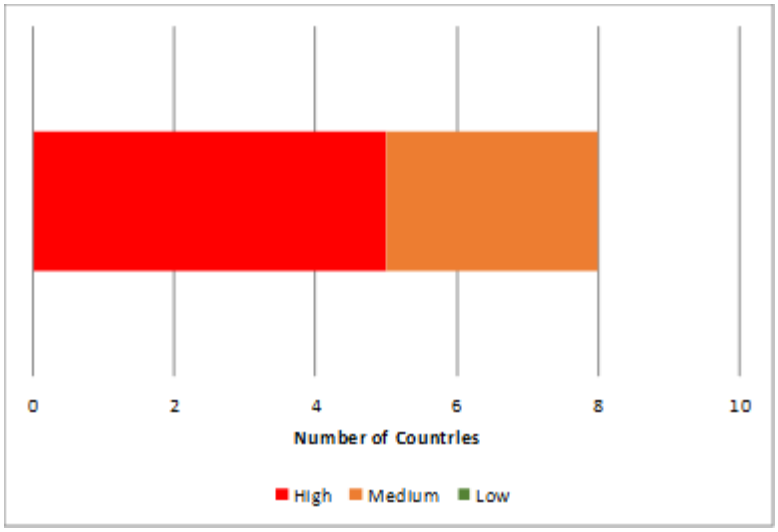
SURVEILLANCE (Surv.), VACCINATION (Vacc.) AND POST VACCINATION MONITORING (PVM)		
Country	**Activity**	**Description**
South Africa [9]	Surv.	The Agricultural Research Council, Onderstpoort Veterinary Institute, Transboundary Animal Diseases (OIE Reference Laboratory) analysed 4,908 sera in solid-phase competition ELISA for the detection antibodies against FMDV serotypes SAT 1, SAT 2 and SAT 3 and 45 in non-structural protein ELISA.

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).

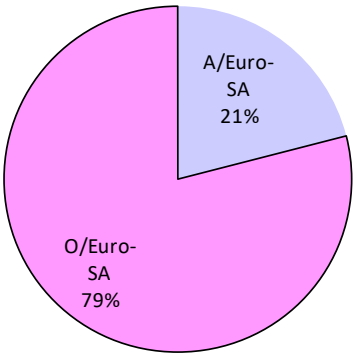


H. POOL 7 – South America

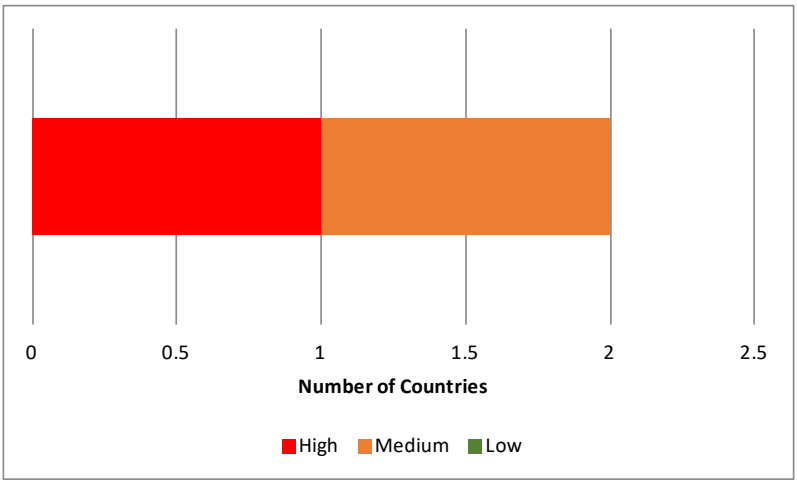
No outbreaks are reported for this Pool during the present month.

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).



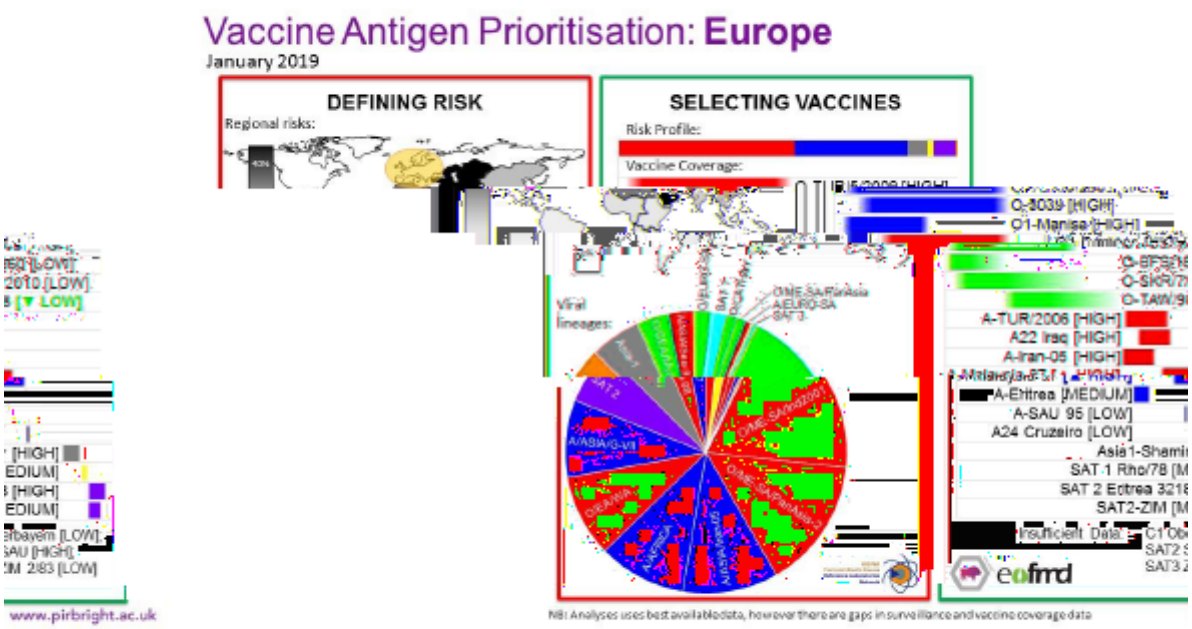
V. OTHER NEWS

[1]The 1st WRLFMD Quarterly Report for the period January-March 2019 contains the recommendations of FMDV vaccines to be included in antigen banks for Europe. The discussion of Table 11 is contained within the report.

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

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	-	-	-	-	-	-	-	-



e eight *source regions*,
r **Europe** (using data
for assistance to tailor
ata presented is based
ividual vaccines.

The table defines the relative distribution of FMDV lineages in each of th
while the figure highlights the importance of these *source regions* fo
collected at the EU-RL Workshop); please contact WRLFMD EuFMD
these outputs to other geographical regions. NB: Vaccine-coverage da
on available data and may under-represent the true performance of ind

VI. REFERENCES – Superscripts

1. World Reference Laboratory for Foot-and-Mouth Disease (WRLFMD), www.wrlfmd.org.
2. Foot and Mouth Disease and TADS Investigation Laboratory, Nepal - Dr. Sharmila Chapagain
3. Central Veterinary Research and Development Laboratory (CVDRL), Aghanistan - *Dr. Wahidullah* Head of Laboratory.
4. http://www.oie.int/animal-health-in-the-world/the-world-animal-health-information-system/data-after-2004-wahis-interface/
5. National FMD Reference Laboratory, Embakasi, Kenya – *Dr. Kenneth Ketter.*
6. FMD Research Centre, Virology Research Department, National Veterinary Research Institute, Vom, Plateau State, Nigeria - *Dr. Ularamu Hussaini*
7. OIE/FAO FMD Reference Laboratory Network, Annual Report 2016
8. ICAR-Directorate of Foot and Mouth Disease, Mukteswar, India - *Dr. S. Saravanan*.
9. ARC -Onderstepoort Veterinary Institute, Republic of South Africa - *Dr LE Heath/Ms E Kirkbride*
10. FMD Situation in SEACFMD Countries 2015-2016; presentation at the The 23rd SEACFMD Sub-Commission Meeting 9-10 March 2017, Siem Reap, Cambodia, http://www.rr-asia.oie.int/fileadmin/sub_regional_representation/sub_regional_programme/seacfmd/SEACFMD_Activities/sub_com/23nd_Meeting__2017_/presentations/1.3_Regional_FMD_situation.pdfhttps://www.ncbi.nlm.nih.gov/pmc/articles/PMC5283054/
11. Islam, M. S., et al. "Distribution of foot and mouth disease virus serotypes in cattle of Bangladesh." SAARC Journal of Agriculture 15.1 (2017): 33-42. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5283054/ and neighbouring countries (A lineage).
12. http://www.fao.org/ag/againfo/commissions/eufmd/commissions/eufmd-home/reports/westeurasia-roadmap/en/
13. Ibrahim Eldaghayes et al. Exploiting serological data to understand the epidemiology of foot-and-mouth disease virus serotypes circulating in Libya Open Vet J. 2017; 7(1): 1–11 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5283054/
14. Progressive Control of Foot and Mouth Disease in Pakistan - *Dr. Muhammad Afzal*, Project Coordinator.

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 June 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	Dec 2016/ A & O	high	◑		◑	◑				◑			medium	1
CHINA	April 2019/O, May 2017/A	high	◔		◕	◔		◔	◔	◔		◔	medium	1
CHINA (HONG KONG, SAR)	Dec 2018/O	high			●							●	medium	1
KOREA, DEMOCRATIC PEOPLE'S REPUBLIC OF	May 2014/not confirmed, July 2014/O	high	◑		◕	◑		◕					high	as per REPUBLIC OF KOREA (SOUTH KOREA)
LAO PEOPLE'S DEMOCRATIC REPUBLIC (LAOS)	Jan 2018/O Mar 2015/A	high	◔		◕	◔			◕	◔			medium	1
MALAYSIA	May 2018/O, August 2016/A	medium			●					●			medium	1
MONGOLIA	May 2018/O, Sept 2016/A	medium			●			◑	◑	◑			medium	1
MYANMAR	May 2018/O, April 2017/Asia 1, July 2016/ not typed, 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
TAIWAN PROVINCE OF CHINA	Jun 2015/A	low/sporadic			●							●	high	as per HONG KONG
THAILAND	Oct 2018 /A & 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 June 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	Dec 2016/A, ASIA 1 and O	high	◔	◔	◕	◔	◔	◕	high	11
BHUTAN	Jan 2019/O, Sep 2017/A	high	◔		◕	◔		◕	medium	1
INDIA	Mar 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	May 2018/O	high			●			●	medium	1

Table 14: Conjectured circulating FMD viral lineages in each country of Pool 3 –West Eurasia (current to June 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	June 2019/O & Asia 1, Dec 2018/A	high	◑	◔	◑			◑	◔		◑			medium	3
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	Feb 2018/A, Asia 1& O,	high	◑	◔	◑		◔	◑	◔		◑			medium	1
IRAQ	Dec 2013/A, ASIA 1	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 Arabia
KUWAIT	April 2016/O	high	◕		◑		◕			◔	◔			high	1, as per Saudi Arabia
KYRGYZSTAN	Aug 2014/not typed & Apr 2013 /O, A,	low/sporadic	◔	◕	◔			◔	◕		◔			high	as per Pakistan
LEBANON	2010/not typed	low/sporadic	◔		◕		◔				◕			high	as per Turkey
OMAN	May 2015/SAT 2	high				●							●	high	1
PAKISTAN	April 2019/ A, O & Asia 1	high	◔	◕	◔			◔	◕		◔			medium	1
PALESTINE	Mar 2019/Untyped, Dec 2017/O, Mar 2013/Sat 2	low/sporadic			●							●		medium	1
QATAR	Dec 2013/O	low/sporadic	◕		◑		◕			◔	◔			high	as per Saudi Arabia
SAUDI ARABIA	Dec 2018/O & Oct 2016/A	high	◕		◑		◕			◔	◔			high	1
SYRIAN ARAB REPUBLIC (SYRIA)	2002/ A & O	high	◔		◕		◔				◕			high	as per Turkey
TAJIKISTAN	Nov 2012/ not typed & Nov 2011/Asia 1,	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	Sep 2016/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 June 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/serotyping pending, Oct 2013/O	high	◔	◔	◕	◔	◔	◕	high	13, as per egypt
MOROCCO	May 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 June 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	Aug 2013 / not available	high	◑	◔	◔	◔		◑		◔	◔	◔		high	as per Tanzania
COMOROS	March 2019/O	high		●					●					high	no data available
DJIBOUTI	Not available	high	◔	◕	◔		○	◔		◕	◔		○	high	as per Ethiopia
ERITREA	Nov 2016/not reported, Jan 2012/O	high	◔	◕	◔		○	◔		◕	◔		○	high	as per Ethiopia
ETHIOPIA	April 2019/A, O &SAT 2, Feb 2018/SAT 1	high	◑	◕	◔		○	◔		◕	◔		○	medium	1
KENYA	June 2019/SAT 2, Mar 2019/A, Nov 2018/O, May 2018/ SAT 1	high	◔	◕	◔	◔		◔	◕		◔	◔		medium	1
RWANDA	Nov 2012/not typed	high	◔	◕	◔	◔		◔	◕		◔	◔		high	as per Kenya
SOMALIA	June 2016/not reported	high	◔	◕	◔		○	◔		◕	◔		○	high	as per Ethiopia
SOUTH SUDAN	June 2017/O & SAT 2, Mar 2018/A Dec 2016/ not sampled	high		●						●				high	1
SUDAN	May 2017/O	high	◑	◔		◔		◑		◔		◔		medium	1
TANZANIA, UNITED REPUBLIC OF	Oct 2016/SAT 1, Aug 2016/O & SAT 2, Jun 2016/ A	high	◑	◔	◔	◔		◑		◔	◔	◔		high	1
UGANDA	Feb 2019/A & O, Nov 2014/SAT1, Jan 2015/SAT 3, July 2015/ SAT 2 and untyped	high	◑	◑	◔	◔		◑	◑		◔	◔		high	1, as per Kenya
YEMEN	2009/O	high	◔	◕	◔		○	◔		◕	◔		○	high	as per Ethiopia

Table 17: Conjectured circulating FMD viral lineages in each country of Pool 5 (current to June 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	Jun 2014/O, A, SAT 1, SAT 2	high	◔	◔	◔	◔	◔	◔	◔	◔	high	4
BURKINA FASO	Aug2018/O	high	◑	◑		◑	◑	◑		◑	medium	4, as per Mali
CAMEROON	Dec 2019/untyped, Nov 2014/O, SAT 2, May 2014/SAT 1, Apr 2014/ A	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
CAPE VERDE	Not available	low/sporadic		●				●			high	as per Senegal
CENTRAL AFRICAN REPUBLIC	Not available	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
CHAD	Aug 2016/Not reported	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
CONGO	Jun 2013/not typed	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
CONGO, DEMOCRATIC REPUBLIC OF	Mar 2018/untyped	high	◑	◑	◑		◑	◑	◑		high	4
COTE D'IVOIRE	Jun 2018/O	high		●				●			high	4, as per Guinea
EQUATORIAL GUINEA	Not available	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
GABON	Not available	high	◑	◑		◔	◑	◑		◔	high	
GAMBIA	July 2018/O	high		●				●			medium	4
GHANA	Sep 2018/ O & SAT 2	high		◑		◑		◑		◑	high	1
GUINEA	Sep 2018/O	high		●				●			medium	4
GUINEA-BISSAU	Dec 2018/O	high		●				●			high	as per Guinea
LIBERIA	Not available	high		●				●			high	as per Guinea
MALI	Oct 2016/not reported	high	◑	◑		◑	◑	◑		◑	high	4
MAURITANIA	Aug 2018/O, Dec 2014/SAT 2	high				●				●	medium	1
NIGER	2014/not sampled, May 2015/O	high	◑	◑		◔	◑	◑		◔	high	as per Nigeria
NIGERIA	June 2019/untyped/May 2019/A, Sep 2018/O &Sat 2, Sept 2016/ SAT 1	high	◑	◑		◔	◑	◑		◔	high	1, 6
SAO TOME AND PRINCIPE	Not available	0									high	no data available
SENEGAL	Sep 2018/O, Feb 2015/ A, 2014/ SAT 2	high		●				●			medium	1
SIERRA LEONE	Aug 2018/O	high		●				●			medium	as per Senegal
TOGO	2012/O	high	◑	◑		◔	◑	◑		◔	high	4, as per Nigeria

Table 18: Conjectured circulating FMD viral lineages in each country of Pool 6 (current to June 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	July 2018/SAT 2, June 2015/SAT 1	medium				●					●		medium	1
MALAWI	Feb 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	Sep 2017/SAT 2, Aug 2017/typing pending, May 2015/SAT 1	medium			◑	◑				◑	◑		high	1
SOUTH AFRICA	Jan 2019/SAT 2, Oct 2017/SAT 1, Dec 2015/SAT 3	medium			○	◕				○	◕		high	1
ZAMBIA	April 2019/SAT 2, March 2019/O, Feb 2019/ A, May 2017/SAT 3, Jan 2013/SAT 1	medium	○	◑	○	○	◔	○	◑	○	○	◔	medium	1
ZIMBABWE	April 2019/SAT 1 & SAT 2, Sep2018/typing pending, Jun 2013/SAT 3	high			◑	◑				◑	◑		medium	1, 4

Table 19: Conjectured circulating FMD viral lineages in each country of Pool 7 (current to June 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	7
COLUMBIA	2011/O, 2013/A	medium		●		●	medium	4

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