



**FMDV genetic lineages reported in Middle East.
Antigenic matching with vaccine production strains.
Examples of the use of the ARRIAH-manufactured vaccines**

Presented by Dr. Viktor Nikiforov



FMD International Statuses of ARRIAH

- WOA (OIE) Reference Laboratory for FMD (1995)
- WOA Collaborating Centre for Diagnosis and Control of Animal Diseases (1997)
- FAO Reference Centre for FMD for Central Asia and Western Eurasia (2013)
- WOA Reference Laboratory for Avian Influenza and Newcastle Disease (2018)
- FAO Reference Centre for Zoonotic Coronaviruses (2022)



FGBI ARRIAH

Federal Centre for Animal Health



- More than 120 Doctors and Candidates of Science are employed by ARRIAH, more than 40 PhD students study here
- ARRIAH produces more than 140 different veterinary products including 70 vaccines, 57 diagnostic kits protected by 48 valid patents.
- Has the greatest diagnostic capacities to perform tests for many infectious animal diseases
- Ability to control produced vaccines from the development stage to practical application
- Scientific support of products and permanent consulting on farms



Basic approach to the manufacture of the FMD vaccines intended for the customers in different countries

- Continuous monitoring of immunobiological properties of recovered FMDV isolates;
- Examination of the recovered FMDV isolates' matching with the vaccine strains;
- Preparation of new FMDV production strains;
- Determination of the relevance of the FMDV strains for the region;
- Selection of antigenically related production strains in the ARRIAH's strain collection or deposition of new production strains selected out of the FMDV isolates submitted by the partner countries for the vaccine manufacture



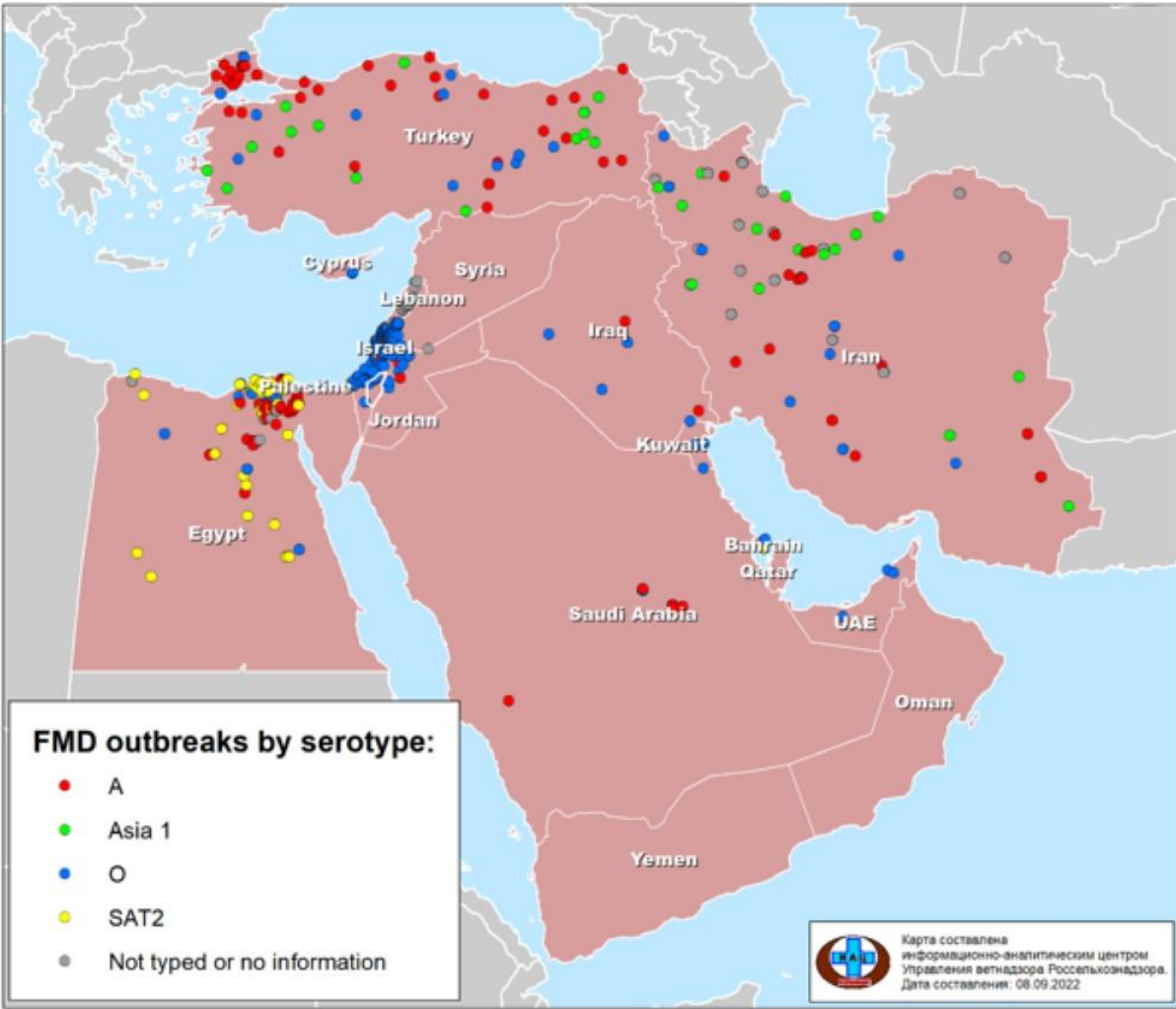
FMD epizootic situation in Middle Eastern countries, 2020 - 2022

as for WOAAH data



Number of FMD outbreaks by country

Country	2020	2021	2022
Bahrain	-	-	-
Egypt	9 (A, SAT 2)	-	-
Israel	-	19 (O)	91 (O)
Jordan	-	8 (O)	-
Iran	1909 (A, O)	317 (A, O)	-
Iraq	88 (O)	31 (O)	-
Yemen	-	34 (n/t)	-
Qatar	2 (O)	-	-
Cyprus	-	-	-
Kuwait	-	-	-
Lebanon	-	-	-
UAE	-	3 (O)	-
Oman	11 (n/t)	-	-
Palestine	-	4 (O)	3 (O)
Saudi Arabia	19 (O)	110 (O)	-
Syria	-	-	-
Turkey	-	-	-

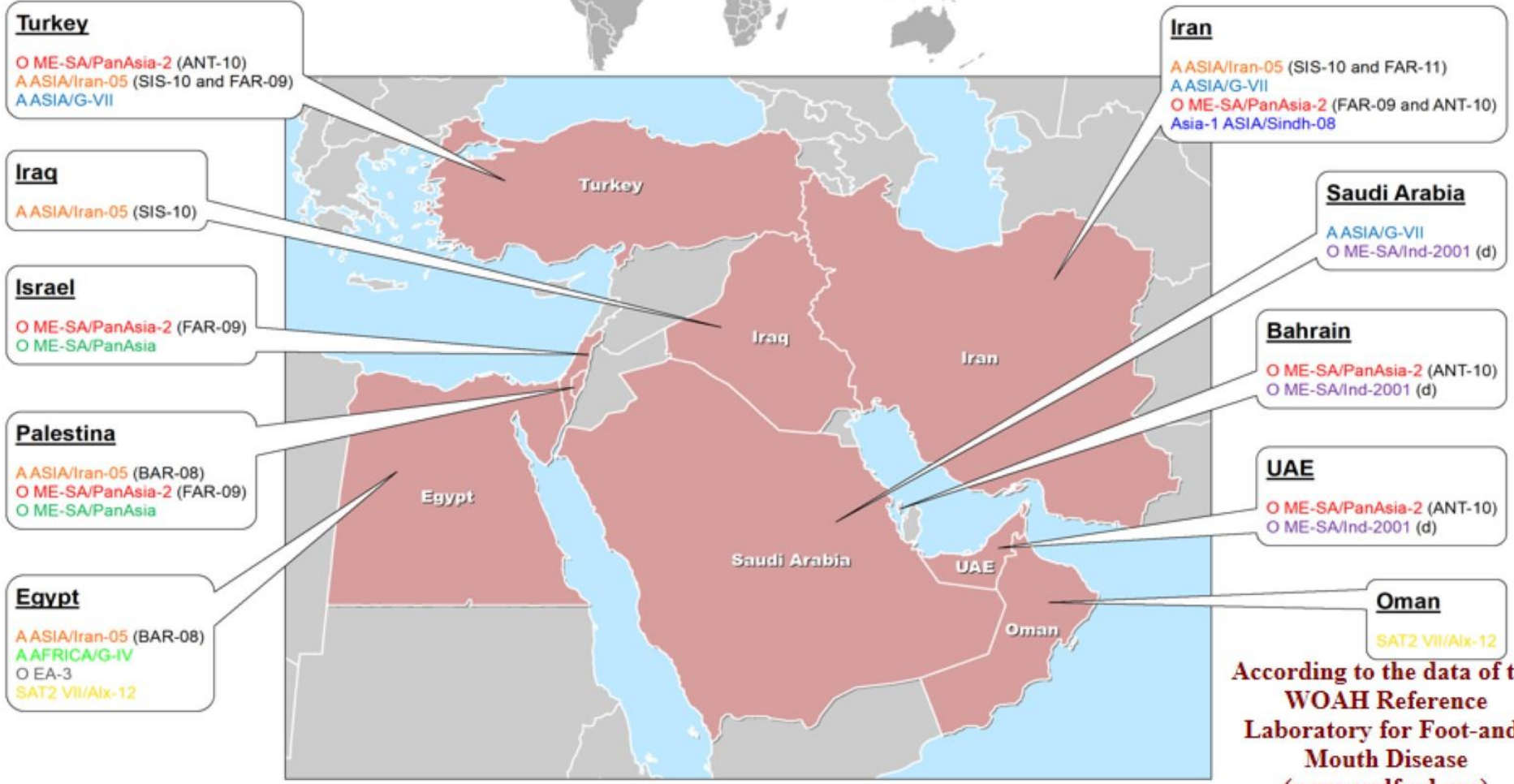


Карта составлена информационно-аналитическим центром Управления ветеринара Россельхознадзора. Дата составления: 08.09.2022



Genetic lineages of FMD virus circulating in Middle Eastern countries from 2013 to 2015

Карта составлена информационно-аналитическим центром Управления ветеринара Россельхознадзора.
Дата составления: 04.08.2022



According to the data of the
**WOAH Reference
 Laboratory for Foot-and-
 Mouth Disease**
 (www.wrlfmd.org)



Genetic lineages of FMD virus circulating in Middle Eastern countries from 2016 to 2018

Карта составлена информационно-аналитическим центром Управления ветеринара Россельхознадзора. Дата составления: 04.08.2022



Turkey
 O ME-SA/PanAsia-2 (ANT-10 and QOM-15)
 A ASIA/G-VII

Iran
 A ASIA/Iran-05 (SIS-10, SIS-13 and FAR-11)
 A ASIA/G-VII
 O ME-SA/PanAsia-2 (QOM-15 and ANT-10)
 Asia-1 ASIA/Sindh-08

Jordan
 O ME-SA/Ind-2001 (e)

Israel
 O ME-SA/PanAsia-2 (QOM-15)
 O EA-3
 A ASIA/G-VII

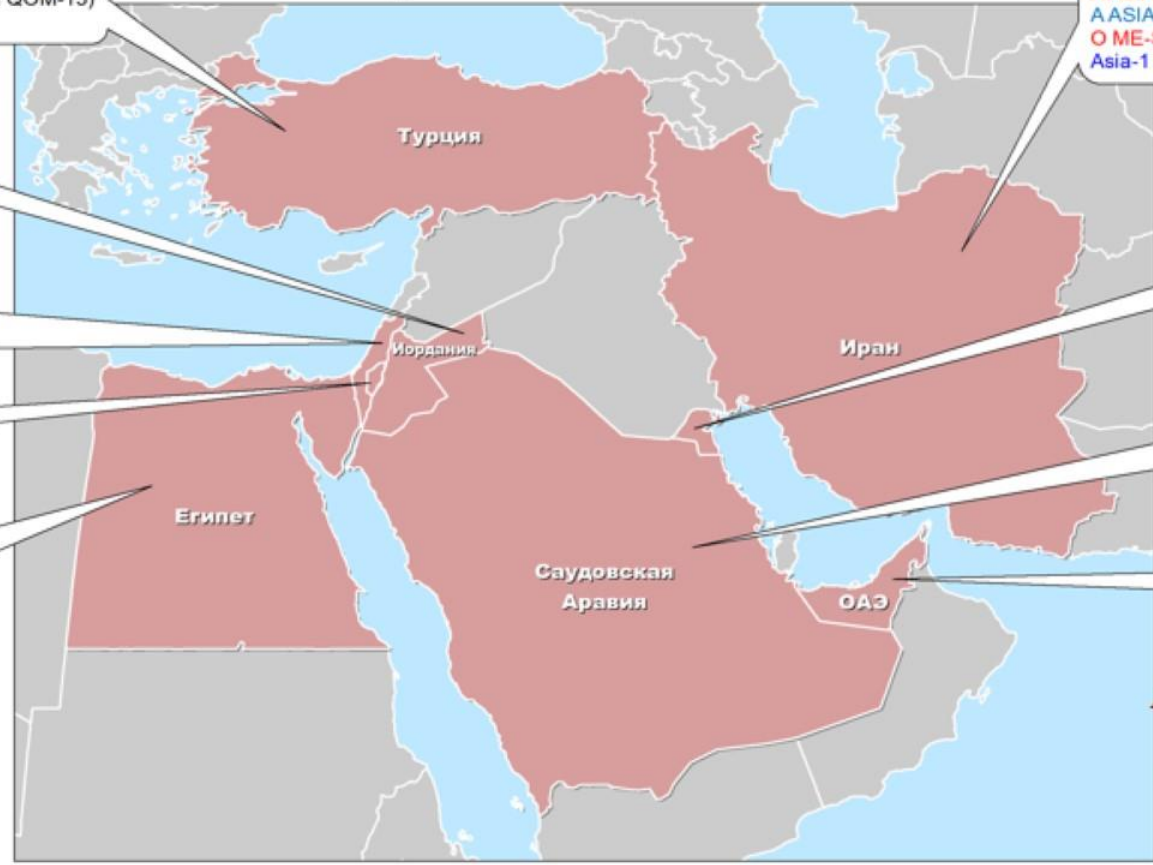
Kuwait
 O ME-SA/PanAsia-2 (QOM-15)

Palestina
 O EA-3

Saudi Arabia
 A ASIA/G-VII
 O ME-SA/Ind-2001 (d and e)

Egypt
 A AFRICA/G-IV
 O EA-3
 SAT2 VII/Aix-12
 SAT2 VII/Ghb-12
 SAT2 VIII/Lib-12

UAE
 O ME-SA/Ind-2001 (d)



According to the data of the WOA Reference Laboratory for Foot-and-Mouth Disease (www.wrlfmd.org)



Genetic lineages of FMD virus circulating in Middle Eastern countries from 2019 to 2022

Карта составлена информационно-аналитическим центром Управления ветеринара Россельхознадзора. Дата составления: 04.08.2022

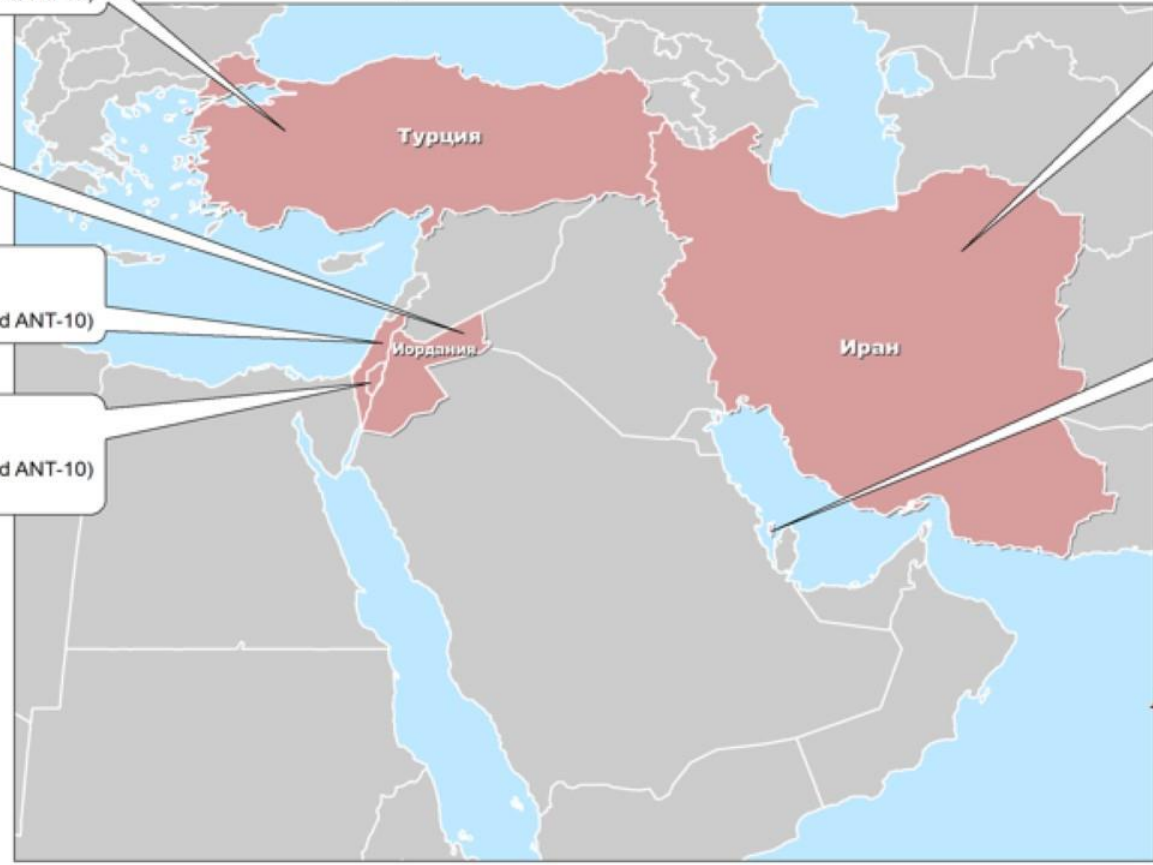


Turkey
 O ME-SA/PanAsia-2 (ANT-10 and QOM-15)

Jordan
 O ME-SA/PanAsia-2 (ANT-10)

Israel
 O ME-SA/PanAsia-2 (QOM-15 and ANT-10)

Palestina
 O ME-SA/PanAsia-2 (QOM-15 and ANT-10)
 O EA-3



Iran
 A ASIA/Iran-05 (FAR-11)
 O ME-SA/PanAsia-2 (ANT-10)
 Asia-1 ASIA/Sindh-08

Bahrain
 A AFRICA/G-I
 O EA-3

According to the data of the WOA Reference Laboratory for Foot-and-Mouth Disease (www.wrlfmd.org)



Vaccine matching, WRL FMD Pirbright



POST-VACCINATION SEROLOGY



Middle Eastern countries	Genetic lineages of FMDV that caused outbreaks in 2018 – 2022					Vaccine matching, r 1
	2018	2019	2020	2021	2022	
Bahrein	-	-	-	A AFRICA/G-I	-	A Sau/95 – 0,35 A G-VII – 0,39
	-	-	-	O EA-3	-	O 3039- 0,62 O Manisa – 0,5 O Tur/09 – 0,56 O Campos – 0,63
Egypt	A AFRICA/G-IV	-	-	-	-	A Eritrea/98 – 0,42
	SAT2 VII/Ghb-12	-	-	-	-	r 1 less than 0,3
	SAT2 VII/Lib-12	-	-	-	-	SAT 2 ERI – 0,83
Israel	O ME-SA/PanAsia-2	O ME-SA/PanAsia-2	-	O ME-SA/PanAsia-2	O ME-SA/PanAsia-2	O 3039- 0,48 O Manisa – 0,46 O Tur/09 – 1,0 O Campos – 0,76
Jordan	-	-	-	O ME-SA/PanAsia-2	-	O 3039 - 0,38 O Tur/09 – 0,56
Iran	A ASIA/Iran-05	-	A ASIA/Iran-05	A ASIA/Iran-05	-	A Tur/06 – 0,36 A 22 IRQ – 0,32 A G-VII - 0,71
	A ASIA/G-VII	-	-	-	-	O 3039 - 0,5 O Manisa – 0,31 O Tur/09 – 0,63 O Campos – 0,48
	O ME-SA/PanAsia-2	-	O ME-SA/PanAsia-2	O ME-SA/PanAsia-2	-	Asia Shamir: 0,24 - 0,48
	Asia-1 ASIA/Sindh-08	-	Asia-1 ASIA/Sindh-08	-	-	
Palestine	-	O ME-SA/PanAsia-2	-	O ME-SA/PanAsia-2	-	O 3039 - 0,54 O Tur/09 – 0,58
	O EA-3	-	-	O EA-3	-	O 3039 - 0,4 O Manisa – 0,37 O Tur/09 – 0,63
Saudi Arabia	O ME-SA/Ind-2001 (e)	-	-	-	-	No data
Türkiye	O ME-SA/PanAsia-2	O ME-SA/PanAsia-2	O ME-SA/PanAsia-2	-	-	No data



Vaccine matching results obtained at the FGBI “ARRIAH”, Type O

FMDV, genetic lineage	Post-vaccinal monovalent antiserum against production strain (ARRIAH)				
	O ₁ Manisa	O PanAsia	O PanAsia-2	O Ind-2001	O Campos
O ME-SA/PanAsia-2	0.2	0.14	0.5	0.26	0.2
O/Ind-2001 (Russia 2021)	0.28	0.04	0.56	1.0	0.22
O/Ind-2001 (Kazakhstan 2022)	0.23	0.22	0.67	1.0	0.27

$r_1 \geq 0,3$ – suggest that there is a close relationship between field isolate and vaccine strain

A potent vaccine containing the vaccine strain is likely to confer protection

$r_1 < 0,3$ - suggest that the field isolate is so different from the vaccine strain that the vaccine is unlikely to protect.



Vaccine matching results obtained at the FGBI “ARRIAH”, Type A

FMDV, genetic lineage	Post-vaccinal monovalent antiserum against production strain (ARRIAH)			
	A Iran-05	A ASIA /G-VII	A SEA 97	A ₂₂ Irak 64
A ASIA/Iran-05	1.0	0.08	0.97	0.07
A AFRICA/G-I	0.3	0.08	0.78	0.42
A AFRICA/G-IV	0.27	0.07	0.37	0.1
A ASIA/G-VII	0.02	1.0	0.01	0.01

$r_1 \geq 0,3$ – suggest that there is a close relationship between field isolate and vaccine strain

A potent vaccine containing the vaccine strain is likely to confer protection

$r_1 < 0,3$ - suggest that the field isolate is so different from the vaccine strain that the vaccine is unlikely to protect.



Vaccine matching results obtained at the FGBI “ARRIAH”, Type Asia-1

FMDV, genetic lineage	Post-vaccinal monovalent antiserum against production strain (ARRIAH)	
	Asia-1 Sindh-08	Asia-1 Shamir
Asia-1 ASIA/Sindh-08	0,3	0,09

$r_1 \geq 0,3$ – suggest that there is a close relationship between field isolate and vaccine strain

A potent vaccine containing the vaccine strain is likely to confer protection

$r_1 < 0,3$ - suggest that the field isolate is so different from the vaccine strain that the vaccine is unlikely to protect.



Selection of vaccine strains relevant for the Middle Eastern countries

Epizootic FMDV isolates circulating in the Middle Eastern countries	Vaccine strains of the FGBI «ARRIAH»	Vaccine matching
O/ME-SA/PanAsia-2	O/PanAsia-2	r1 0.5
O/EA-3	O/PanAsia-2	r1 0.56*
O/ME-SA/Ind-2001	O/Ind-2001	r1 1.0
A ASIA/Iran-05	A /Iran-05	r1 1.0
A AFRICA/G-I	A/SEA 97	r1 0.78
A AFRICA/G-IV	A/SEA 97 or A/G-IV	r1 0.37 research is in process
A ASIA/G-VII	A/G-VII	r1 1.0
Asia-1 /Sindh-08	Asia-1/Sindh-08	r1 0.3
SAT-2/VII/lib-12	SAT-2/VII/lib-12	research is in process



Examples of the use of the ARRIAH-manufactured vaccines



Epizootic situation in South Korea as a result of ARRIAH-VAC emulsion vaccine use

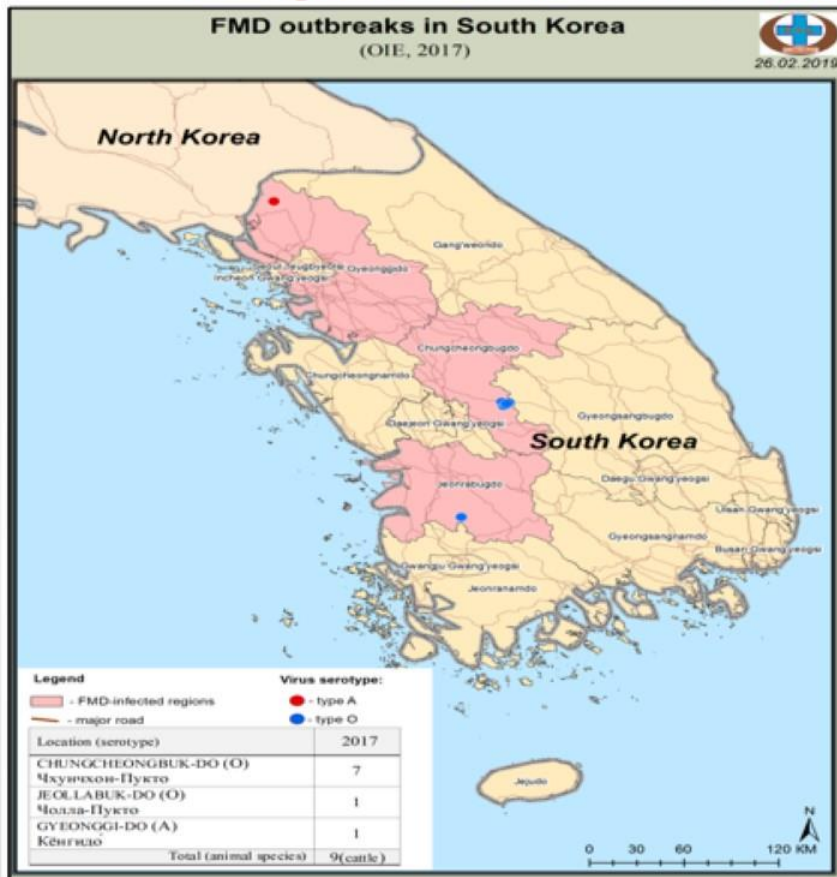


ARRIAH started supplies of ARRIAH-VAC emulsion mono- and bivalent vaccine to South Korea in 2016.

- In 2015 159 outbreaks of Type O FMD were reported in South Korea;
- In 2016 – 21 outbreaks of Type O FMD were reported



FMD epizootic situation in South Korea as a result of ARRIAH-VAC emulsion vaccine use



In 2017 9 outbreaks of Type A, O FMD were reported;

In 2018 2 outbreaks of Type A FMD were reported;

In 2019 3 outbreaks of Type O FMD were reported

Vaccination with FMD emulsion vaccine ARRIAH-VAC reduced the number of outbreaks in the country from 159 outbreaks in 2015 to 3 outbreaks in 2019.

In 2020-2022, there were no outbreaks in South Korea notified to the WOA.









Official recognition of the FMD free status of Kazakhstan by the OIE as a result of vaccination with ARRIAH-manufactured FMD vaccines

FMD free zones Kazakhstan

Last update May 2017



Official FMD status in Kazakhstan

-  FMD free zone where vaccination is not practised, covering Akmola, Aktobe, Atyrau, West Kazakhstan, Karaganda, Kostanay, Mangystau, Pavlodar and North Kazakhstan (August 2014)
-  FMD free zone where vaccination is practised, consisting of zone 1, covering Almaty (August 2016)
-  FMD free zone where vaccination is practised, consisting of zone 2, covering East Kazakhstan (August 2016)
-  FMD free zone where vaccination is practised, consisting of zone 3 covering part of Kyzylorda, the northern part of South Kazakhstan and northern and central parts of Zhambyl (August 2016)
-  FMD free zone where vaccination is practised, consisting of zone 4, covering the southern part of Kyzylorda and the south-western part of South Kazakhstan (August 2016)
-  FMD free zone where vaccination is practised, consisting of zone 5, covering the south-eastern part of South Kazakhstan and the southern part of Zhambyl (August 2016)

- The last FMD outbreaks were reported in Kazakhstan:
- in the *zone without vaccination* in 2011,
- in the *zone with vaccination* in 2013.

• In 2015 the status of Kazakhstan as an “FMD free zone without vaccination” was officially recognized at the OIE General Session

• In 2017 the OIE officially recognized the status of 5 FMD free zones with vaccination

• Supplies of ARRIAH 5-strain adsorbed vaccine to Kazakhstan was started in 2013 and allowed to prevent FMD outside the *protection zone with vaccination* and then to receive the OIE official disease free status in the regions where vaccination is practiced.



According to WOA, “FMD free zone where vaccination is not practiced” status was officially suspended from 9 June 2022

FMD free zones in Kazakhstan



Official FMD status in Kazakhstan

The FMD free zones (with and without vaccination) are covering the whole country of Kazakhstan

FMD free zones where vaccination is practised (August 2016)

- Zone I covering Almaty
- Zone II covering East Kazakhstan
- Zone III including part of Kyzylorda, the northern part of South Kazakhstan and northern and central parts of Zhambyl
- Zone IV including the southern part of Kyzylorda and the south-western part of South Kazakhstan
- Zone V including the south-eastern part of South Kazakhstan and the southern part of Zhambyl

Suspension of FMD free status without vaccination

- Zone 1 consisting of West Kazakhstan, Atyrau, Mangystau and south-western part of Aktobe region (9 June 2022)
- Zone 2 including north-eastern part of Aktobe region, southern part of Kostanay region and western part of Karaganda region (9 June 2022)
- Zone 3 including northern and central parts of Kostanay region, western parts of North Kazakhstan and Akmola regions (9 June 2022)
- Zone 4 including central and eastern parts of North Kazakhstan region and northern parts of Akmola and Pavlodar regions (9 June 2022)
- Zone 5 including central and eastern parts of Karaganda region and southern parts of Akmola and Pavlodar regions (3 January 2022)

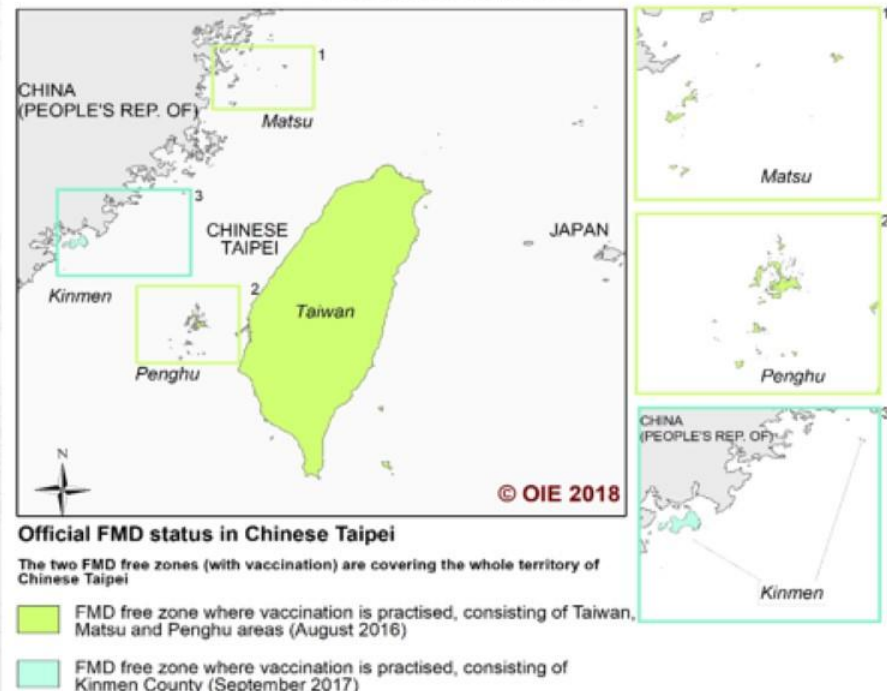
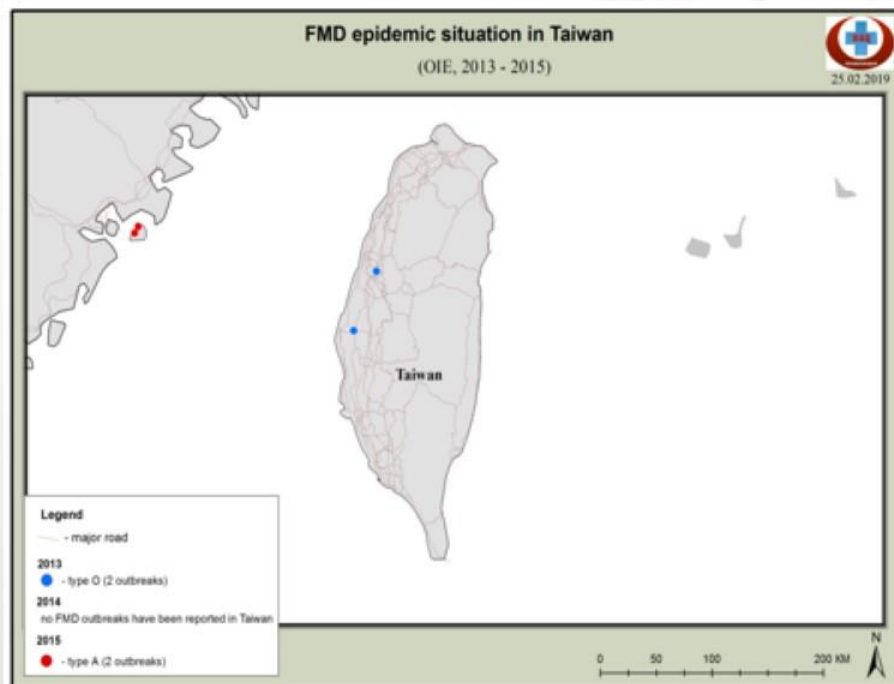
Region Framed Regions are part of different FMD free zones

* Dates shown in brackets indicate when the relevant applications were submitted to the World Organisation for Animal Health by the Delegate.

Official OIE recognition of FMD-free zones in Taiwan following the use of FGBI ARRIAH-manufactured FMD vaccine

FMD free zones in Chinese Taipei

Last update May 2018



- The last two FMD outbreaks were reported in Taiwan in 2015.
- Start of the use of FGBI ARRIAH- manufactured *monovalent emulsion FMD vaccine* in 2009 allowed for FMD eradication in Taiwan.
- From 2017 to 2019 Taiwan enjoyed official OIE status of *FMD free zone where vaccination is practiced*.



Official OIE recognition of *FMD-free zones* in Taiwan following the use of FGBI ARRIAH-manufactured FMD vaccine



From 2019, Taiwan is official OIE status recognized as FMD-free zone where *vaccination is not practised*.



General Information

Official Disease Status

List of Members with an endorsed official control programme for FMD

According to [Resolution No. 12](#) (89th General Session, May 2022)

Endorsed official control programme for FMD

Botswana	<u>Kyrgyzstan</u>	Namibia
China (People's Rep. of)	<u>Mongolia</u>	Thailand
India	<u>Morocco</u>	

Some countries using the ARRIAH-manufactured vaccine have a WOAHA endorsed official control programme for FMD


FMD FREE ZONE IN RUSSIA


Last update January 2017




© OIE 2017

Official FMD status in Russia

 FMD free zone where vaccination is not practised (August 2015 and March 2016)

 Zone of Russia without a recognised FMD status

 Containment zone within a FMD free zone where vaccination is not practised, consisting of Vladimir Oblast (January 2017)

* Dates shown in brackets indicate when the documents describing the zone were submitted to the OIE by the Delegate






In May 2021, two FMD-free zones *with vaccination* were officially recognized in the Russian Federation during the 88th General Session of the World Assembly of the OIE Delegates: zone South and zone Sakhalin

FMD free zones in Russia



Official FMD status in Russia

-  FMD free zone where vaccination is not practised (August 2015 and March 2016)
-  FMD free zone where vaccination is practised (Sakhalin) consisting of the Island of Sakhalin and the Kurile islands (August 2020)
-  Zone of Russia without a recognised FMD status
-  FMD free zone where vaccination is practised (South) including Southern and North Caucasian Federal Districts, consisting of 13 Subjects: Rostov Oblast, Stavropol Krai, Krasnodar Krai, Volgograd Oblast, Astrakhan Oblast, Republic of Kalmykia, Chechen Republic, Republic of Ingushetia, Republic of Dagestan, Kabardino-Balkarian Republic, Karachay-Cherkess Republic, Republic of North Ossetia-Alania, Republic of Adygea (August 2020)

* Dates shown in brackets indicate when the documents describing the zone were submitted to the OIE by the Delegate






In May 2022, zone Eastern Siberia was officially recognized as FMD-free zone *with vaccination* during the 89th General Session of the World Assembly of the WOAAH Delegates



FMD free zones in Russia



© World Organisation for Animal Health

Official FMD status in Russia

-  FMD free zone where vaccination is not practised (August 2015 and March 2016)
-  FMD free zone where vaccination is practised (Sakhalin) consisting of the Island of Sakhalin and the Kurile islands (August 2020)
-  FMD free zone where vaccination is practised of Eastern Siberia consisting of two Subjects (Republic of Tuva and Republic of Buryatia) and one administrative Raion of the Republic of Altai (Kosh-Agachsky Raion) (August 2021)

-  FMD free zone where vaccination is practised (South) including Southern and North Caucasian Federal Districts, consisting of 13 Subjects: Rostov Oblast, Stavropol Krai, Krasnodar Krai, Volgograd Oblast, Astrakhan Oblast, Republic of Kalmykia, Chechen Republic, Republic of Ingushetia, Republic of Dagestan, Kabardino-Balkarian Republic, Karachay-Cherkess Republic, Republic of North Ossetia-Alania, Republic of Adygea (August 2020)
-  Zones of Russia without a recognised FMD status



* Dates shown in brackets indicate when the documents describing the zone were submitted to the World Organisation for Animal Health by the Delegate





FGBI ARRIAH



Thank you for attention!

