



# Regional FMD threats to North Africa

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# Global Networks

## OIE/FAO FMD Laboratory Network



- OIE and FAO Reference Centres (+ affiliates)
  - Working Groups (nomenclature and PVM)
  - Meeting report available
- **Global surveillance and changing patterns in risk pathways**
- **Harmonised and improved lab capacity**

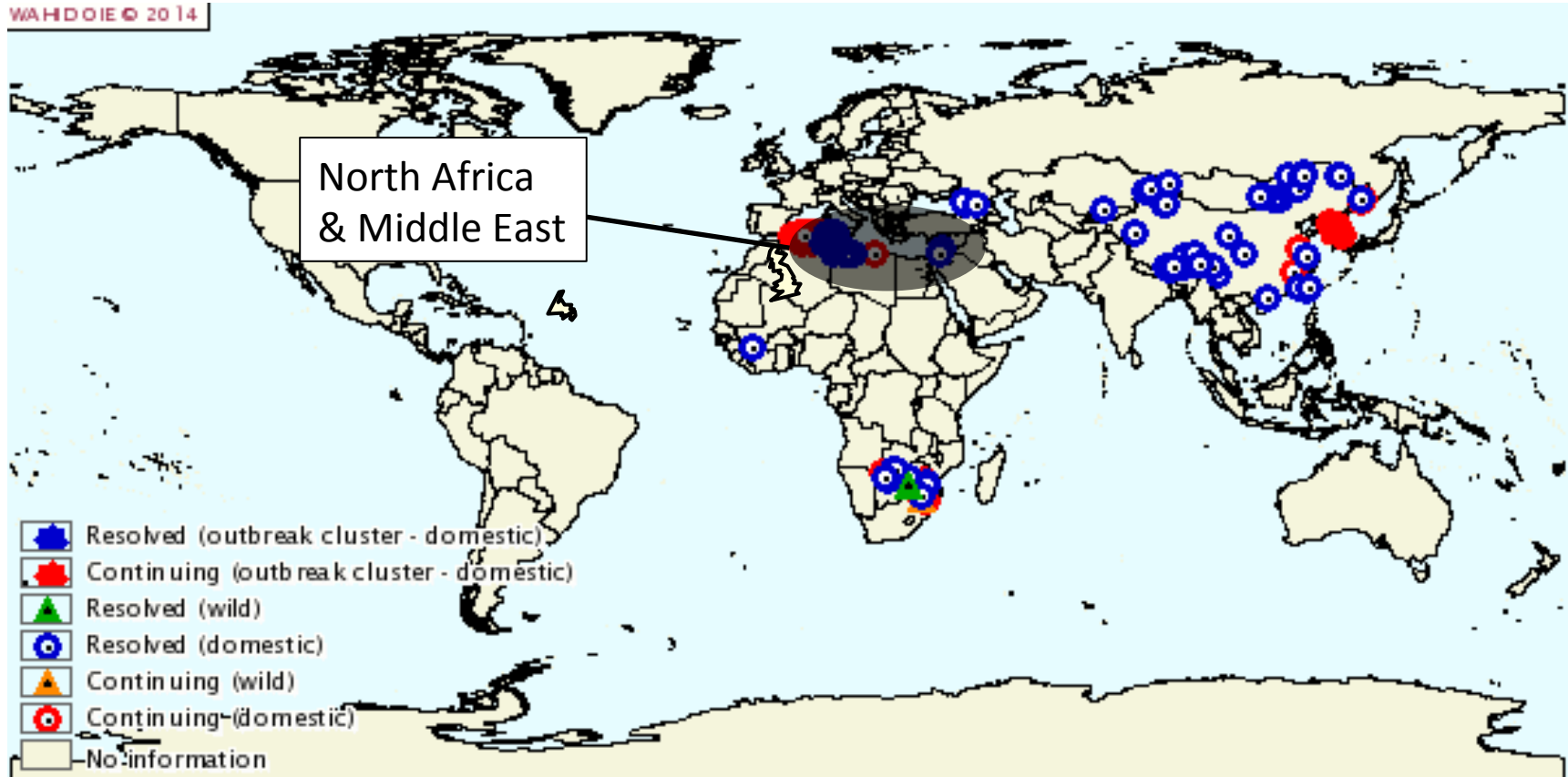


Brussels, Belgium – November 2015

[www.pirbright.ac.uk](http://www.pirbright.ac.uk)

# Viruses on the move:

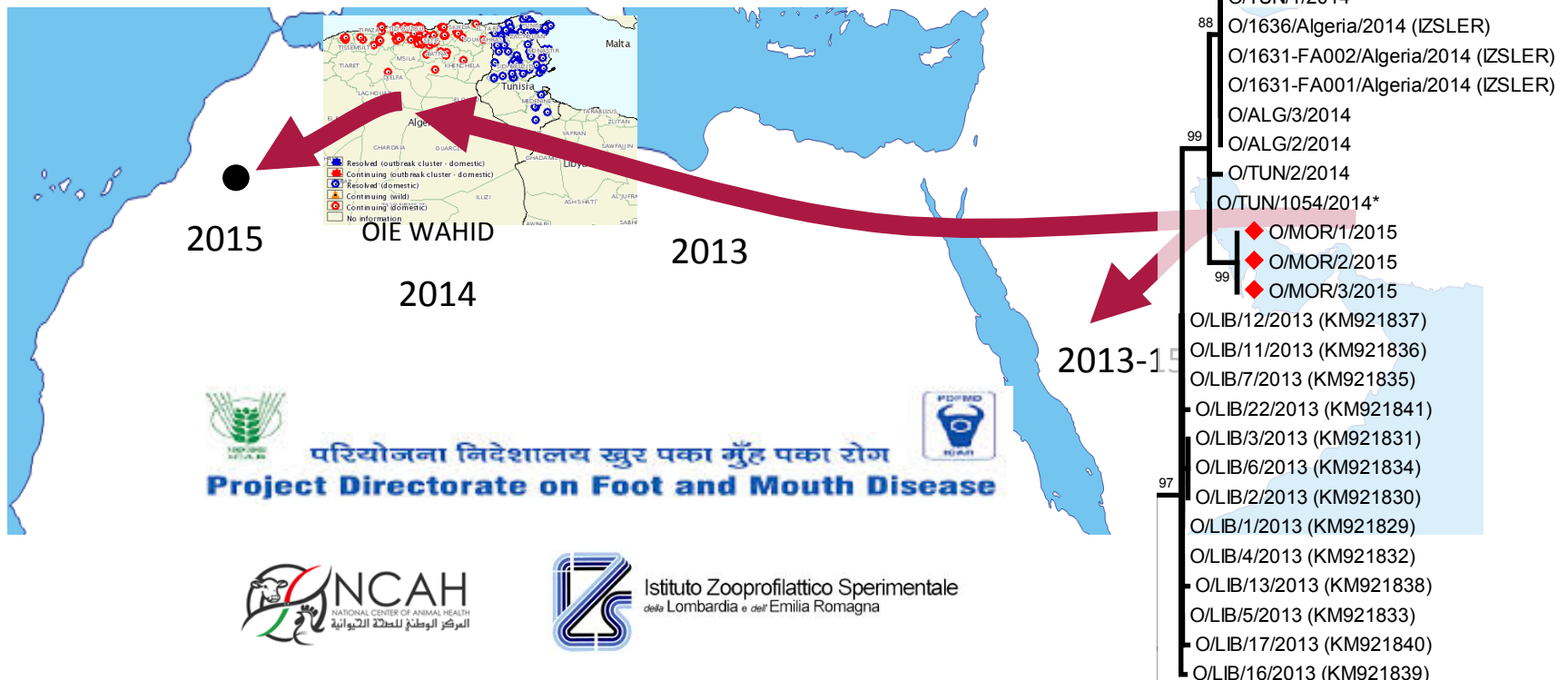
Changing epidemiological patterns and examples of data sharing between OIE and FAO FMD Reference Laboratories



Outbreaks reported to the OIE (change of epidemiological status):  
<http://www.oie.int/wahid-prod/public.php?page=home>

# Recent serotype O cases in North Africa

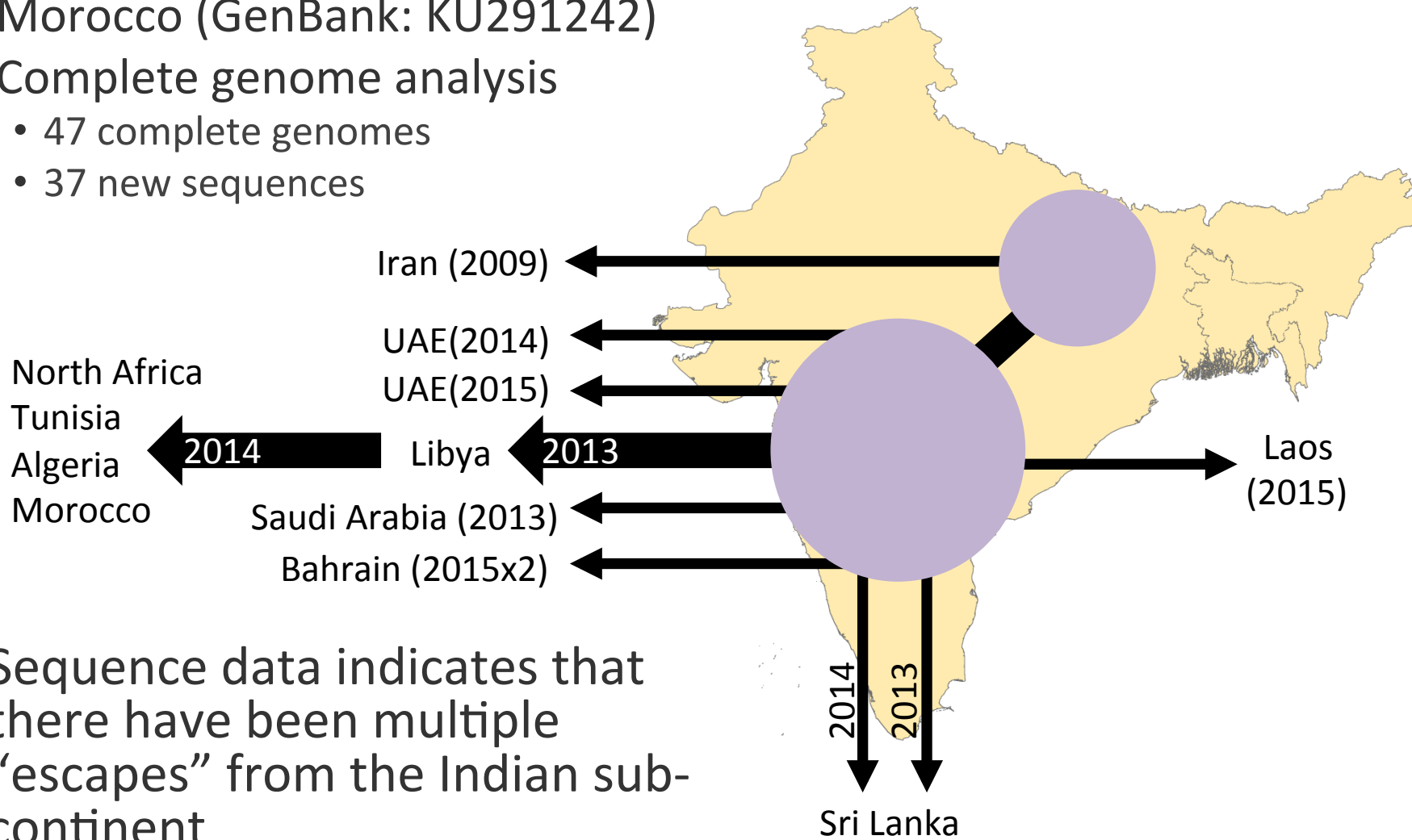
- O/ME-SA/Ind2001 lineage from the Indian sub-continent
- Since 2013: FMD Outbreaks in **Saudi Arabia, UAE, Bahrain, Libya, Tunisia, Algeria**
- Transmission links from the Indian sub-continent unknown?
- Increasing threats to Europe



# O/ME-SA/Ind 2001

## New full genome analysis

- Morocco (GenBank: KU291242)
- Complete genome analysis
  - 47 complete genomes
  - 37 new sequences



- Sequence data indicates that there have been multiple “escapes” from the Indian sub-continent

# Vaccine matching for O/ME-SA/Ind-2001

26 field isolates:

Field Isolate	Vaccine strain		
	O-3039	O Manisa	O/TUR/5/09
LIB 1/2013	Matched	Not Matched	Matched
LIB 7/2013	Matched	Not Matched	Matched
LIB 17/2013	Matched	Not Matched	Matched
LIB 22/2013	Matched	Matched	Matched
NEP 13/2012	Matched	borderline	Matched
NEP 6/2012	borderline	Not Matched	Matched
NEP 21/2012	Not Matched	Not Matched	Matched
NEP 6/2013	Matched	Not Matched	Matched
NEP 18/2013	Matched	Not Matched	Matched
NEP 1/2014	Matched	Not Matched	Matched
NEP 6/2014	Matched	Not Matched	Matched
SAU 1/2013	Matched	Not Matched	Matched
SAU 4/2013	Matched	Not Matched	Matched
SAU 6/2013	Matched	Not Matched	Matched
SAU 7/2013	Matched	Matched	Matched
SAU 1/2014	borderline	Not Matched	Matched
SRL 1/2013	Matched	Not Matched	Matched
SRL 1/2014	Matched	borderline	Matched
UAE 1/2014	Matched	borderline	Matched
UAE 2/2014	Matched	borderline	Matched
ALG 1/2014	borderline	Not Matched	Matched
TUN 1/2014	borderline	Not Matched	Matched
BAR 8/2015	Matched	Not Matched	Matched
BAR 14/2015	Matched	Not Matched	Matched
MOR/1/2015	Matched	Not Matched	Matched
MOR/2/2015	Matched	Matched	Matched

Using VNT  
r-value 0.3 cut-off

- Matched
- Not Matched



# Vaccine Potency Trial

O/ME-SA/Ind2001



- Funded via EU (from EU-RL) contribution
- Experiments hosted by CVI-Lelystad
- Adopted protocol according to European Pharmacopeia
- O-Manisa vaccination (at least 6PD<sub>50</sub>) with O/ALG/2014 challenge

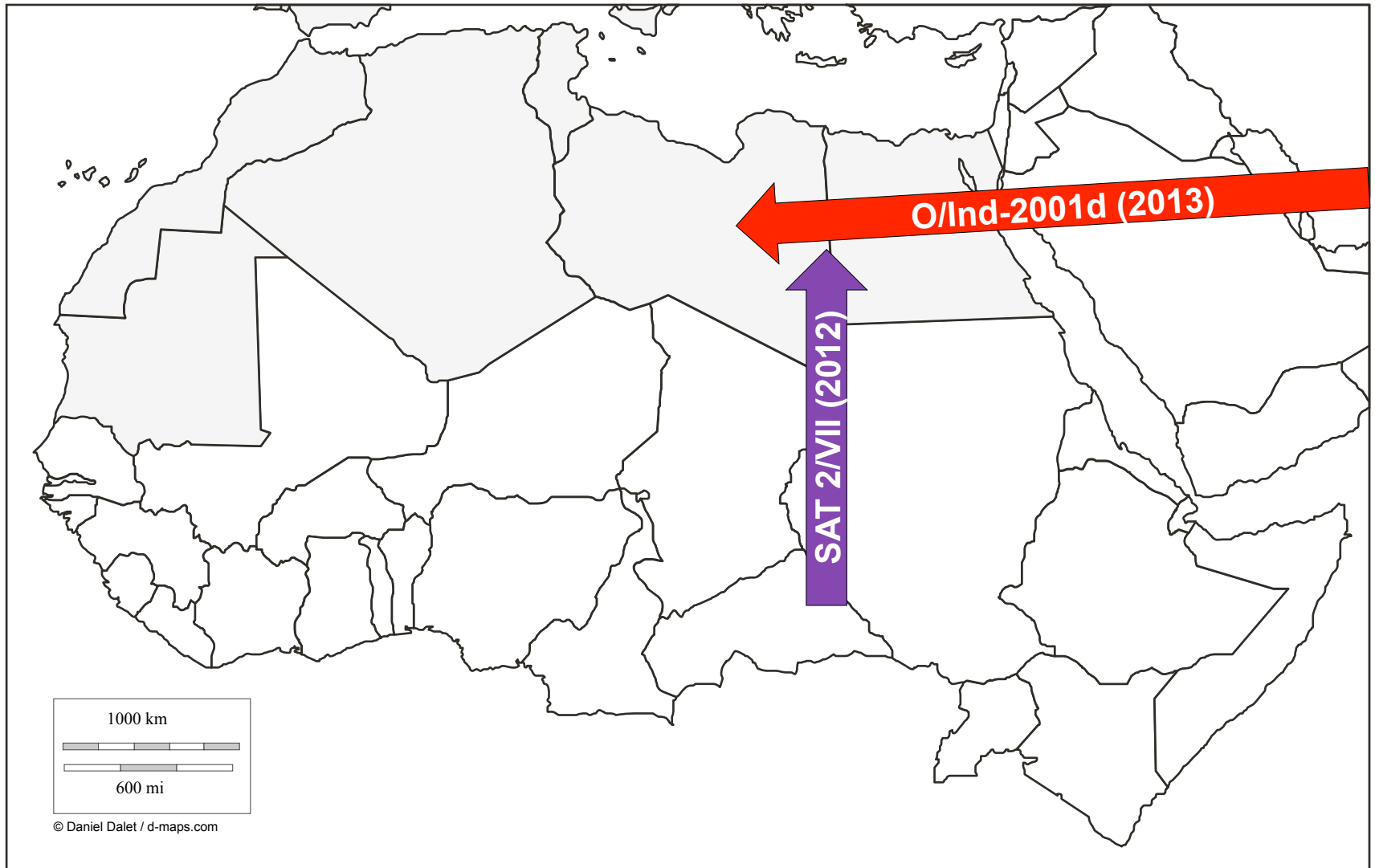
Vaccine Dose	Number Protected vs Vaccinated	Serological Results (O Manisa Log <sub>10</sub> VNT mean 21DPV)
Full	3/5	2.65
1/4	4/5	2.67
1/16	0/5	1.68
Unvaccinated*	0/2	

- Estimated heterologous potency ~3 PD<sub>50</sub>



# North Africa: other threats

Relevant for a regional vaccine bank?

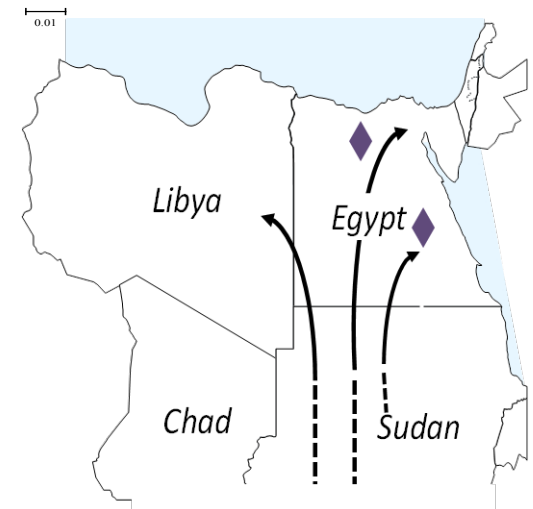
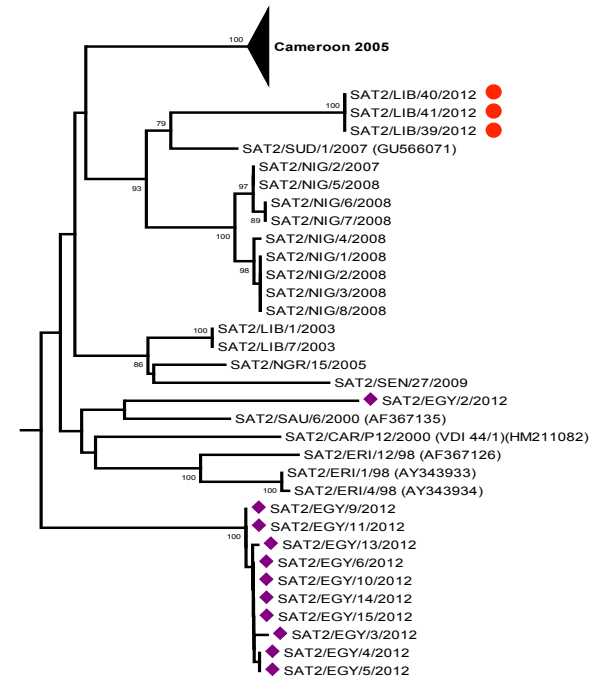




# North Africa:

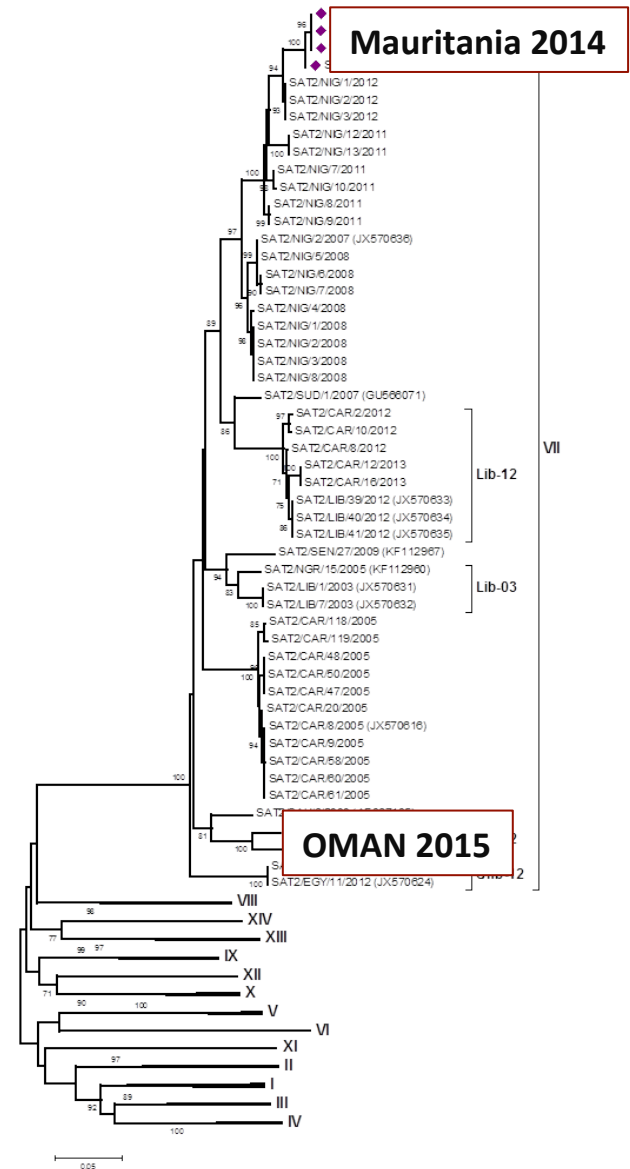
## serotype SAT 2 in Egypt during 2012

- First FMD cases in Egypt due to serotype SAT 2 since 1950
- Sequence data supported at least two introductions of SAT 2 FMDV into Egypt Within SAT 2 topotype VII
  - topotype VII from Libya
  - topotype IV from Bahrain
- SAT 2 (Alx-12) detected in Egypt during 2014



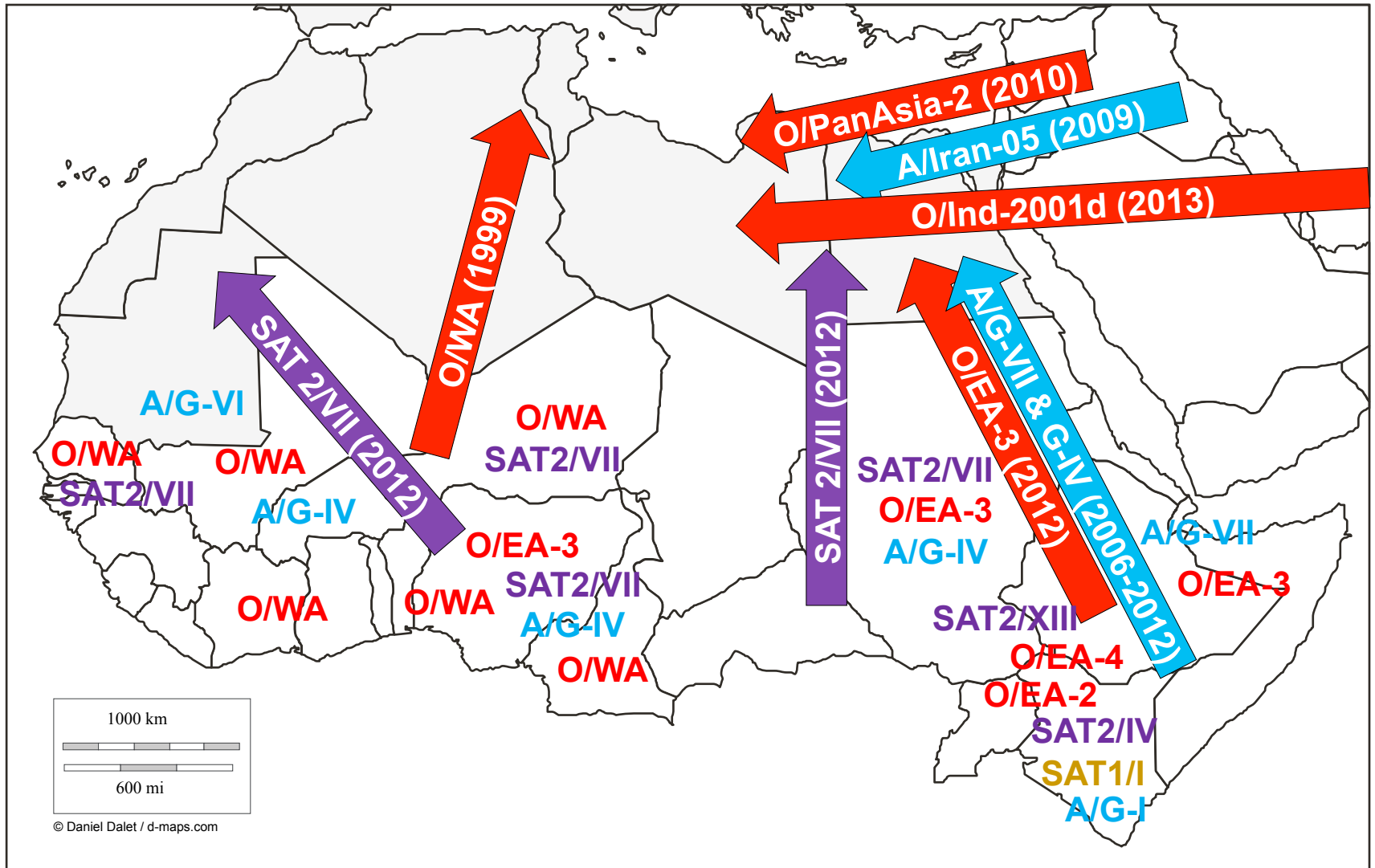
# Recent outbreaks due to SAT 2 Mauritania and Oman

- New SAT 2 samples from field outbreaks
- VP1 sequencing: two different genetic groups within topotype VII
- Oman 2015:
  - Cattle
  - Genetically similar to FMD viruses from previous outbreaks in Egypt (Alx-12 sub-lineage)
- Mauritania 2014:
  - Cattle
  - Genetically most similar to FMD viruses from Nigeria



# North Africa: other threats

Relevant for a regional vaccine bank?



# Summary of recently circulating FMDV lineages

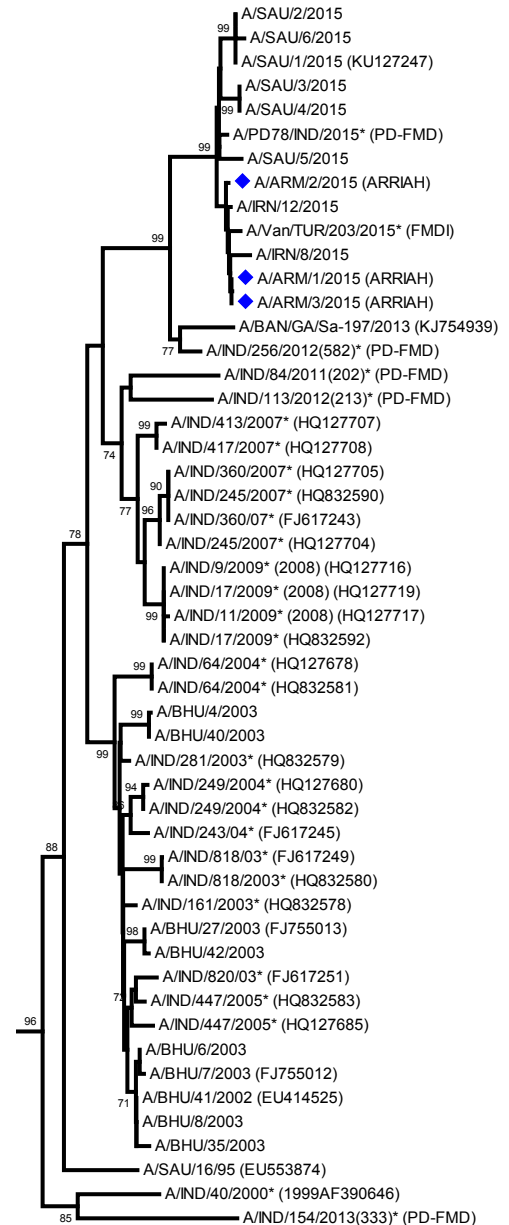
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<b>Viral lineage:</b>	<b>North Africa</b>
O/ME-SA/PanAsia-2	✓
A/ASIA/Iran-05	✓
Asia-1	X
O/ME-SA/Ind-2001	✓
SAT 2 topotype VII	✓
A/AFRICA/G-IV	✓
A/AFRICA/G-VII	✓
O/ME-SA/Sharqia-72	✓
O/EA-3	✓

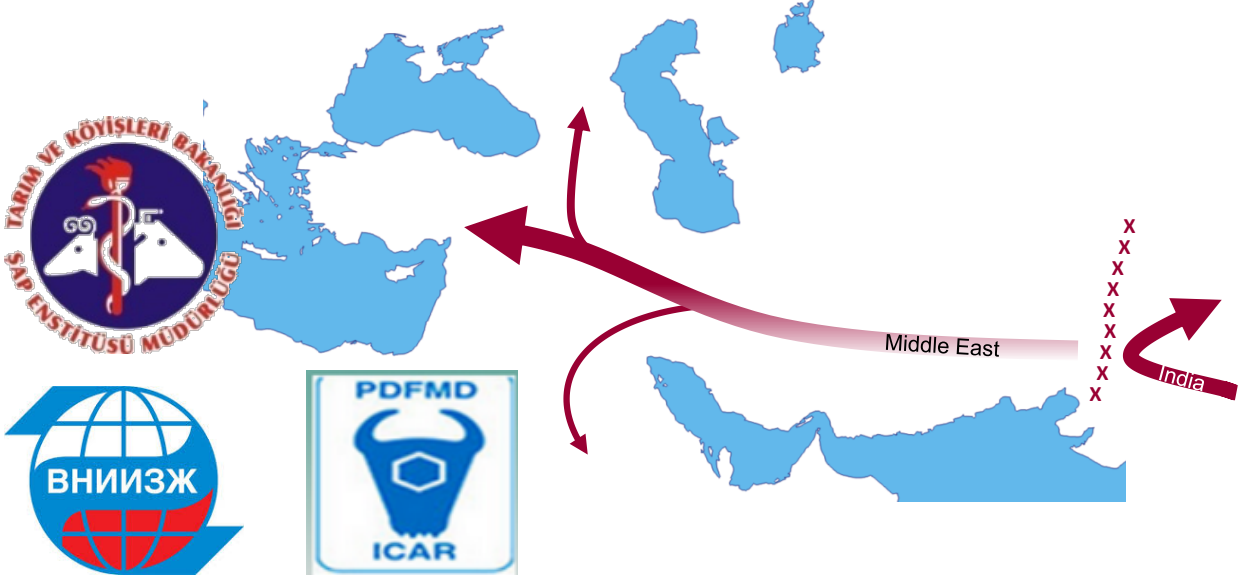
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# New serotype A outbreaks in West EurAsia

- Initial reports September 2015
- Saudi Arabia, Turkey, Iran, Armenia
- Originating from the Indian sub-continent
- A further example of new “unexpected” FMDV movement between endemic pools
- Impact upon vaccination?




G-VII (G-18)



# A/ASIA/G-VII (G18)

Poor in-vitro match to many commercial vaccines

 Not matched

Recent  
r-values:

	A/SAU/1/2015	A/SAU/2/2015	A/IRN/8/2015	A/IRN/12/2015
A-Iran-05	0	0	0	0
A-Iran-87	0	0.04	nd	nd
A-Iran-96	0.04	0.06	nd	nd
A-Iran-99	0.01	0.01	nd	nd
A-Sau-95*	0.20	0.19	0.26	0.16
A-22	0.11	0.11	nd	nd
A-Tur-20-06	0.03	0.06	0.01	0.15
A-May-97	0.14	0.23	0.15	0.23
A-Tur-11	0.01	nd	0.10	0.04
A-Tur-14	0	nd	0	0
A-IND-40-2000*	0.26	nd	0.03	0.24

\* Multiple BVS tested

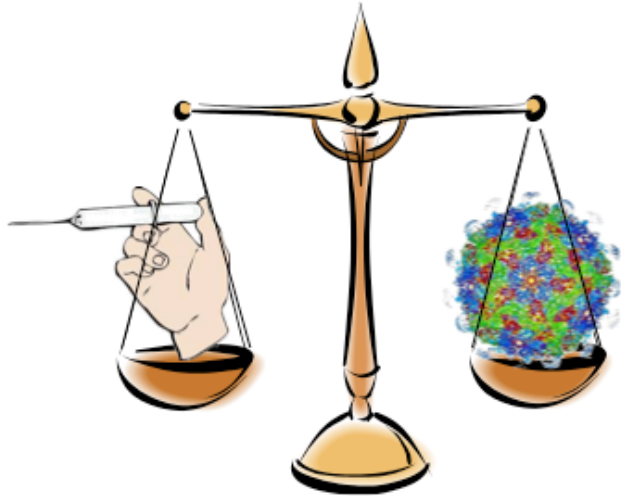


# Talk summary

- Epidemiology of FMD is very dynamic
  - Sampling of field outbreaks is critical
  - During 2015 - new unpredictable patterns in Asia (East and West) and North Africa
  - Impact upon selection and deployment of vaccines
- Does the vaccine bank need to accommodate current circulating strain(s) as well as FMD viral lineages that threaten the region?
  - Data sources:
    - Vaccine matching data
    - Potency data (particularly for heterologous studies)
    - Field studies

# FMDV vaccines

Coordination of different tools that are available?



In-vitro  
vaccine  
matching

Pilot  
Field  
trials

Vaccine  
effectiveness  
studies

In-vivo  
potency  
cross-  
protection

**ASSESSMENT  
of PROTECTION**

**COST and TIME**

# Acknowledgements

- Support for the WRLFMD and research projects
- Collaborating FMD Reference Laboratories and field teams
- Partners within the OIE/FAO FMD Lab Network

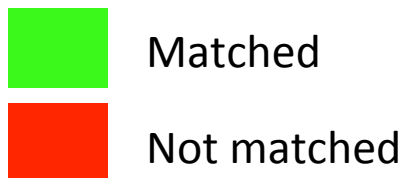


Department  
for Environment  
Food & Rural Affairs



# Vaccine matching data

Serotype O (all O/ME-SA/PanAsia-2 lineages): selected data

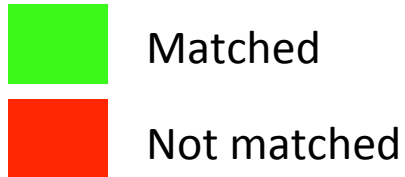


## Vaccine strain

Field isolate	O-3039	O-4625	O/Manisa	O/RUSSIA/ 2000	TAW/98	O/TUR 5/2009
Iran 2012	nd	Matched	Matched	nd	nd	Matched
Iran 2013	Matched	Matched	Not matched	nd	nd	Matched
Iran 2014	Matched	nd	Not matched	nd	Matched	Matched
Pakistan 2012	nd	Matched	Not matched	nd	Matched	Matched
Pakistan 2013	Matched	nd	Not matched	nd	Matched	Matched
Palestinian AT 2013	Matched	nd	Not matched	nd	Matched	Matched
UAE 2013	nd	Matched	Not matched	nd	nd	Not matched
Turkey 2013	Matched	Matched	Not matched	Matched	Matched	Matched
Turkey 2014	Matched	nd	Matched	nd	Matched	Matched
Israel 2014	Matched	nd	Not matched	nd	Matched	Matched

# Vaccine matching data

Serotype A (A/ASIA/Iran-05): selected data



		Vaccine strain				
		A/Eri98	A/IND 17/82	A/Iran 2005	A22Irq 24/64	A/TUR/ 2006
Egypt 2013	BAR-08	Not matched	nd	Not matched	Not matched	Not matched
Iran 2012		nd	nd	Not matched	Not matched	Matched
Iran 2013	SIS-10	nd	nd	Not matched	Not matched	Not matched
Pakistan 2012	HER-10	nd	Not matched	Not matched	Matched	Matched
Pakistan 2012	SIS-12	nd	Not matched	Not matched	Matched	Matched
Pakistan 2013	FAR-11	nd	nd	Not matched	Not matched	Matched
Pakistan 2014	FAR-11	nd	nd	Not matched	Matched	Matched
Pakistan 2014	FAR-09	nd	nd	Matched	Matched	Matched
Palestinian AT 2013	BAR-08	nd	nd	Not matched	Not matched	Matched
Turkey 2013	SIS-10	nd	nd	Not matched	Not matched	Matched
Turkey 2014	SIS-10	nd	nd	Not matched	Not matched	Not matched