West Euro-Asia: recent epidemic situation, progress and challenges to implement the regional roadmap for progressive FMD control

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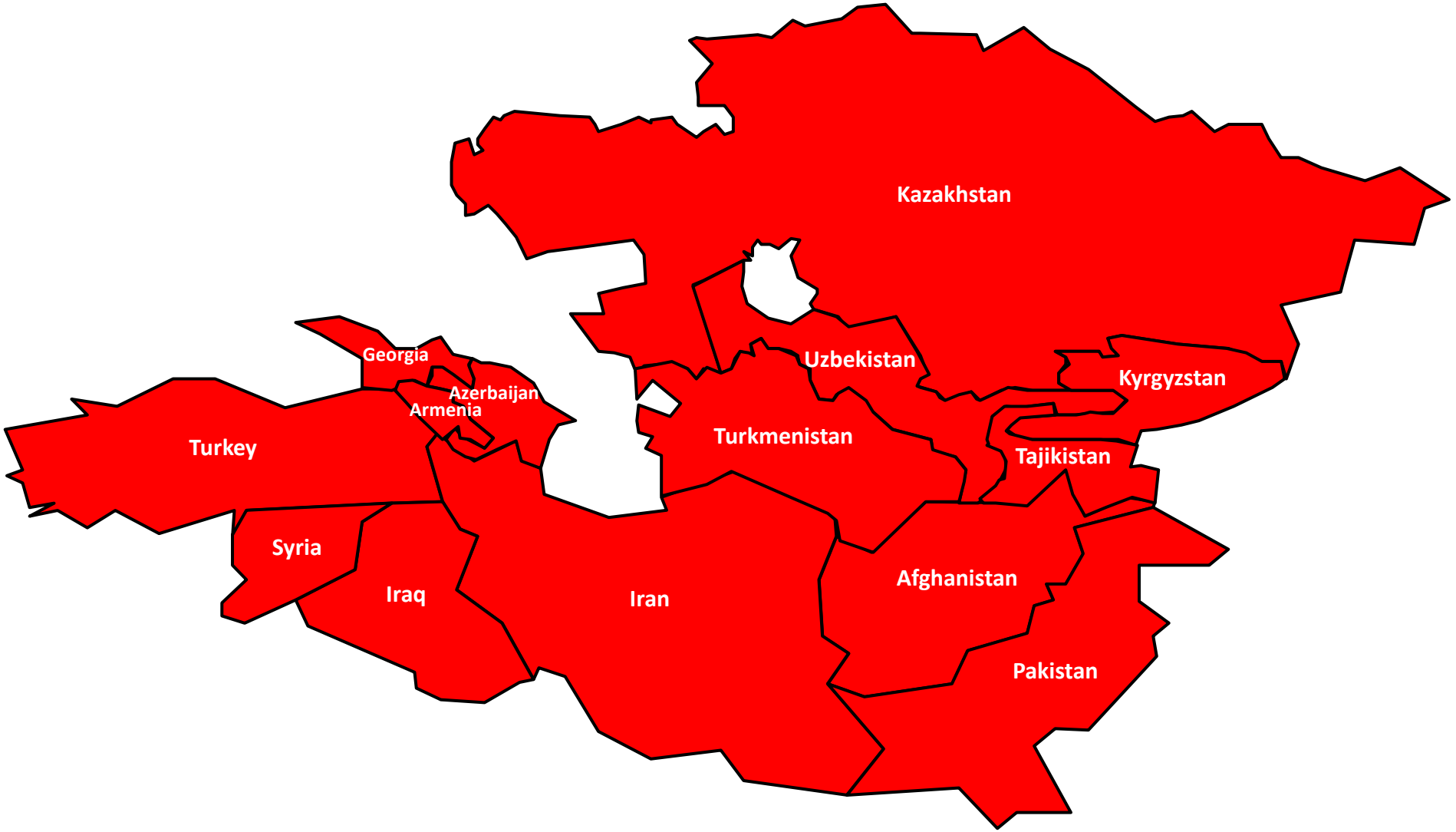
FMD Week, Istanbul, March 27-29, 2012

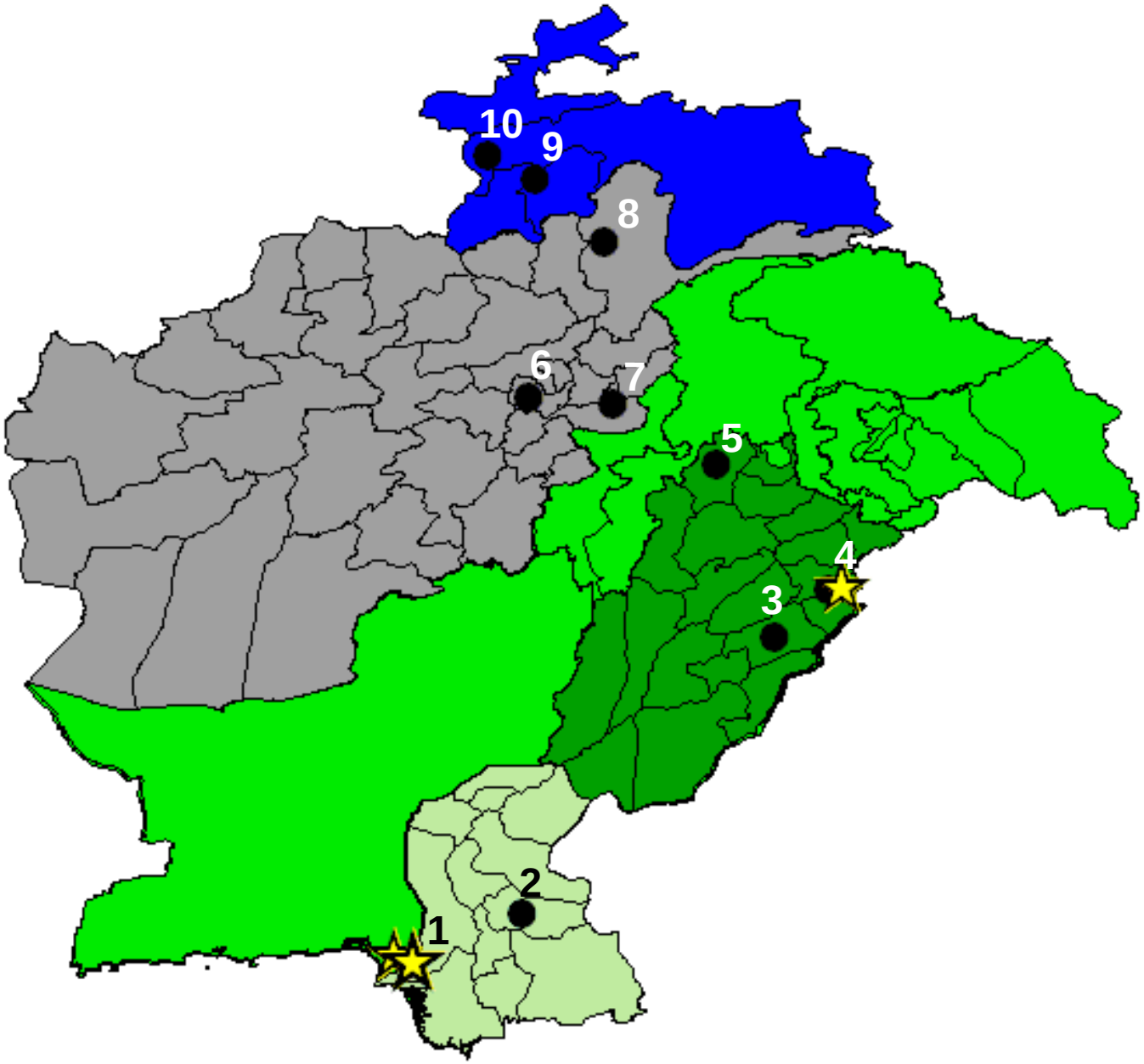
West Euro-Asian Countries



- In response to the repeated epidemic events and requests for assistance by the affected and at risk countries, FAO convened a meeting of 14 directly affected countries in Shiraz, Iran in 2008 to develop a long term (2020) vision for FMD control in the region.
- The FAO developed Progressive Control pathway (PCP-FMD) was utilised to develop national and regional action plans and support.
- Several FAO projects supported national/regional PCP activities.
- The progress at national level along the PCP-FMD was assessed at three regional meetings in 2008, 2009 & 2010, where the country representative presented the evidence of national activities.

- **Presentation of FMD monitoring results has provided evidence that FMD infection is far more frequent than previously recognised and may provide a more useful indicator of impact of control measures than the outbreak case numbers.**

- **Vaccine suitability for the region and threat of vaccine break through have been monitored.**



The locations of the live animal markets (marked with circles) and dairy colonies (marked with stars) from where clinically healthy animals were sampled

Oral swab samples collected and tested from live markets and dairy colonies (July 08 to Aug. 2009)

Species	Live Markets			Dairy Colonies (Pakistan)	Total
	Pakistan	Afghanistan	Tajikistan		
Cattle	3/210	18/180	0/120	12/202	33/412
Buffaloes	10/287	0	0	29/502	39/789
Total	13/497 (2.62%)	18/180 (10%)	0/120 (0%)	41/704	72/1501

LDC, Karachi, Pakistan **(collected from a cohort of 179 animals)**	Cattle	12/104
	Buffaloes	29/233
	Total	41/337

0/367

Circulation of FMD Vir
in Landhi Dairy Colon

Result	NSP Ab +ve	NSP Ab -ve	Total
FMDV RNA positive	29	10	39
FMDV RNA negative	101	39	140
Total	130	49	179

Eight animals became NSP +ve within first month in the colony, One became positive within two months, whereas one remain negative throughput the study period

27 animals tested positive for NSP Ab within the first month, 9 remained negative throughout the study, while 3 lost to follow

~22% of the apparently healthy animals were carrying FMDV while entering the colony

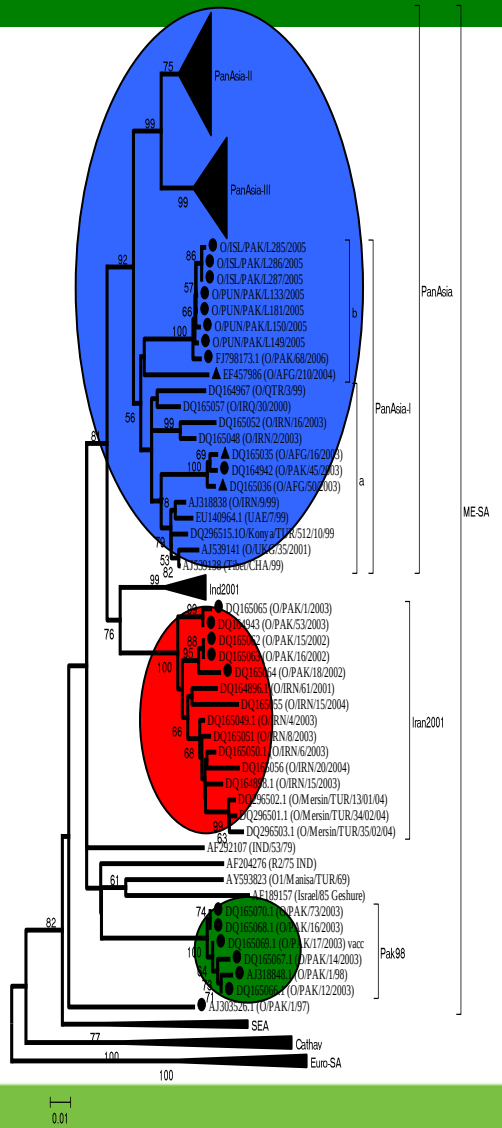
FMDV Serotype O in West Euro-Asian region, 1998-2012

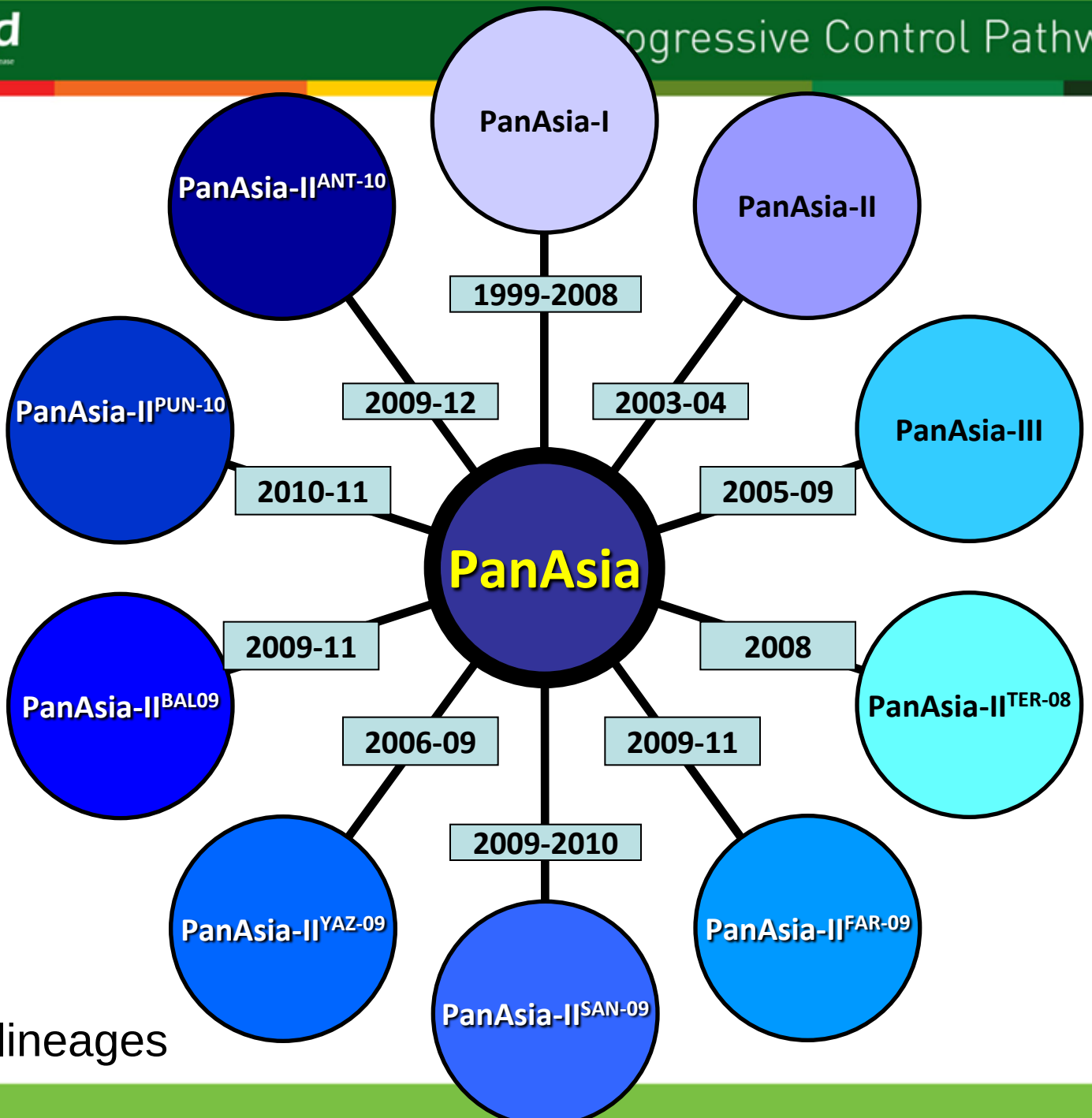
Topotype ME-SA

Lineages

- Pak98 (1998 and 2003)
- Iran2001 (2001-2004)
- PanAsia (1999-2012)

Plus Incursion from other regions

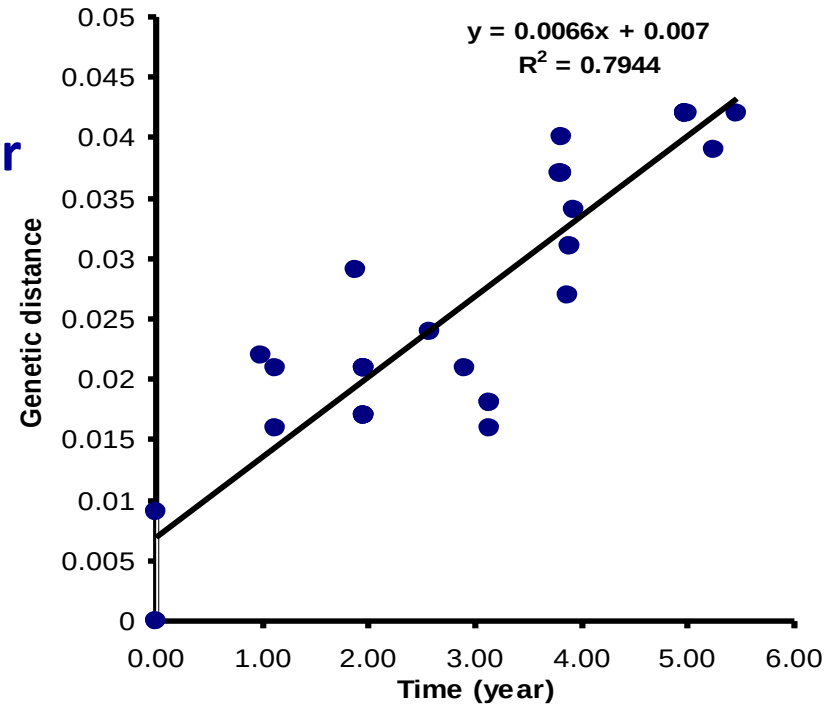


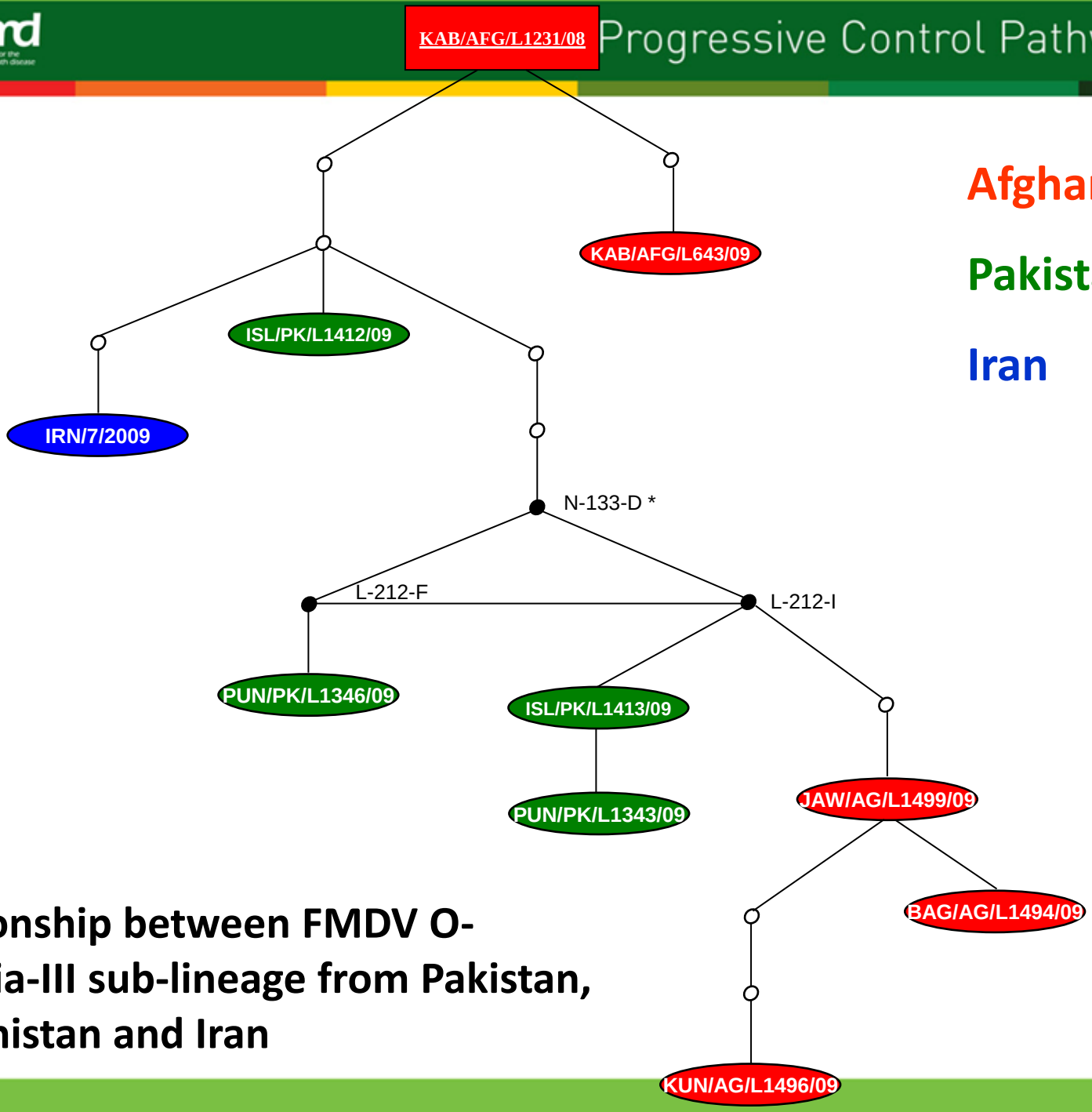


10 sublineages

Rate of Evolution of O-PanAsia

- 6.65×10^{-3} (5.49 to 7.80×10^{-3}) s/nt/yr
- New sublineage arises within 5-6 years
- No significant effect of:
  - Host species (cattle/buffalo)
  - Country of origin (Pakistan/Afghanistan)





Afghanistan

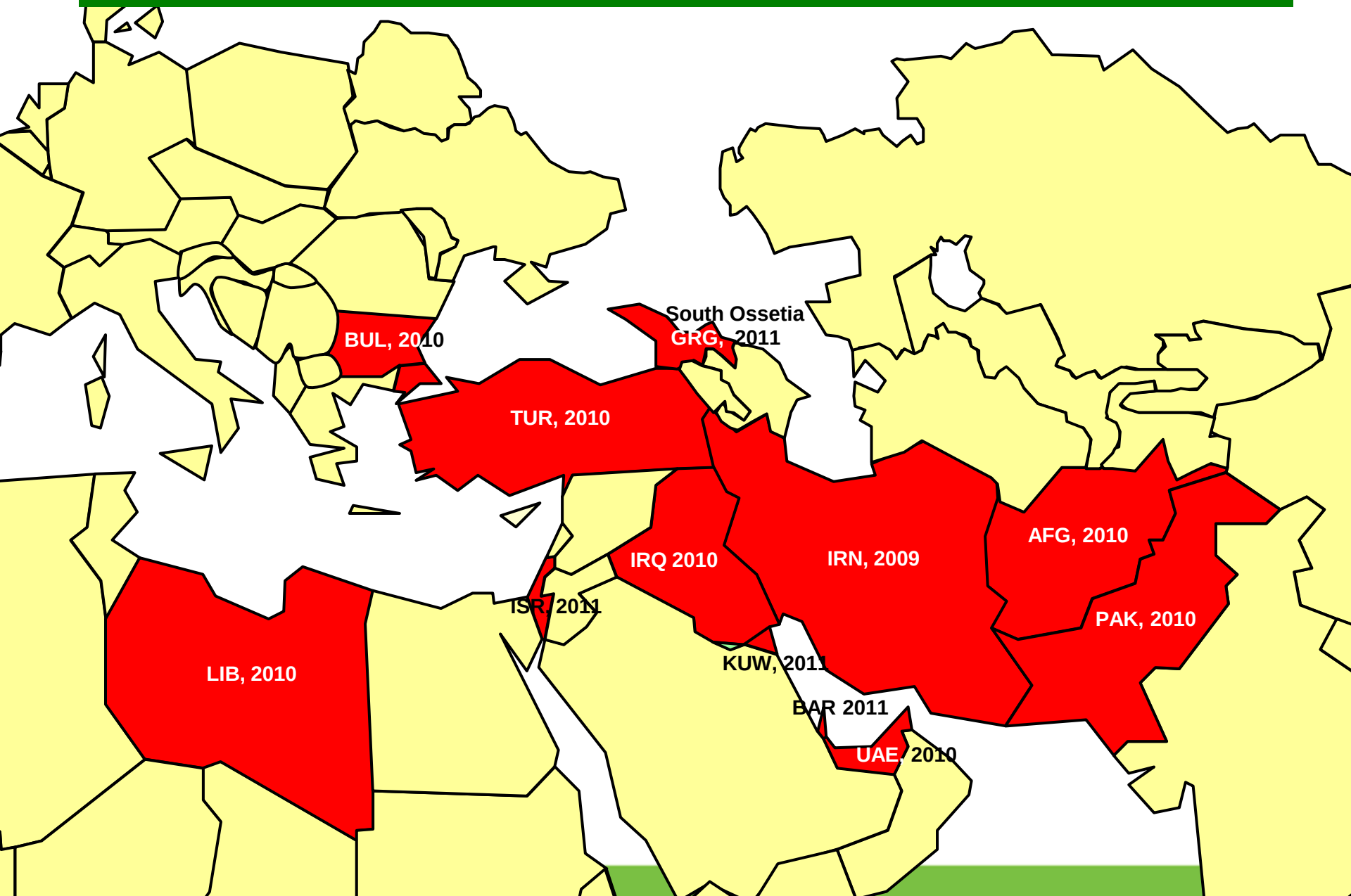
Pakistan

Iran

Relationship between FMDV O-PanAsia-III sub-lineage from Pakistan, Afghanistan and Iran

Distribution of O-PanAsia-II^{ANT-10} viruses in the West EuroAsian Region

Global distribution of O-PanAsia-II^{ANT-10}



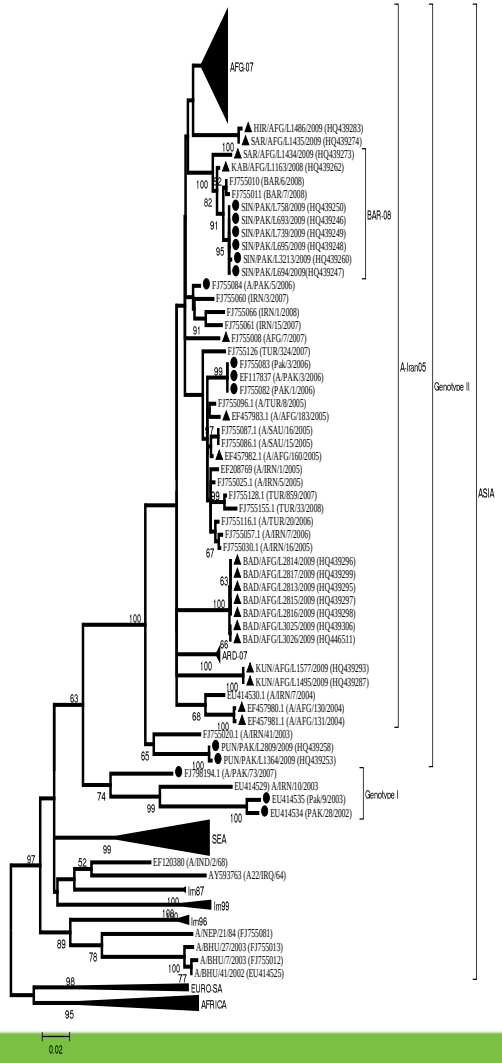
FMDV Serotype A in West Euro-Asian region, 1996-2011

Topotype Asia

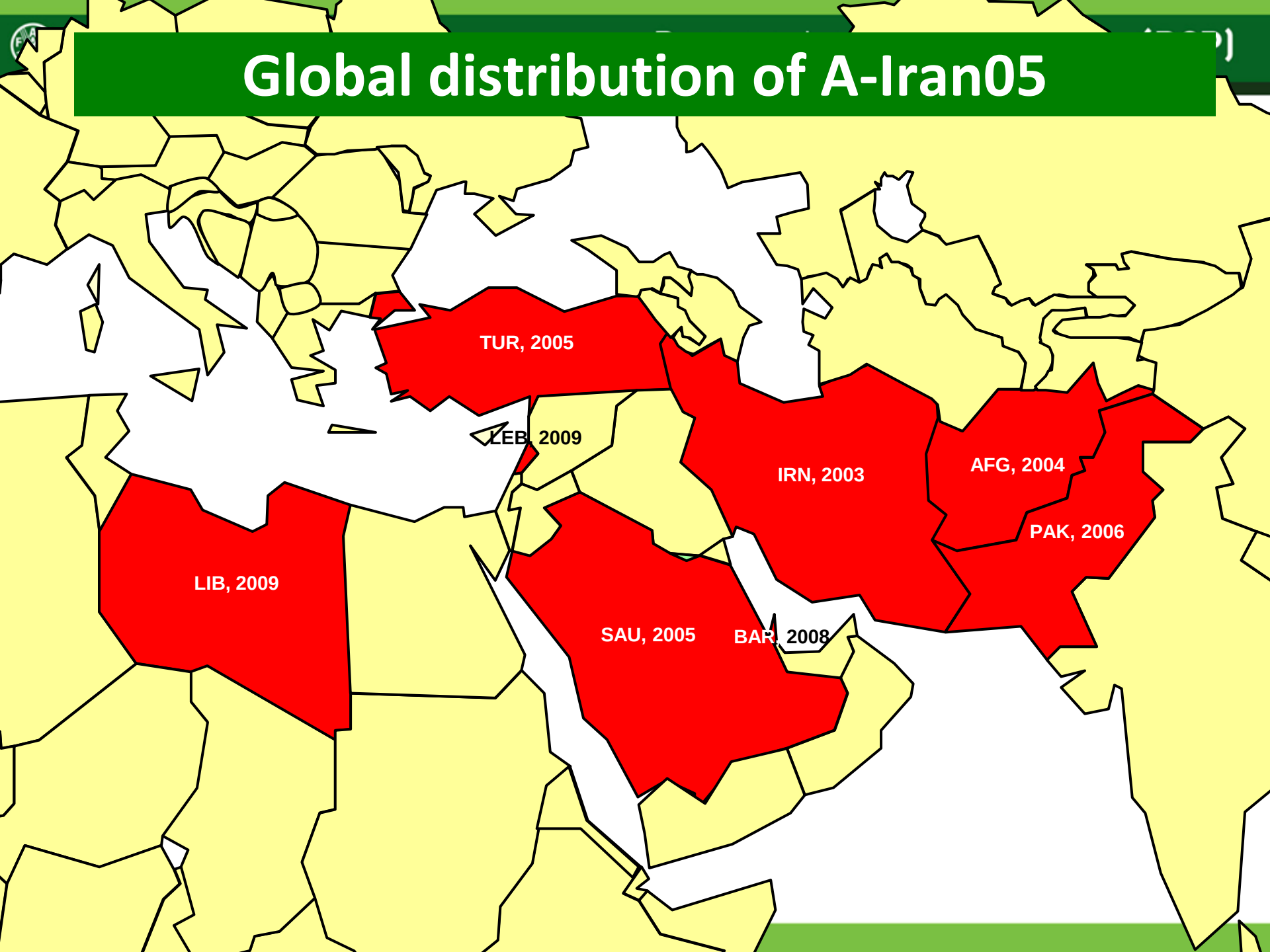
Genotypes I & II

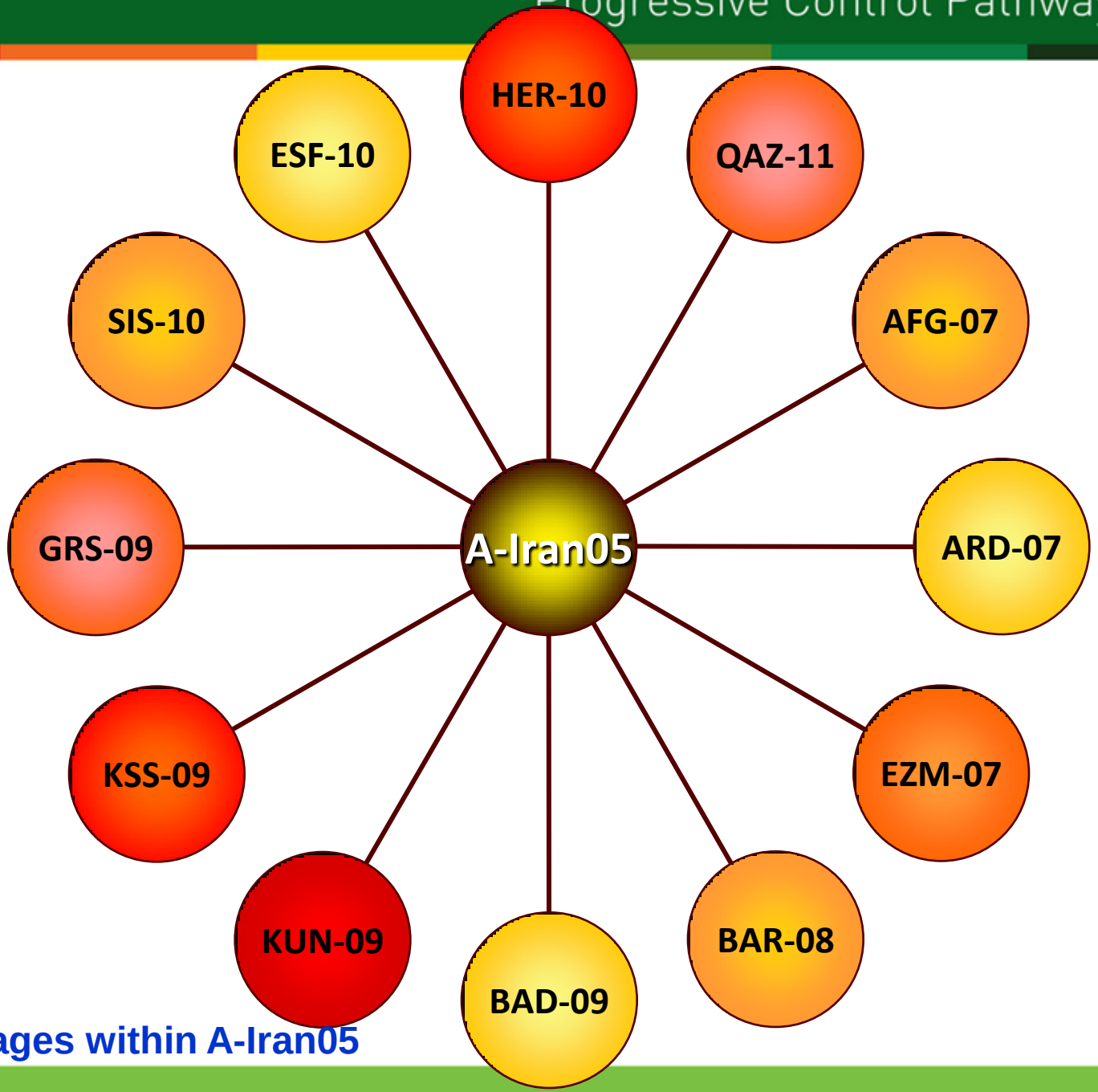
Lineages

- A-Irn96
- A-Irn99
- A-Iran05
- A-Pak09



Global distribution of A-Iran05

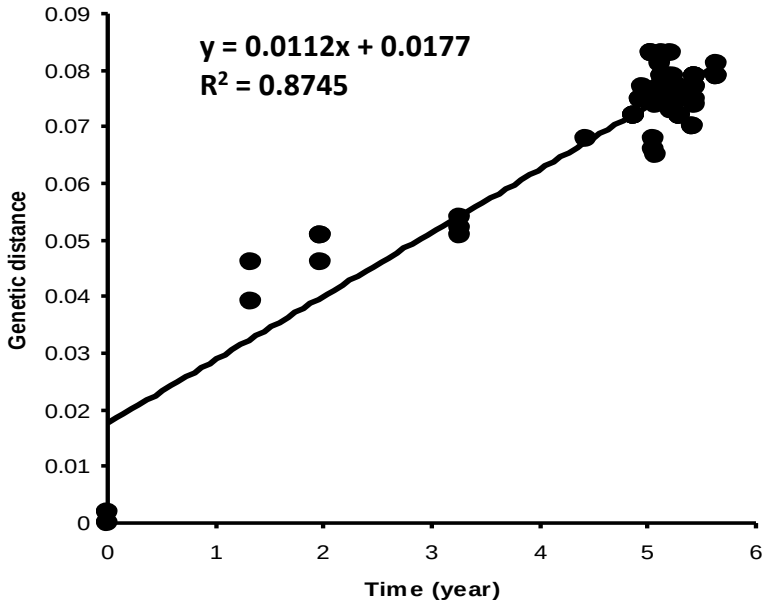


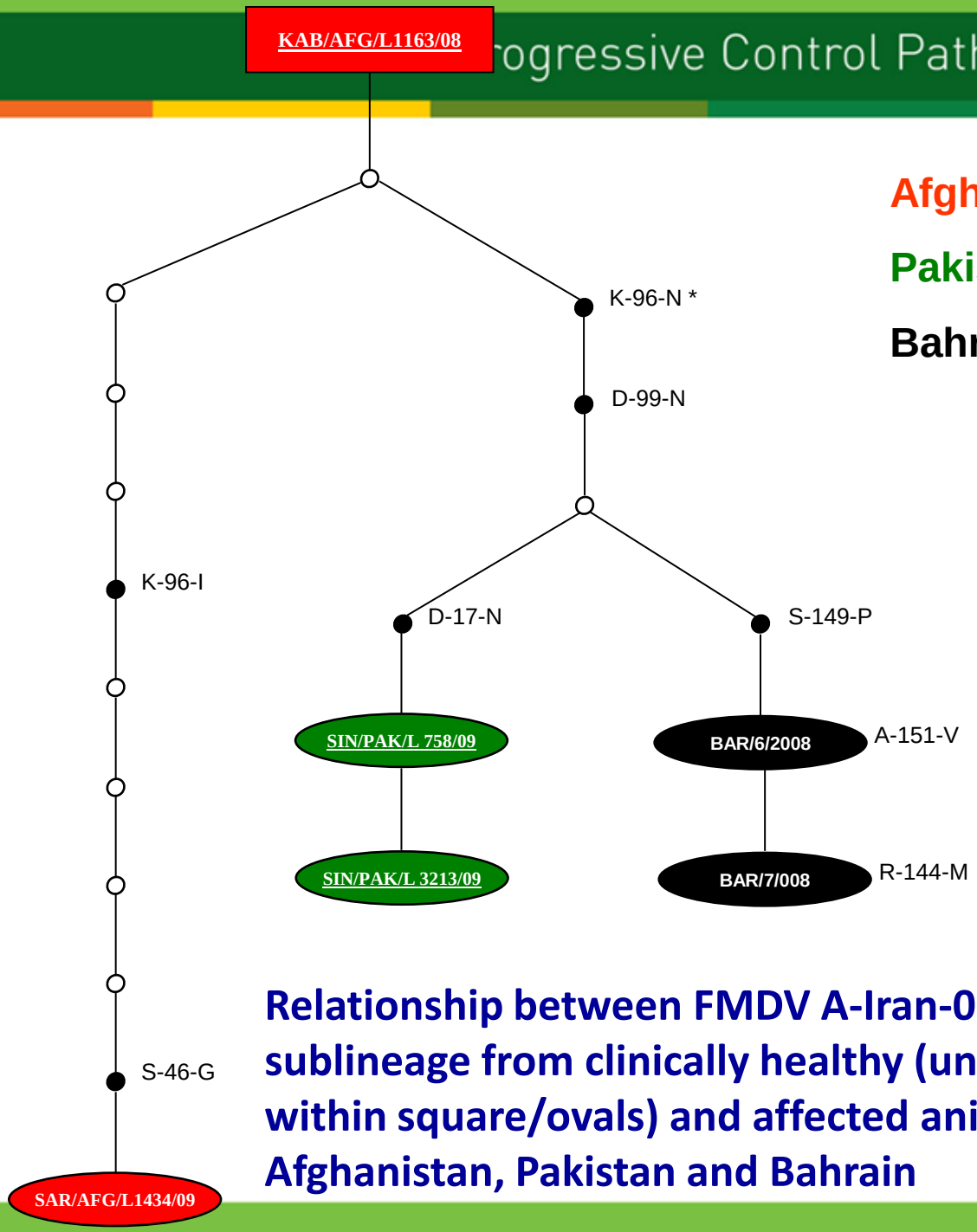


12 sublineages within A-Iran05

Rate of evolution of A-Iran-05 lineage

- 1.12×10^{-2} (1.02 to 1.22×10^{-2}) s/nt/yr
- New sublineage arises within 3 years
- No significant effect of:
  - Host species (cattle/buffalo)
  - Country of origin (Pakistan/Afghanistan)





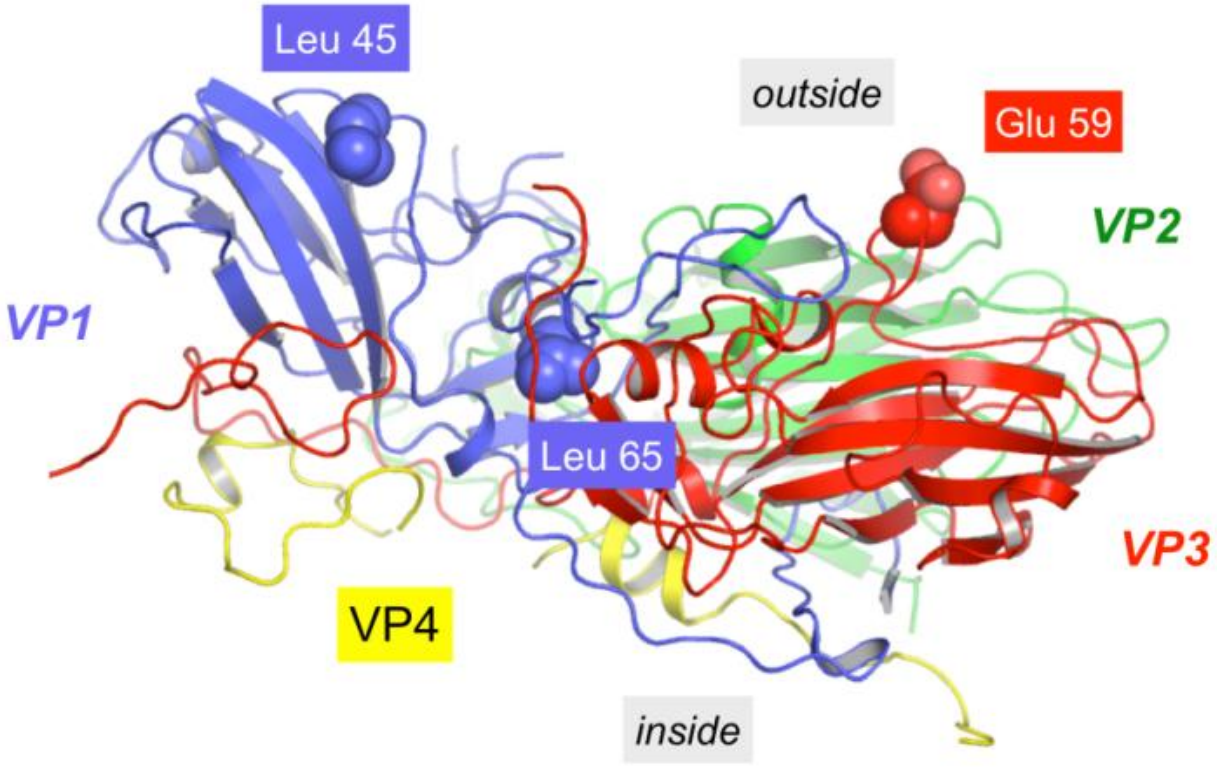
Afghanistan

Pakistan

Bahrain

Relationship between FMDV A-Iran-05^{BAR-08} sublineage from clinically healthy (underlined within square/ovals) and affected animals in Afghanistan, Pakistan and Bahrain

Selected capsid protein differences between A-Iran05^{Bar08} and the A22 Iraq vaccine strain were mapped on the structure of the vaccine virus



A22	BAR-08
45 L (TTG)	A (smaller) (GCG)
65 L (CTG)	F (phenyl alanine, hydrophobic branched aromatic) (TTT)
59 E (glutamine) –vely charged (GAA)	N (Asparagine, neutral) (AAC)

FMDV serotype Asia-1 in West Euro-Asian Region, 1998-2012

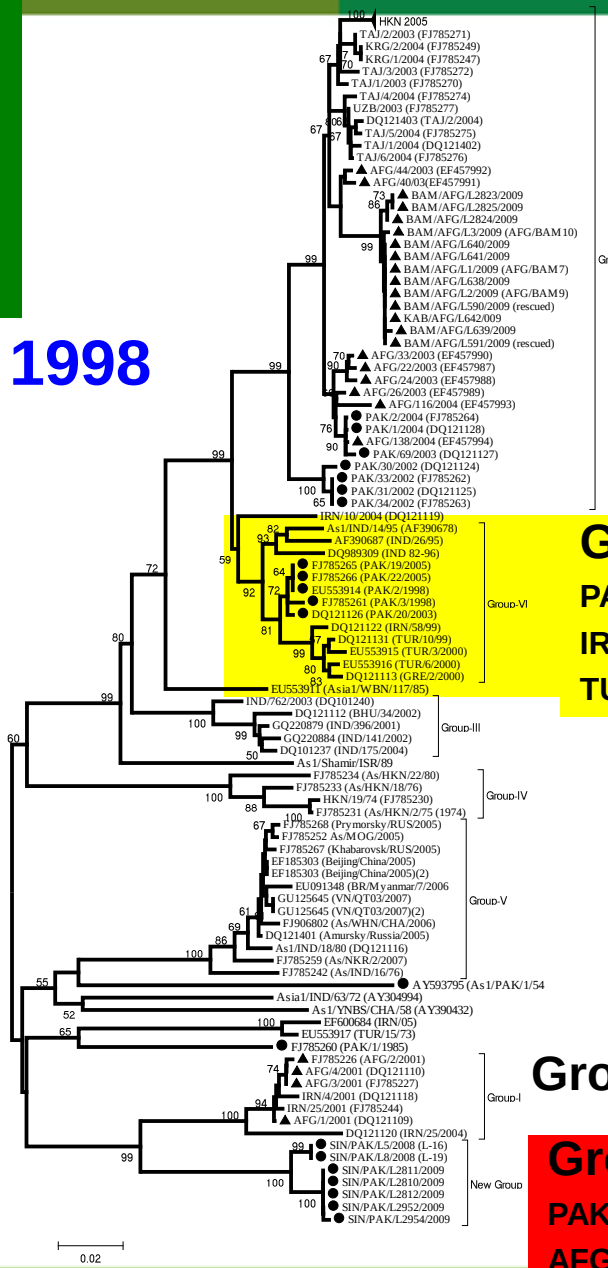
Four genetic Groups since 1998

Vaccine Matching

- Group II & VI covered with Shamir but the recent Group II viruses not neutralized with Shamir

- The new (Group-VII) not blocked using any vaccine strain.

- SAP Institute Turkey recently prepared vaccine using this new Group and preliminary results gave promising results



Group-II
PAK 2002-04
TAJ. UZB. KRG 2003-4
AFG 2003, 05, 09

Group-VI
PAK 1998, 2003, 2005
IRN, 1999
TUR, GRE, 2000

Group-I AFG. IRN 01

Group-VII
PAK 2008-2012
AFG, IRN, BAR, TUR

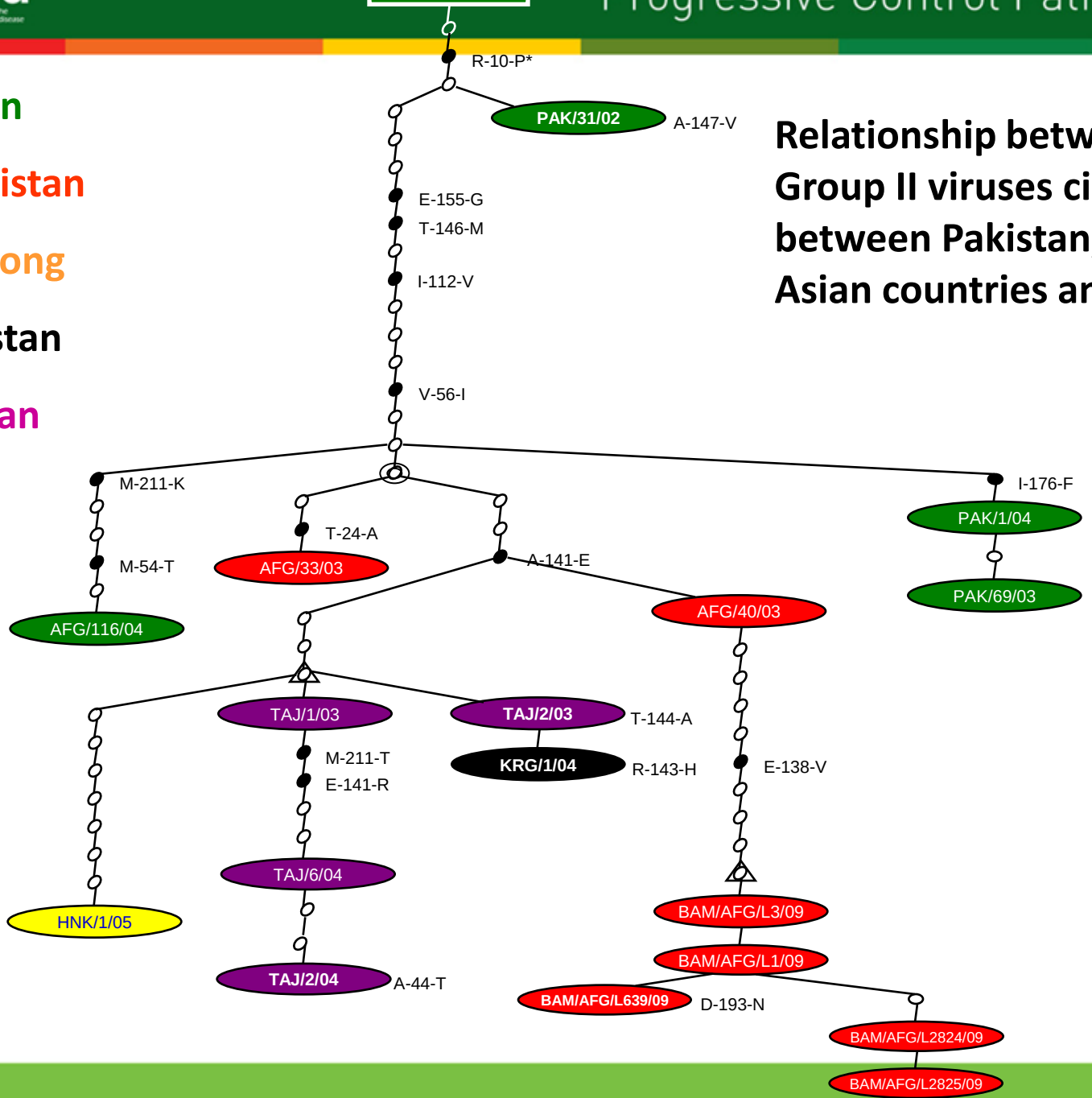
Pakistan

Afghanistan

Hong Kong

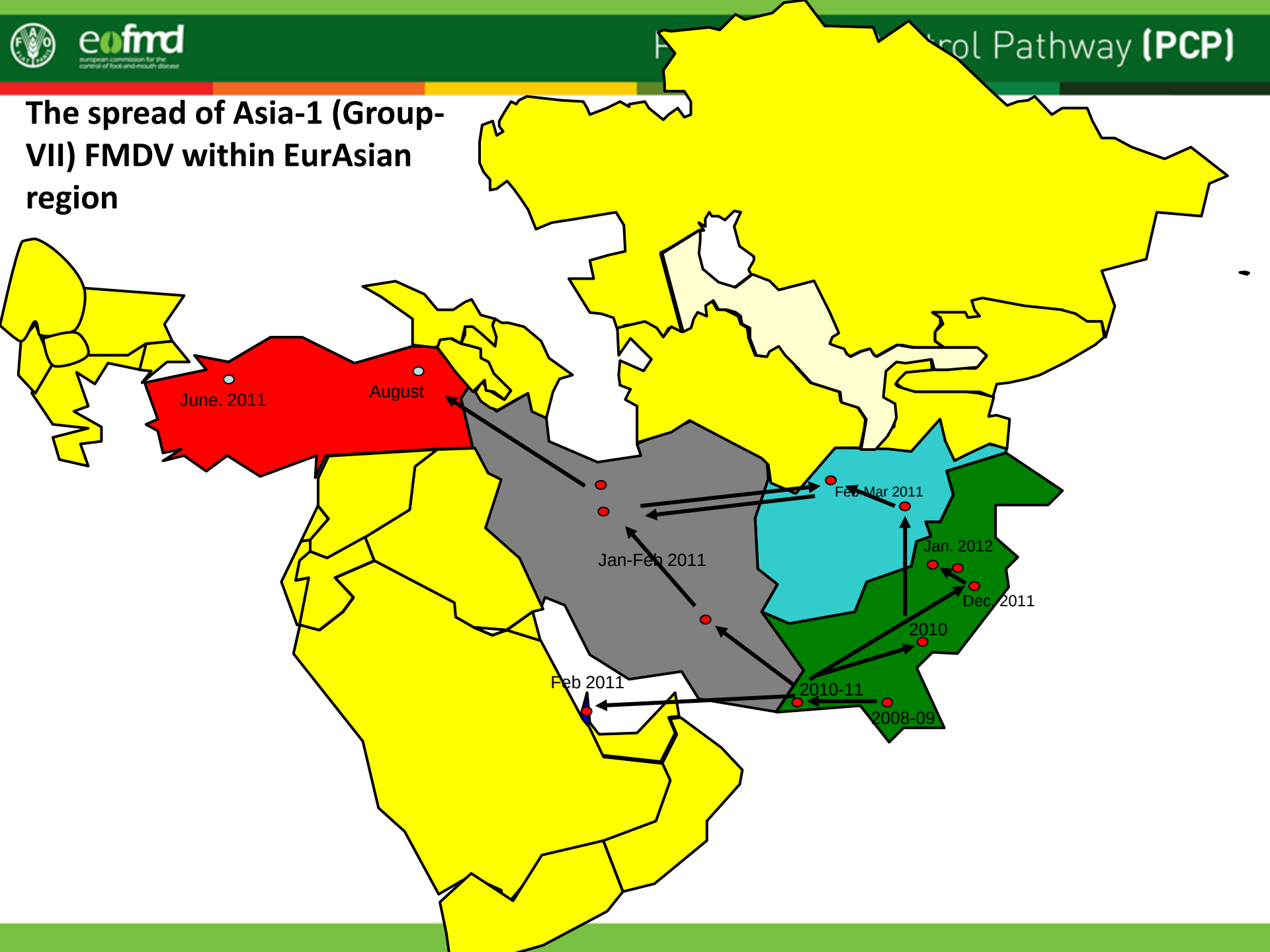
Kyrgyzstan

Tajikistan



Relationship between Asia-1 Group II viruses circulating between Pakistan, Central Asian countries and Hong Kong

The spread of Asia-1 (Group-VII) FMDV within EurAsian region



Nucleotide identity (%) portions of L-2810 with that of the other viruses

	Viruses	5' UTR (492nt)	L-region (603nt)	P1+2A (VP1) (2253nt)	P2 (1410nt)	P3 (2724nt)	3' UTR (87nt)
Asia-1	As/SIN/PAK/L5/2008 (L-16)	91.9	86.9	96.8 (98.4)	93.9	92.5	86.2
	As/BAM/AFG/L590/2009	88.8	87.4	85.4 (82.1)	93	96.6	94.4
	As/HKN/CHA/1/2005	87.4	88.7	86.3 (83.2)	92.1	92.8	86.2
	As/IND/491/97	89	85.9	86 (85.2)	94.2	93	93.1
	As/IND/321/01	94.1	88.7	85.9 (82.9)	92.6	92.8	90.8
A	A/PAK/3/2006	91.3	86.1	79.7 (69.8)	95.7	93.2	87.4
	A/SIN/PAK/L4/2008	99.2	98.8	80.2 (69.7)	98.6	99.4	97.7
O	O/Tibet/CHA/1/99	88.2	85.7	79.5 (67.6)	92.8	92.4	89.6
	O/UKG/35/2001	88	86.4	79.4 (66.4)	92.4	92.4	87.4
	O/ISL/PAK/L1573/2009	95.9	94.2	79 (67.3)	94.5	95.4	94.2
	O/PAK/45/2008	96.3	95.0	79.4 (68.2)	92.8	95.6	93.1

Vaccine Matching Studies (VNT) for FMDVs isolated from Euro-Asia, 2010-11

Vaccine Strain	Total Tested	Total Matched	% Matched
O Manisa	59*	35*	59
O Ind R2/75	31**	31**	100
O 4625	38	38	100
O TUR 09	31*	31*	100
A22 Iraq	25	8	32
A Iran 2005	15	7	47
A TUR 06	25	22	88
Asia1 Shamir	15	2	13
As/WBN/117/85	15	1	7
As/Ind/8/79	15	0	0
Total	269	175	65

* Including 4 from Bulgaria, 2 from Israel and one from Libya (ANT-10)

** Including one from Libya

Conclusions

- A higher proportion of oral swab samples collected from apparently healthy animals in live animal markets were positive for FMDV RNA compared to those collected from dairy colonies.
- LDC, Karachi is not only the reservoir of FMDV, entry of replacement animals into the colony is also a source of maintaining the infection there.
- Marketing and farming systems characterized by high turn-over of the animals appear to create suitable conditions for FMDV to be maintained and it is likely that they play an important role in the chain of transmission of the disease.
- Collection and testing of swab samples may be an important component of a surveillance program in endemic settings. In this regard, animal live markets have proved to be a good collection point from which FMDV RNA can be detected in healthy animals.

Conclusions (cont.)

- The procedure for collecting oral swabs (in contrast to the use of probang cups) is not invasive and is usually accepted by the traders in the market.
- Multiple sublineages within serotypes O, A and Asia-1 have been circulating in the region and new sub-lineages rapidly appearing.
- O-PanAsia, A-Iran05 and New Asia-1 (Group-VII) viruses are wide-spread in most of the Eurasian countries
- The activities implemented since the 2008 meeting in Shiraz (Iran) have allowed to detect the occurence of three epidemics of regional significance in the past three years;
  - A Iran-05 in 2008-2012
  - O Panasia-II^{ANT-10} in 2009-2012
  - New Asia-1 (Group-VII) in 2008-2012

Conclusions (cont.)

- All of these epidemics travelled from East to West and to some extent involved Central Asian countries.

- The rapidity for spread of FMDV across borders of the region highlight some difficult issues for FMD control such as:

  - Limited use or impact of effective quarantine measures,
  - The lack of control at animal exchanges/markets,
  - Lack of and achievement of effective immunity in animals before short or long distance trade.

- The A-Iran05^{BAR-08} viruses are not expected to be blocked with A22 vaccine.

Conclusions (cont.)

- Mapping of the amino acid differences between the capsid proteins of the A22/Iraq vaccine strain and the BAR-08 viruses onto the known structure of the vaccine strain indicated that non-conservative substitutions in highly exposed residues in VP1 and VP3 are strong candidates to explain the lack of protection induced by the A22/Iraq vaccine against the BAR-08 viruses.
- Serotype Asia-1 virus detected in Pakistan, Afghanistan, Iran, Bahrain & Turkey belongs to a new Group (Group-VII) and requires attention to identify an efficient vaccine.
- The Roadmap process and regular and systematic review process has been popular and appreciated, and the PCP framework has assisted countries to review their national short and long term objectives.

Acknowledgements

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