Global and regional status of FMD
– Reference centre presentations

FMD Current Epidemic Situation in China

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OIE/China national FMD reference laboratory

13th Feb 2012, New Delhi

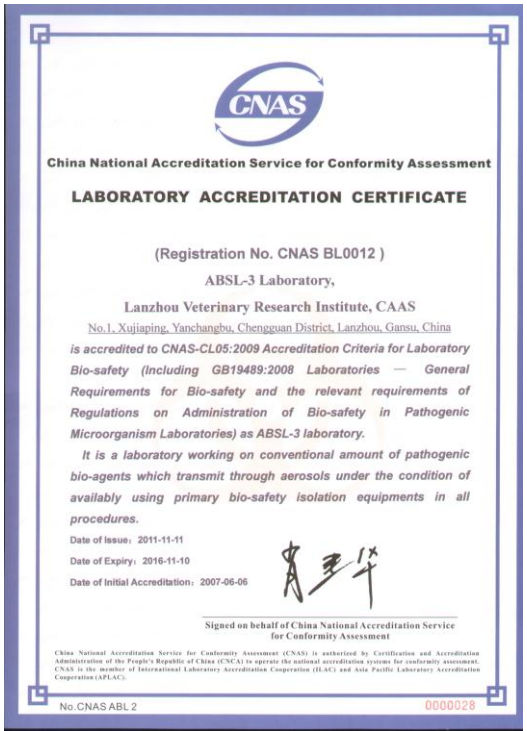
Contains

- **Introduction of CNFMDRL** briefly
- **Current situation of FMD in China**
  - **Type O (2011)**
  - **Type A (2009-2010) & type Asia1 (2005-2009)**
  - **Threatened outbreaks or strains from neighboring countries**
- **Diagnostic techniques**
- **FMD routine surveillance & active monitoring**
- **Future directions and needs**

Lanzhou Veterinary Research Institute, CAAS

China National Foot-and-Mouth Disease Reference Laboratory

- **Founded in 1958: FMD research group**
- **Renamed as NFMDRL by MoA of China in 2002**
- **OIE FMDRL in May, 2011**
- **Centre of FMD diagnosis, research, consulting service in China**



CNAS

China National Accreditation Service for Conformity Assessment

LABORATORY ACCREDITATION CERTIFICATE

(Registration No. CNAS BL0012)

ABSL-3 Laboratory,

Lanzhou Veterinary Research Institute, CAAS

No.1, Xujiaping, Yanchangbu, Chengguan District, Lanzhou, Gansu, China

is accredited to CNAS-CL05:2009 Accreditation Criteria for Laboratory Bio-safety (Including GB19489:2008 Laboratories — General Requirements for Bio-safety and the relevant requirements of Regulations on Administration of Bio-safety in Pathogenic Microorganism Laboratories) as ABSL-3 laboratory.

It is a laboratory working on conventional amount of pathogenic bio-agents which transmit through aerosols under the condition of availably using primary bio-safety isolation equipments in all procedures.

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Date of Initial Accreditation：2007-06-06

Signed on behalf of China National Accreditation Service for Conformity Assessment

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No.CNAS ABL 2 0000028

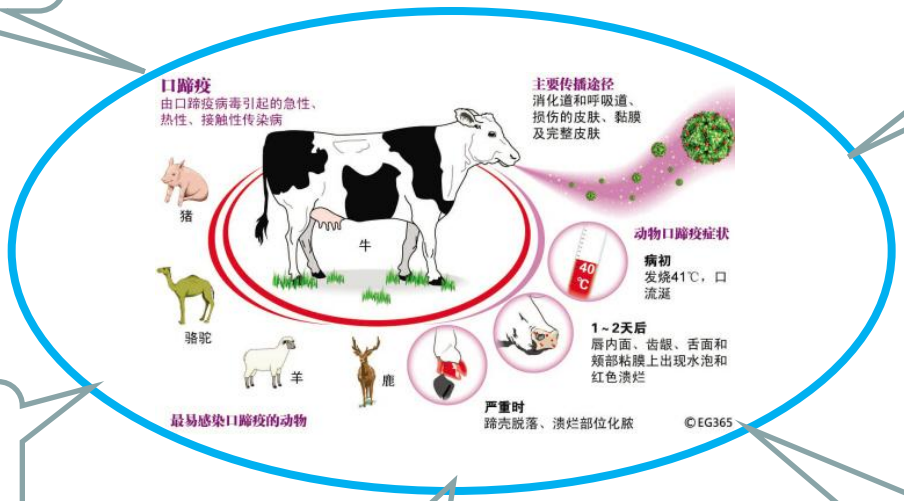
Roles of CNFMDRL

Diagnosis

- ✓Final diagnosis;
- ✓R&D new methods;
- ✓standardization of detection methods;
- ✓Supply reagents

Regional Technical Assistance

- ✓Provide technical consultation and instruction;
- ✓Participate in drawing policies and plans for FMD prevention and control
- ✓Training



Vaccination

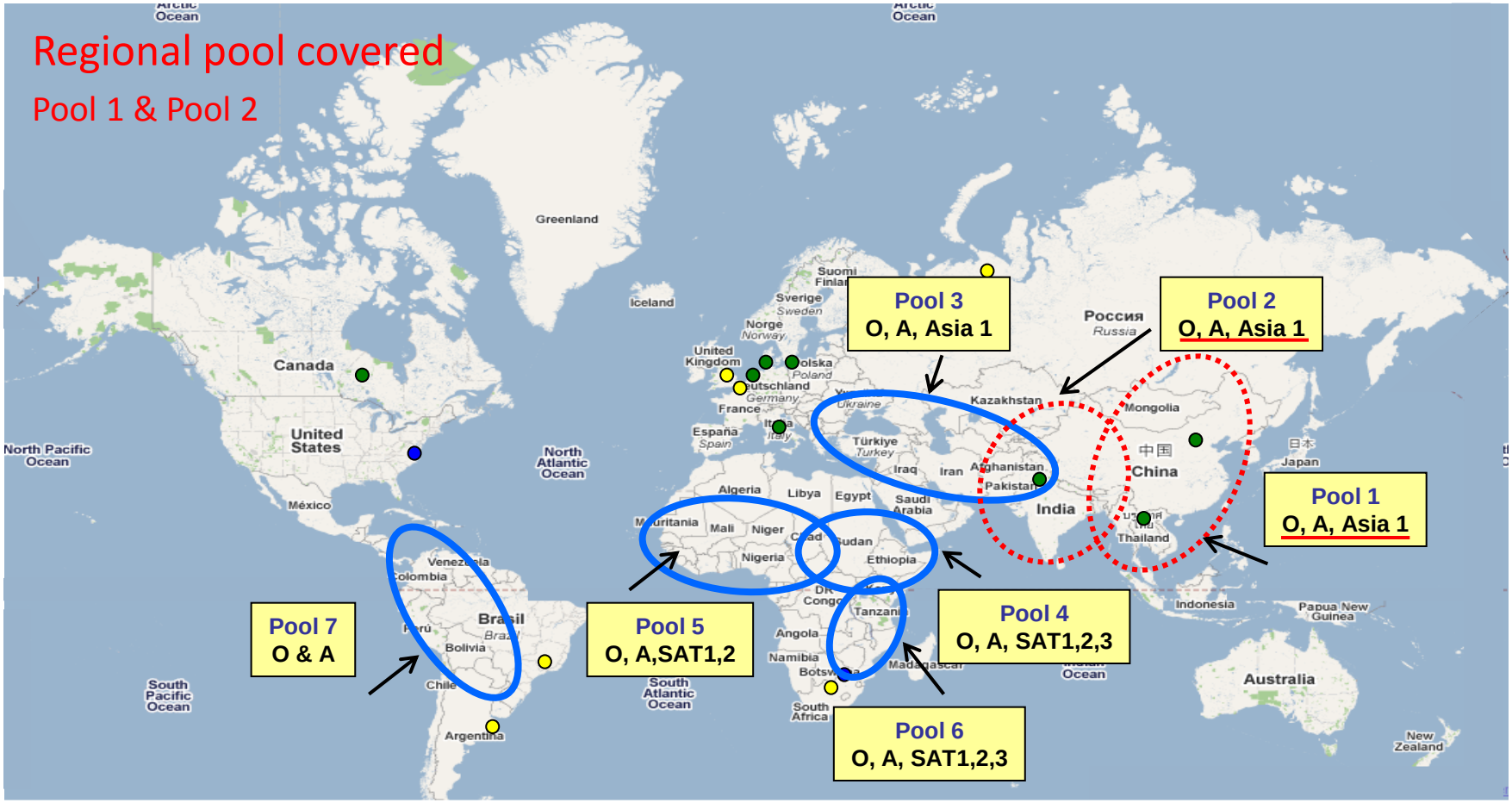
- ✓Evaluation of immune effect in field;
- ✓Detection of antigenic variation of field isolates;
- ✓Screening and recommendation of vaccine strains

FMD prevention

- ✓Epidemiological survey
- ✓.....

Technical consultation

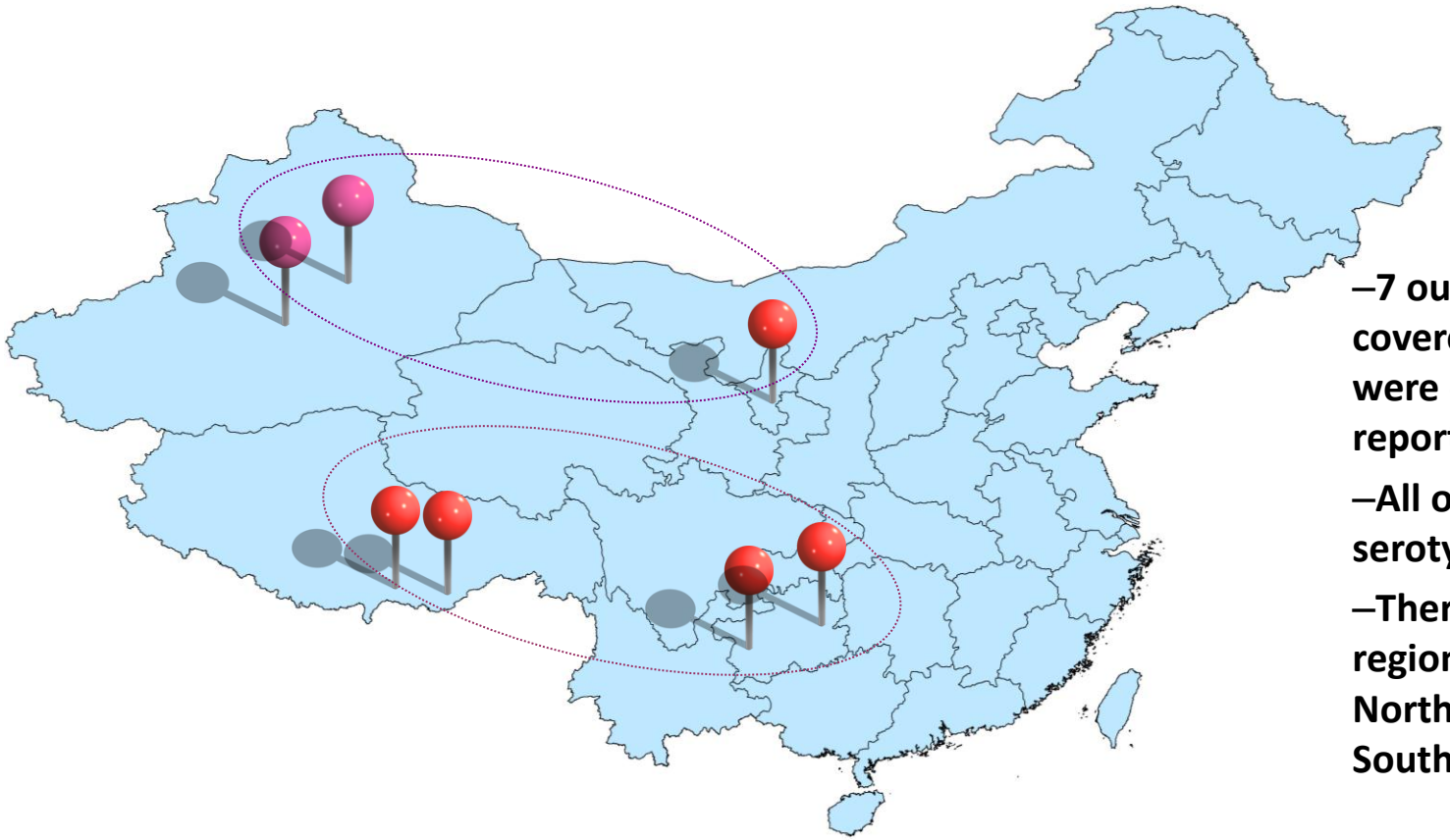
Current situation of FMD in China



- OIE Reference Laboratories And Collaborating Centres
- FAO Additional Reference Centres
- Regional/National Reference Centres

Situation-Serotype O

FMD outbreaks occurred in 2011 in Chinese mainland



–7 outbreaks covered 4 provinces were confirmed and reported to OIE.

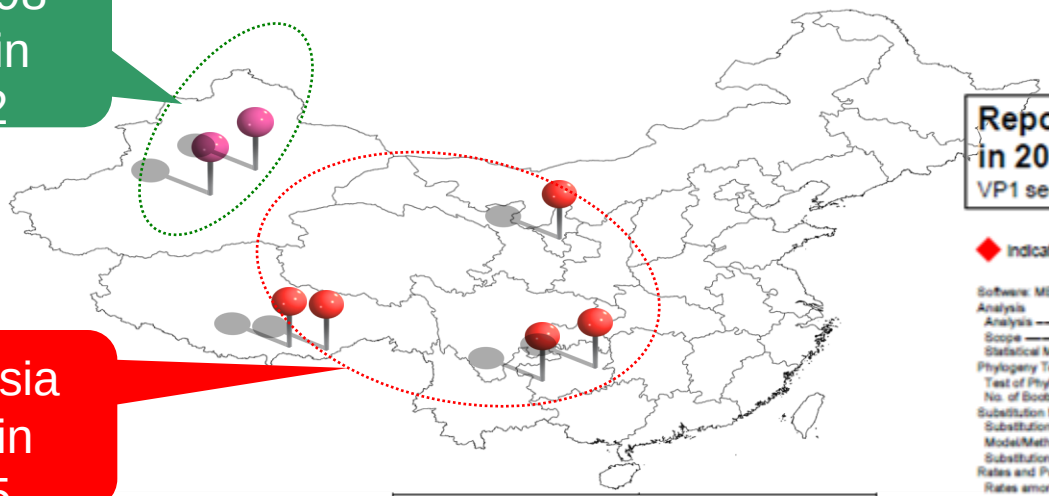
–All of them are serotype O.

–There are 2 serious regions in China: Northwest & Southwest

Gene sequencing

Mya-98 Strain n=2

PanAsia Strain n=5



- **One epidemic PanAsia strain collected from Guizhou Province VP1 sequence was submitted to GeneBank (Accession Number is JF837375).**
- **The virus were very closely related to recent viruses from SEA nations, such as Vietnam, Cambodia and Thailand.**
- **No other topotype strains (CATHAY) or PanAsia-2 strain were found in chain mainland.**

Report on FMDV O in P.R. China in 2011

VP1 sequence received from LVRI, 19/05/2011

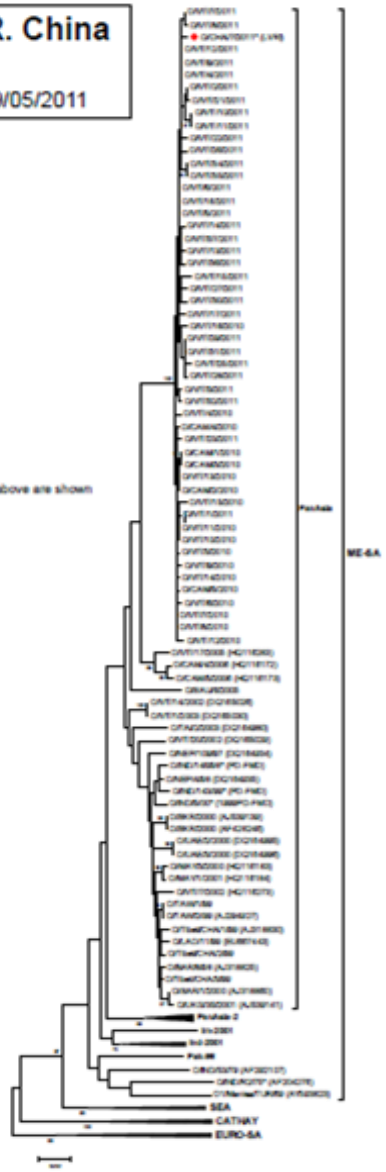
◆ Indicates viruses in this batch

Software: MEGA 5.0
Analysis
Analysis ——— Phylogeny Reconstruction
Scope ——— All Selected Taxa
Statistical Method ——— Neighbor-joining
Phylogeny Test
Test of Phylogeny ——— Bootstrap method
No. of Bootstrap Replications —— 1000
Substitution Model
Substitutions Type ——— Nucleotide
Model/Method ——— Kimura 2-parameter model
Substitutions to Include ——— d: Transitions + Transversions
Rates and Patterns
Rates among Sites ——— Uniform rates
Pattern among Lineages ——— Same (Homogeneous)
Data Subset to Use
Gaps/Missing Data Treatment —— Pairwise deletion
Codons Included ——— 1st+2nd+3rd+Non-Coding
No. of Sites : 639
No Of Bootstrap Reps = 1000 Only bootstrap values of 70% and above are shown

*, not a WRLFMD Ref. No.

N.J. Knowles & J. Wadsworth, 19 May 2011

© *Institute for Animal Health*



Serotype: O	Report date: 19/05/2011
WRLFMD Ref No: CHA/7/2011*	Reported by: N.J. Knowles
Batch No: n/a	Checked by: D.P. King
Sender Ref: O-CHA-7-2011	
Location: Jing Xiang village, Tianzhu, Qian dongnan , Guizhou, P.R. China	Topotype: ME-SA Genotype/strain: PanAsia
Date collected: c. 29/03/2011	Sequence filename: CHA11-AA.SEQ
Date received by WRLFMD: 19/05/2011	Date sequence last updated: 19/05/2011
Species: Not Known	No. of Nt determined: 639
Material used: Not known	No. of ambiguities: 0
Region sequenced: VP1	Gene length: 639
RT-PCR primers: Not known	Total no. of comparisons: 2863 Min. no. of nt for comparison: 600 Total turn-around time: 0 days Analysis time: 0 days
Comments:	

Most Closely Related Viruses

Pos.	Virus name	Filename	No. nt comp.	No. nt match.	No. of ambig.	% Id.	% Diff.	Topotype	Strain
1	O/VIT/12/2011	VIT11-12	639	637	0	99.69	0.31	ME-SA	PanAsia
2	O/VIT/4/2011	VIT11-04	639	637	0	99.69	0.31	ME-SA	PanAsia
3	O/VIT/9/2011	VIT11-09	639	637	0	99.69	0.31	ME-SA	PanAsia
4	O/VIT/16/2011	VIT11-16	639	636	0	99.53	0.47	ME-SA	PanAsia
5	O/VIT/5/2011	VIT11-05	639	636	0	99.53	0.47	ME-SA	PanAsia
6	O/VIT/6/2011	VIT11-06	639	636	0	99.53	0.47	ME-SA	PanAsia
7	O/VIT/7/2011	VIT11-07	639	636	0	99.53	0.47	ME-SA	PanAsia
8	O/VIT/2/2011	VIT11-02	639	635	0	99.37	0.63	ME-SA	PanAsia
9	O/VIT/22/2011	VIT11-22	639	635	0	99.37	0.63	ME-SA	PanAsia
10	O/VIT/26/2011	VIT11-26	639	635	0	99.37	0.63	ME-SA	PanAsia

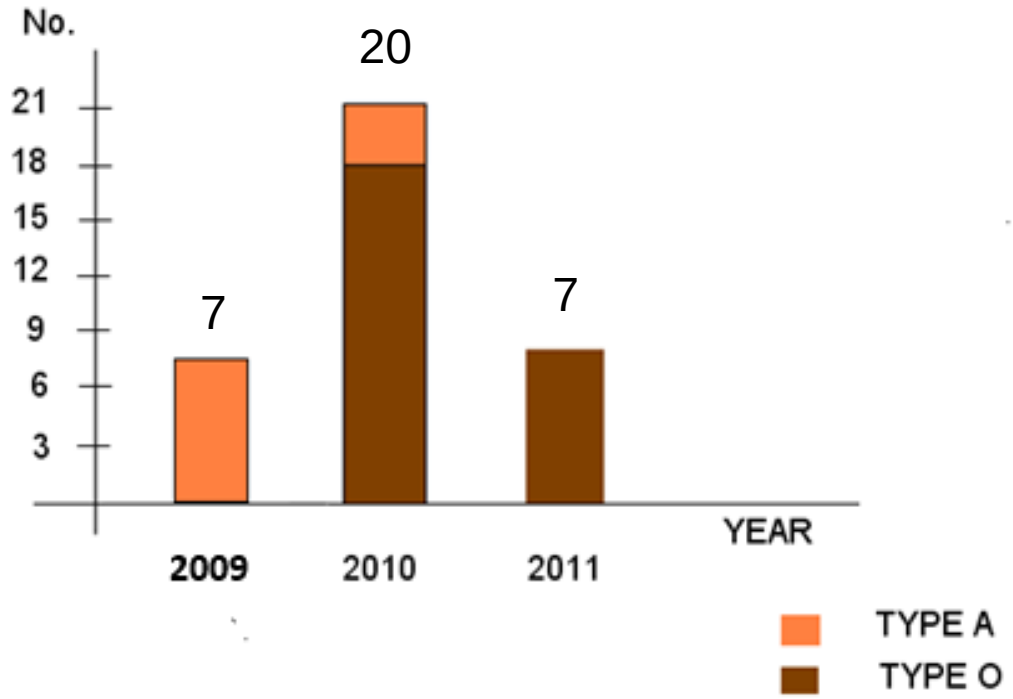
Most Closely Related Reference Viruses

(see http://www.wrlfmd.org/fmd_genotyping/prototypes.htm)

Pos.	Virus name	Filename	No. nt comp.	No. nt match.	No. of ambig.	% Id.	% Diff.	Topotype	Strain
1	O/UKG/35/2001 (AJ539141)	UKG01-35	639	596	0	93.27	6.73	ME-SA	PanAsia
2	O/KUW/3/97 (DQ164904)	KUW97-03	639	586	0	91.71	8.29	ME-SA	Ind-2001a
3	O/IRN/31/2009	IRN09-31	639	581	0	90.92	9.08	ME-SA	PanAsia-2^{FAR-09}
4	O/IRN/8/2005	IRN05-08	639	581	0	90.92	9.08	ME-SA	PanAsia-2
5	O/BHU/3/2009	BHU09-03	639	578	0	90.45	9.55	ME-SA	Ind-2001d
6	O/IRN/18/2010	IRN10-18	639	578	0	90.45	9.55	ME-SA	PanAsia-2^{BAL-09}
7	O/OMN/7/2001 (DQ164941)	OMN01-07	639	578	0	90.45	9.55	ME-SA	Ind-2001b
8	O/UAE/4/2008	UAE08-04	636	572	0	89.94	10.06	ME-SA	Ind-2001c
9	O/PAK/16/2010	PAK10-16	639	574	0	89.83	10.17	ME-SA	PanAsia-2^{PUN-10}
10	O/TUR/257/2008* (FMDI)	TUR08-AD	639	574	0	89.83	10.17	ME-SA	PanAsia-2^{TER-08}

The information of type O reported to OIE from China in 2011

Report Date	Type	Species	Location	Province	Strain
28/02/2011	O	Swine	Qia'erbagexiang, Kuerle, Bazhou, XINJIANG	XINJIANG	mya-98
28/03/2011	O	Swine	Xinjiang Production and Construction Corps, XINJIANG	XINJIANG	mya-98
07/04/2011	O	Cattle	Jing Xiang village, Tianzhu, Qian dongnan , GUIZHOU	GUIZHOU	PanAsia
		Sheep / goats			
		Swine			
21/07/2011	O	Cattle	Longfeng village, Pudi, Bijie, GUIZHOU	GUIZHOU	PanAsia
		Swine			
		Sheep / goats			
05/09/2011	O	Cattle	Liebugou, Lengda village, Jiacha, Shannan, TIBET	TIBET	PanAsia
10/10/2011	O	Cattle	Duixu village, Zhongda town, Lang, Linzhi, TIBET	TIBET	PanAsia
		Sheep / goats			
		Swine			
17/10/2011	O	Cattle	Shuangjing village, Haiyuan, Zhongwei, NINGXIA	NINGXIA	PanAsia
		Sheep / goats			



Outbreaks during 2009-2011

- **Nowadays, the main threat comes from affecting of O/Mya-98 strain and PanAsia strain. The O/Mya-98 strain mainly affect pigs, although cattle and goat/sheep can also show clinical signs in some field cases. However, the PanAsia strain mainly affect cattle.**
- **Epidemiological analysis indicates that animal movements associated with trade are the main factors for the spread of the FMD and for transmission between provinces in China.**
- **After Sep, 2010, the frequency of cases has trended to be decreasing.**
- **Both Mya-98 and PanAsia strains of FMD sequences from PR China was a close relationship with those sequences from outbreaks in Southeast Asia nations .**

Situation-Serotype A

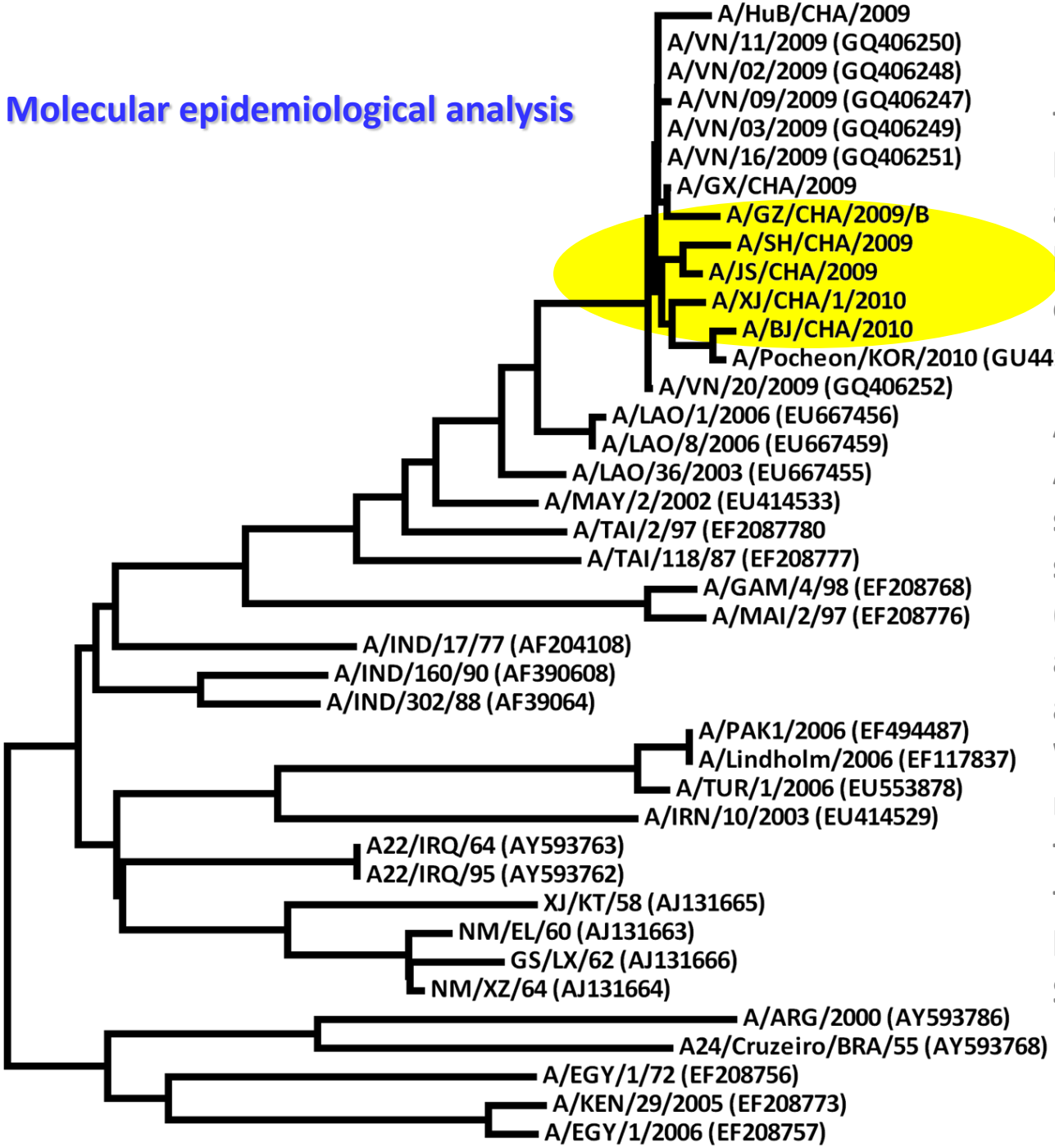
- On January 2009, FMD cases due to serotype A were recognised in Hubei province and Shanghai.
- Prior to the new cases, serotype A had not been reported in PR China .
- 7 cases have been occurred during 2009; and from Jan to Feb 2010, 2 new outbreaks of A serotype were confirmed in Xinjiang, 1 sub-clinical infection was found in routine surveillance in Beijing.

About 24 months from March 2010 to now, No new outbreaks of type A were found in China.

The information of FMDV type A reported to OIE from China

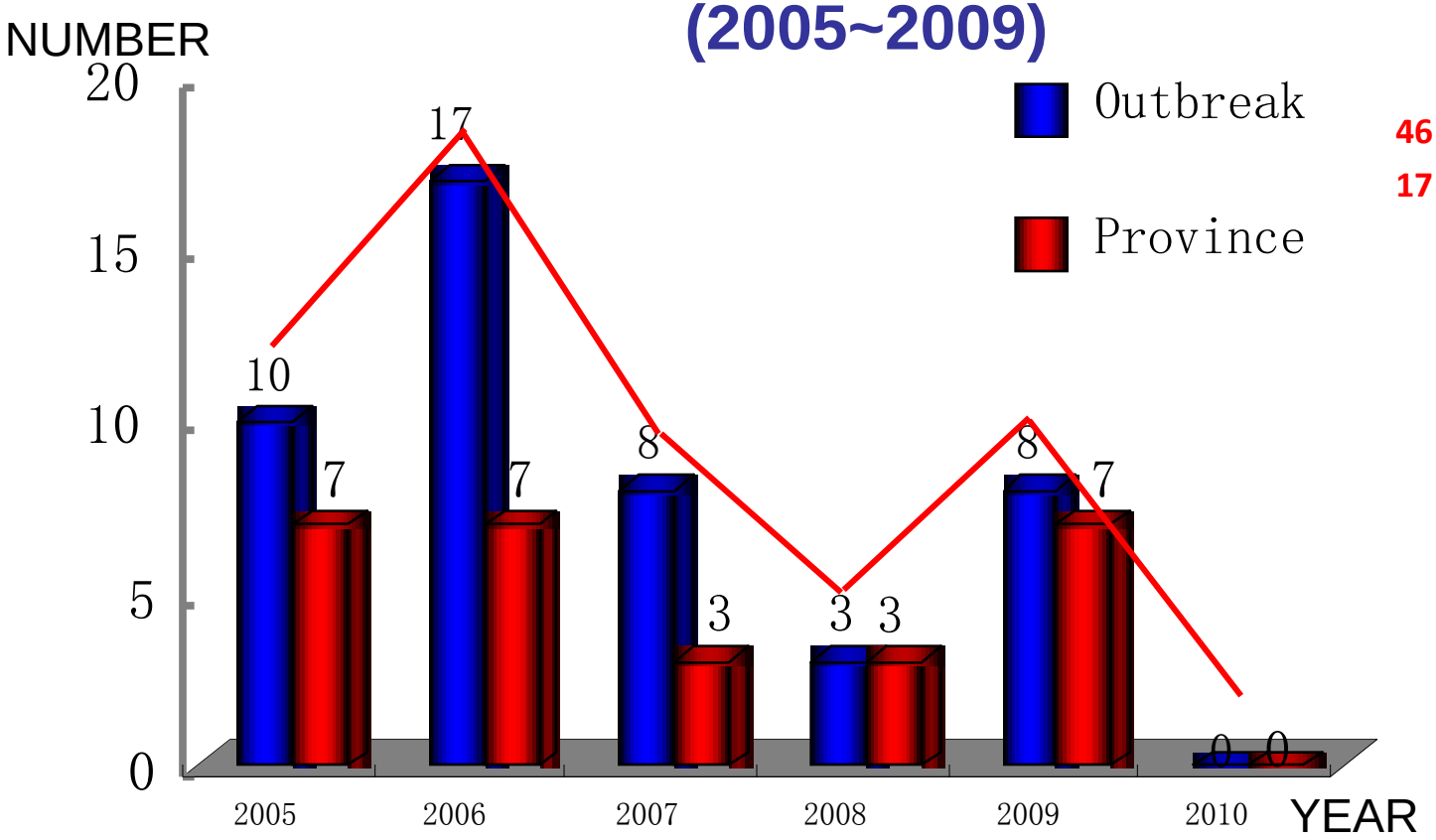
Date	Species	Susceptible	Cases	Location
22/01/2009	Cattle	294	58	Sunwan, Dongxihu, Wuhan, HUBEI 1
12/02/2009	Cattle	440	41	Wusi, Fen Xian, SHANGHAI 2
30/04/2009	Cattle	413	17	Congcong, Wujing, Changzhou, JIANGSU 3
22/05/2009	Cattle	184	12	Xi'nan, Lin'gui, Guilin, GUANGXI 4
	Swine	570	0	
22/05/2009	Cattle	78	71	Haixing chaoyang village, Pan, Liupanshui, GUIZHOU 5
	Swine	19	19	
08/06/2009	Cattle	290	33	Bingzhou, Bingcheng district, Bingzhou, SHANDONG 6
25/11/2009	Cattle	1408	321	Fukang City, Changji Prefecture, XINJIANG 7
15/01/2010	Cattle	37	28	Xi'nier town, XINJIANG
22/01/2010	Cattle	575	23	Longtou village, Lixian town, Daxing district, Beijing 8
02/02/2010	Cattle	44	26	Beicheng county, XINJIANG
	Sheep	125	0	

Molecular epidemiological analysis



- VP1 sequencing showed that the viruses involved have a common source and are different from the historical Chinese strains of type A FMD virus.
- The VP1 sequences of A/HuB/WH/2009 and A/SH/2009 are related to some published VP1 sequences of A/May/02 (95.9%), A/Tai/07 (95.7%) and A/Lao/8/06 (95.3%), and a comparison with WRLFMD sequence data revealed a strong similarity to A/Tai/08 virus, indicated that the virus may have been introduced from Southeast Asia.

OUTBREAKS OCCURRED IN CHINA (2005~2009)



46 outbreaks

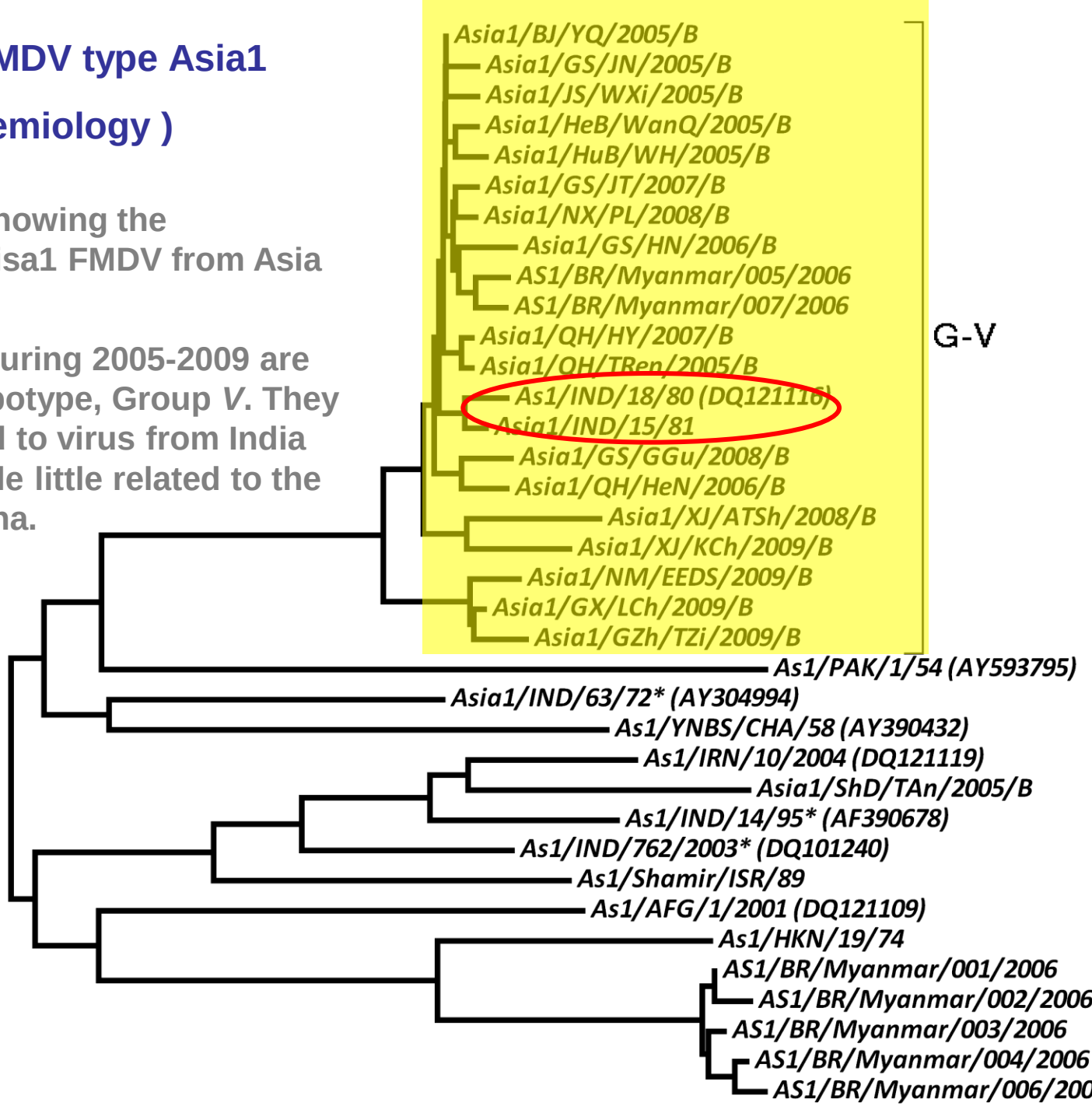
17 provinces

More susceptible animals

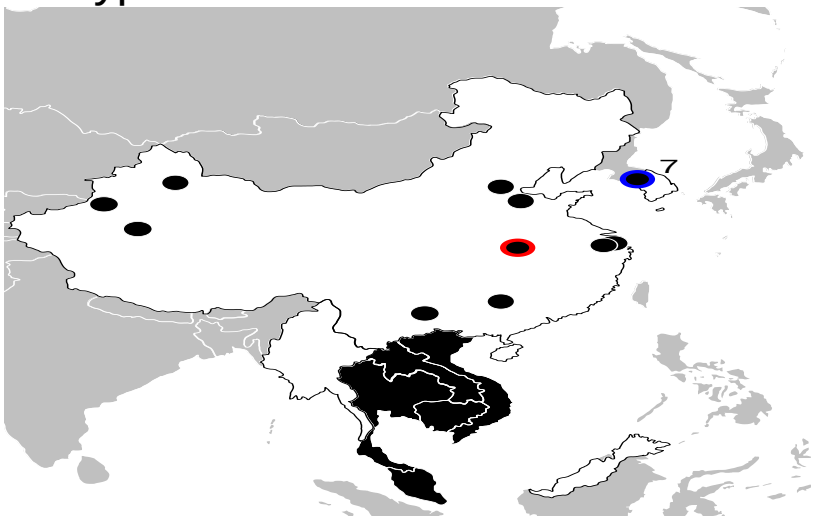
The source of FMDV type Asia1

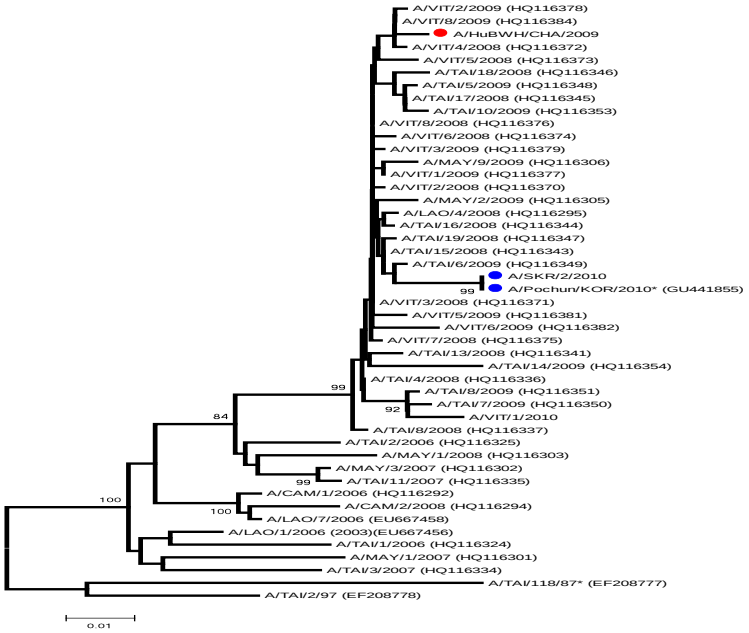
(molecular epidemiology)

- VP1 gene sequences, showing the relationships between Aisa1 FMDV from Asia region .
- FMD virus from China during 2005-2009 are belong to South Asia topotype, Group *V*. They were very closely related to virus from India collected in 1980-81.While little related to the sequence in 1958 in China.
- According to the information from FAO/OIE, during 1998-2004, 12 countries in Asia were affected with Asia1 virus.
- These implies that the isolates were spread from other countries.

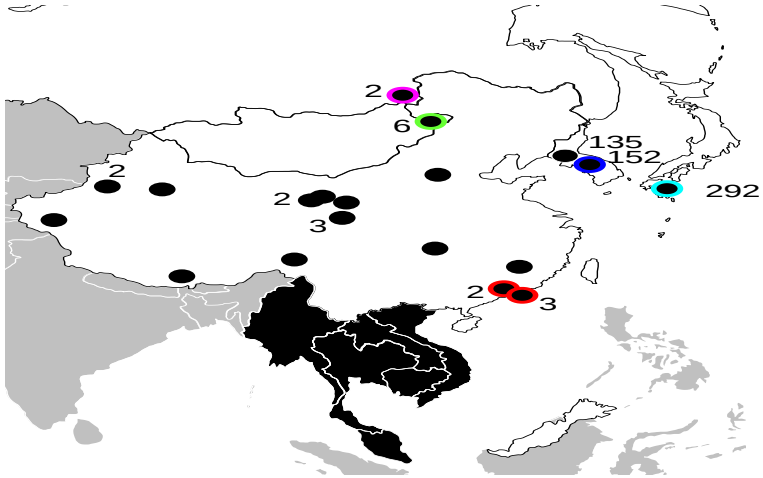


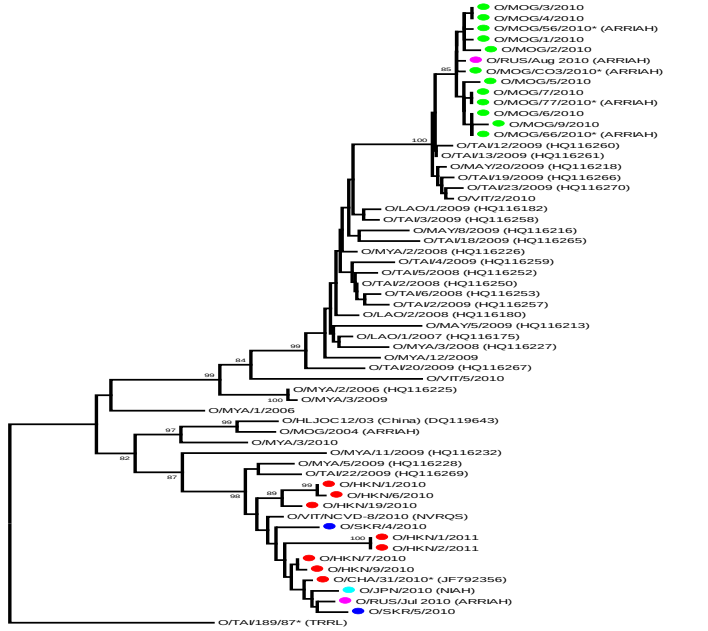
Type A





Type O





Incursions of Southeast Asian Foot-and-Mouth Disease Viruses into East Asia
Nick, Jijun and Don
Emerging Infectious Diseases

- Thus for both O and A serotypes, sequence data implicate FMD endemic parts of mainland Southeast Asia as the source of FMD viruses that have caused recent outbreaks in East Asia.
- *In vitro* vaccine matching data (from IAH) indicates that currently available vaccine strains (A/May/97and O/Manisa) should protect against representative isolates from these two serotypes.
- However, close monitoring of the antigenicity and spread of these Southeast Asian lineages is now essential to ensure the risks of further and continued outbreaks can be mitigated.

HongKong and Taiwan

Hong Kong SAR

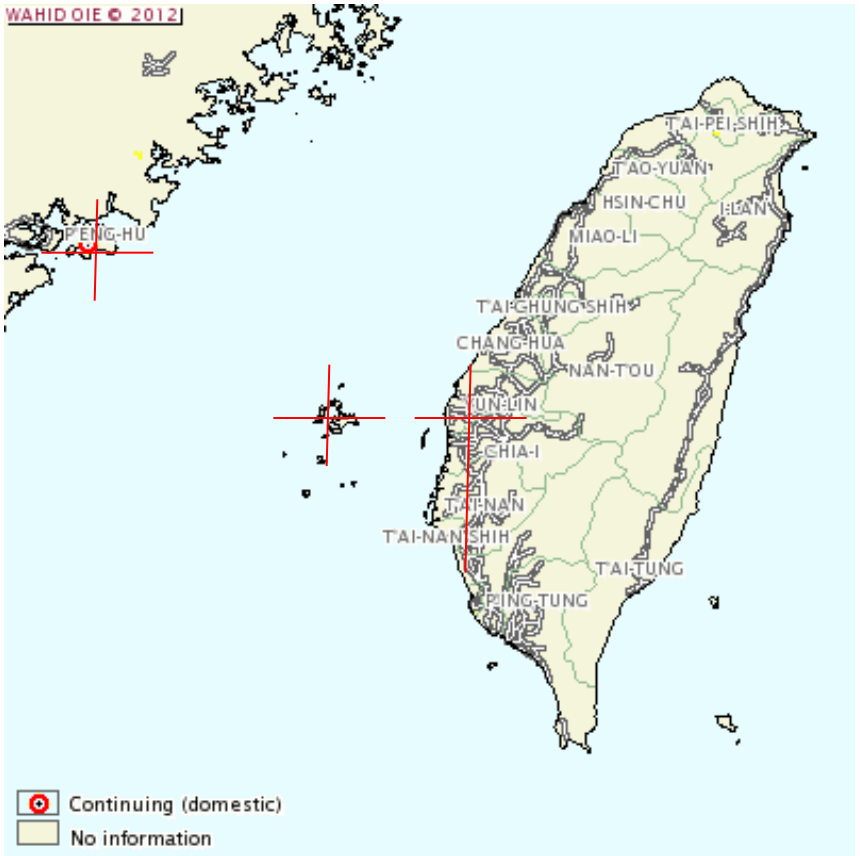
Official name:	Hong Kong Special Administrative Region of the People's Republic of China
WRLFMD code:	HKN
FMD eradicated:	No
Subsequent outbreaks:	-
Current status:	Endemic
Useful websites:	

Serotype	Years
FMDV-Untyped:	2010
FMDV-O:	1956-1964, 1966-1999, 2001-2011
FMDV-A:	1953-1955, 1957, 1959, 1964, 1973
FMDV-C:	0000
FMDV-Asia 1:	1955-1959, 1962, 1974-1976, 1980, 2005
FMDV-SAT 1:	0000
FMDV-SAT 2:	0000
FMDV-SAT 3:	0000

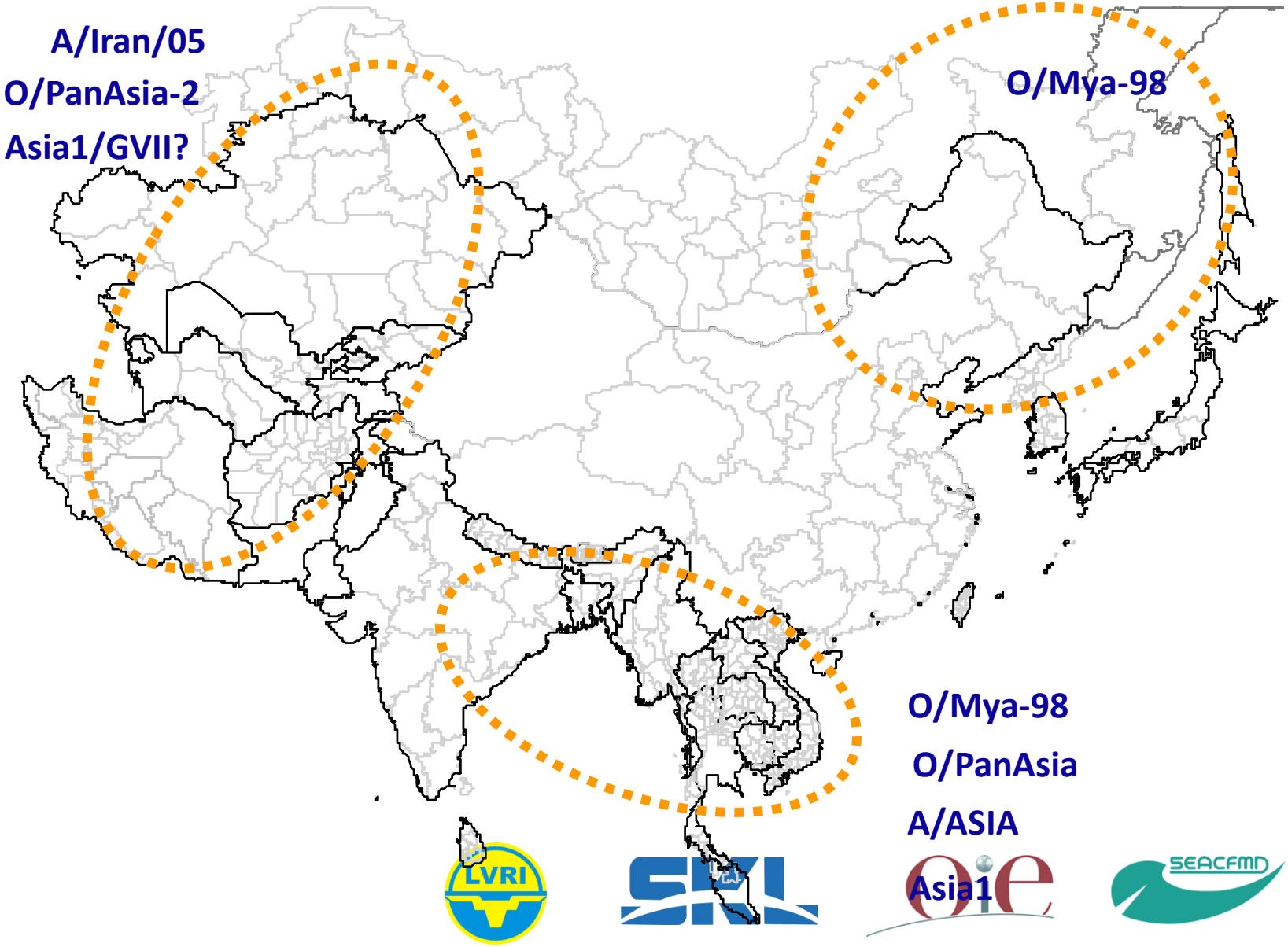
				HKN/12/2010	SEA	Mya-98
				HKN/13/2010	SEA	Mya-98
				HKN/14/2010	SEA	Mya-98
				HKN/15/2010	SEA	Mya-98
				HKN/18/2010	SEA	Mya-98
				HKN/19/2010	SEA	Mya-98
-	WRLFMD/2010/00009	05/03/2010	FMDV-GD	HKN/2/2010	nd	nd
				HKN/3/2010	nd	nd
				HKN/5/2010	nd	nd
				HKN/16/2010	nd	nd
				HKN/17/2010	nd	nd
	WRLFMD-2010-00010	16/03/2010	O	HKN/20/2010	SEA	Mya-98
-	WRLFMD/2010/00013	23/03/2010	O	HKN/21/2010*	nd	nd
-	WRLFMD/2010/00013	23/03/2010	FMDV-GD	HKN/22/2010	nd	nd
-	WRLFMD/2010/00013	23/03/2010	NVD	HKN/23/2010	-	-
	WRLFMD/2010/00047	08/12/2010	O	HKN/24/2010	CATHAY	unnamed
				HKN/25/2010	CATHAY	unnamed
				HKN/26/2010	CATHAY	unnamed
	WRLFMD/2011/00022	20/04/2011	O	HKN/1/2011	SEA	Mya-98
				HKN/2/2011	SEA	Mya-98
	WRLFMD/2011/00039	15/09/2011	O	HKN/3/2011*	CATHAY	unnamed
				HKN/4/2011*	CATHAY	unnamed
				HKN/5/2011	CATHAY	unnamed
				HKN/6/2011	CATHAY	unnamed
				HKN/7/2011*	CATHAY	unnamed
	WRLFMD/2011/00047	07/12/2011	O	HKN/8/2011	CATHAY	unnamed
				HKN/9/2011	CATHAY	unnamed

HongKong and Taiwan

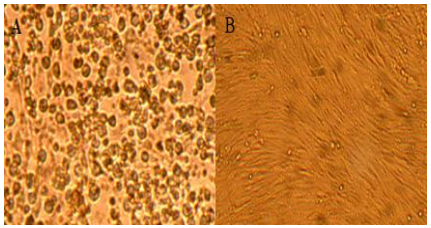
- Pig-adapted type O FMDV reappeared in swine herds in 2009 .
- 8 outbreaks being found in 2009
- Vaccination program resumed in August 2009
- 4 outbreaks have been found in 2010
- 9 outbreaks have been found in 2011



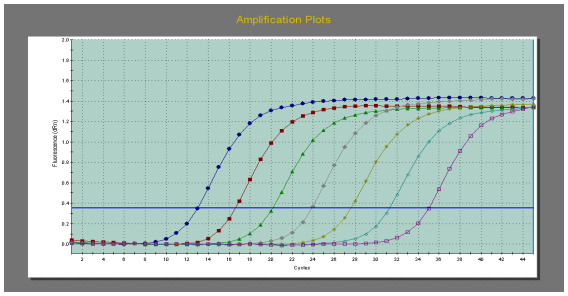
Threatened outbreaks or strains from neighboring country

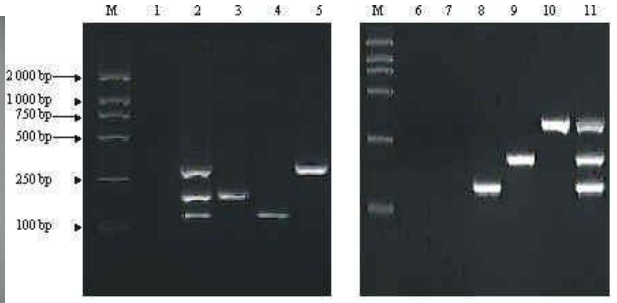


Diagnostic techniques

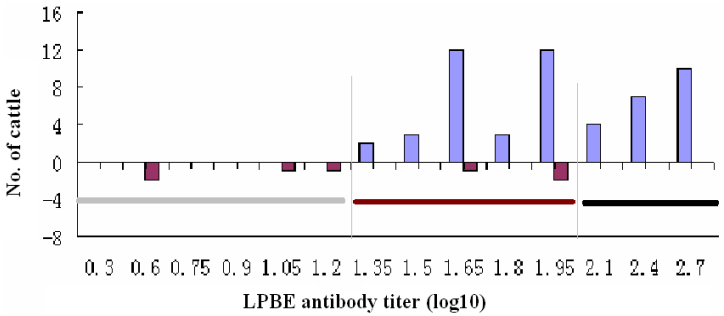


- **Identification of the agent**
  - Virus Isolation
  - FMD Serotyping ELISA
  - FMD Serotyping RT-PCR
  - FMD multiplex RT-PCR
  - FMD real-time RT-PCR
  - FMDV VP1 sequencing and molecular epidemiology
  - Other Techniques for Identification of The Agent
    - Complement Fixation Test (CFT)
    - Reverse Indirect Hemagglutination Assay (RIHA)
    - VNT with reference serum
    - FMD RT-LAMP
    - Colloid-gold test strips

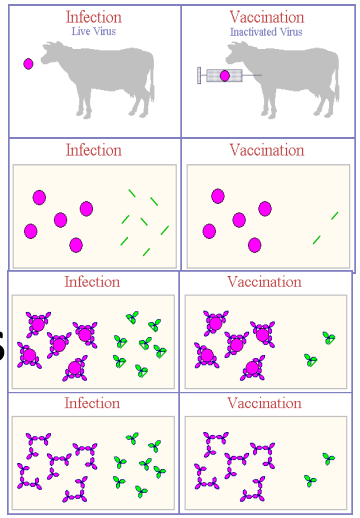


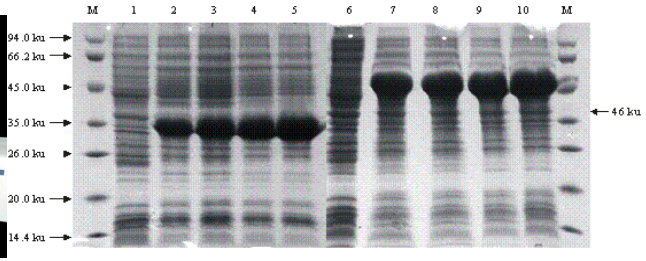


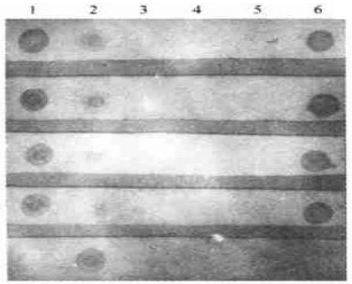
- **FMD Immune Antibody Detection Technique**
  - **LPB-ELISA**
  - **SPC-ELISA**
  - **IHA**
  - **Colloid-gold test strips**

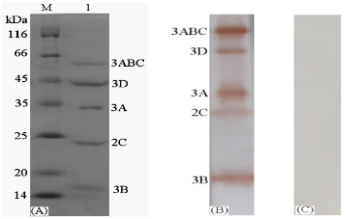


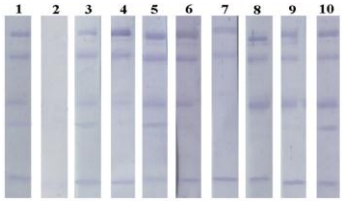
- **FMD Infected Antibody Detection Technique**
  - **FMDV NSP-3ABC ELISA**
  - **FMDV NSP-2C3AB ELISA**
  - **FMDV NSP-2C3AB antibody colloid-gold test strips**
  - **Dot-ELISA**





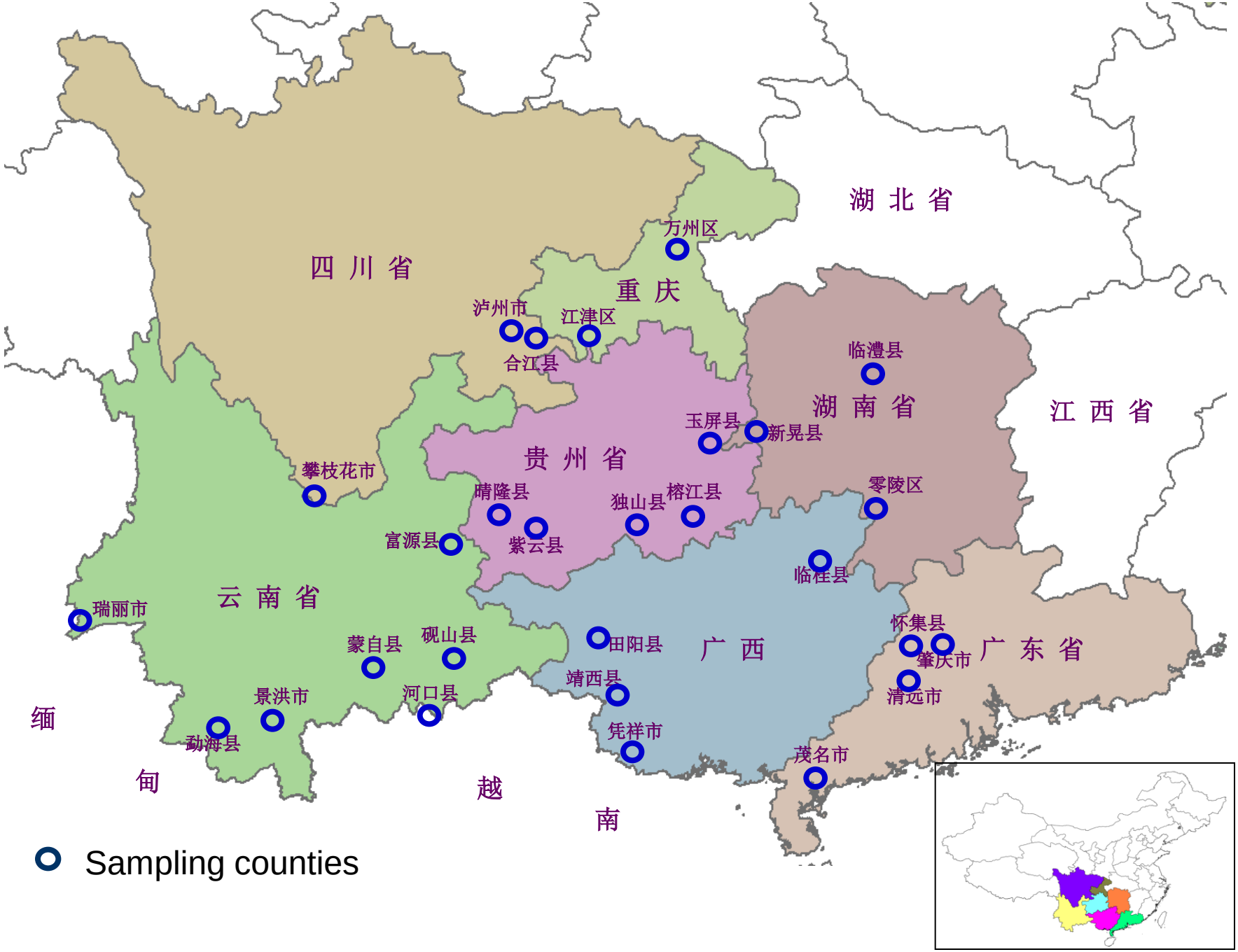






FMD routine surveillance & active monitoring in 2011

- From 15th April to 15th June 2011, an active, routine and large-scale epidemiological survey was organized and implemented with China Animal Disease Center under direction of Veterinary Bureau of MoA, China.
- The monitoring activity covered seven provinces : Yunnan, Guangxi, Guizhou, Guangdong, Hunan, Sichuan and Chongqing, in southwest of China
- Covered 87 sampling sites in 28 counties
- Collected 2198 sera and 2011 etiology samples (ruminant OPF and pig submaxillary lymph nodes)
- Valuable for FMD prevention and control in above zones (data not shown).


湖 北 省
四 川 省
万州区
重 庆
泸州市
江津区
合江县
临澧县
湖 南 省
江 西 省
玉屏县
新晃县
贵 州 省
攀枝花市
晴隆县
独山县
榕江县
零陵区
富源县
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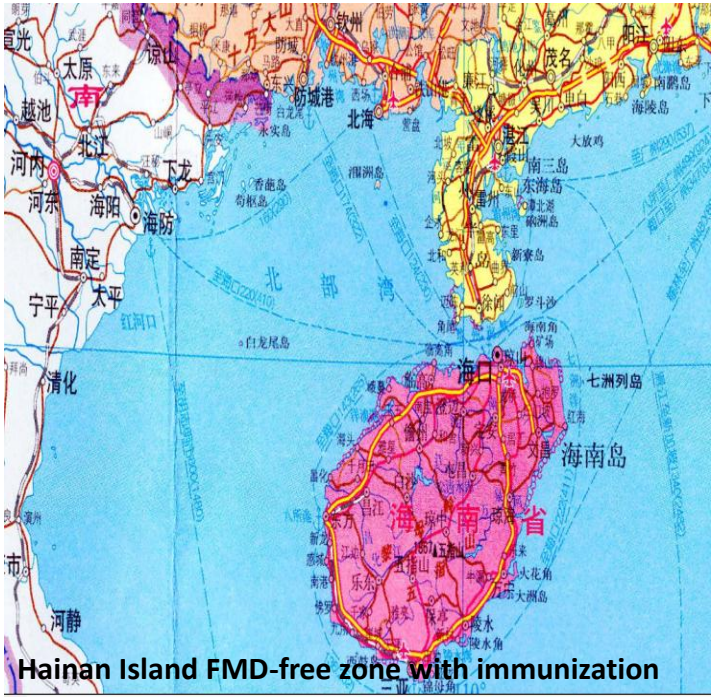
临桂县
云 南 省
瑞丽市
蒙自县
砚山县
田阳县
广 西
怀集县
肇庆市
广 东 省
靖西县
清远市
景洪市
河口县
缅
勐海县
凭祥市
茂名市
甸
越
南
Sampling counties

- **4 emergency epidemiological surveys were carried out in Xinjiang Autonomous Region, Guizhou Province and Tibet after FMD outbreaks in 2011;**
- **Quarterly monitoring for Hainan Island FMD-free zone with immunization was kept implementing;**
- **Yongji, Jinlin province, FMD free zone with vaccine (building), technique support by NFMDRL**

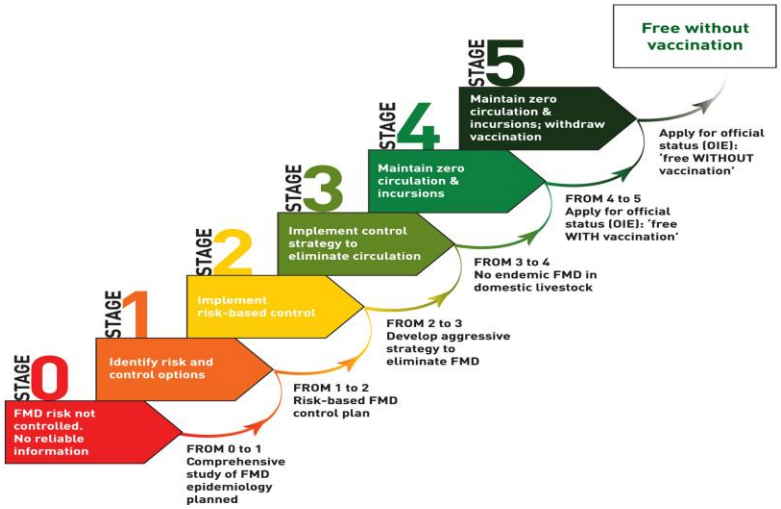


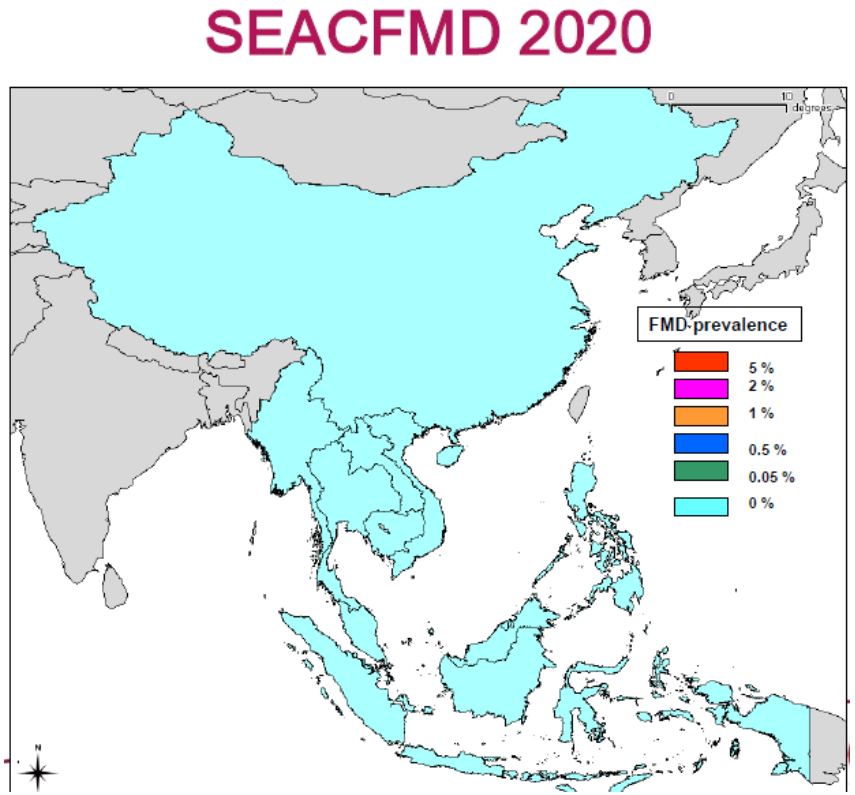
Hainan Island FMD-free zone with immunization

Yongji FMD-free zone with immunization

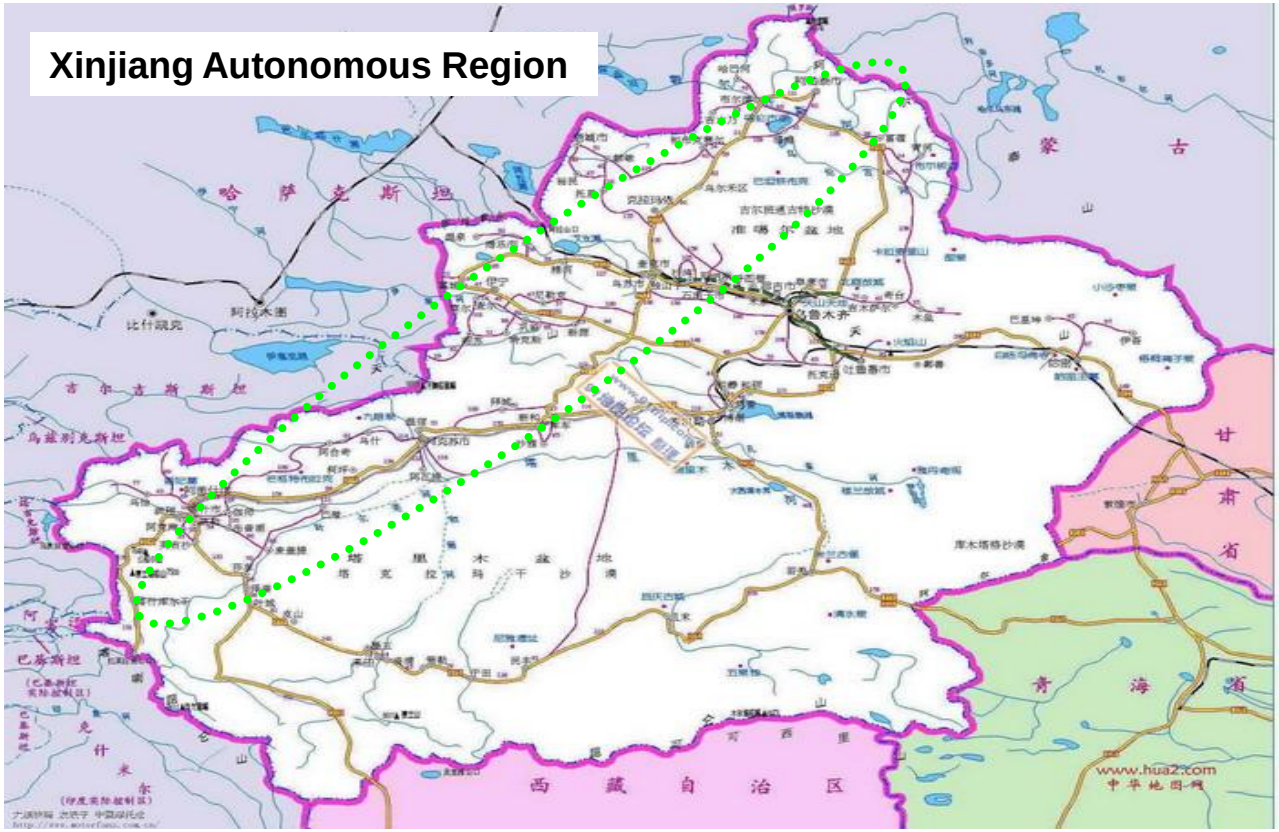
Future directions and needs

- **Take an active part in PCP for FMD control as OIE RL**
- **SEACFMD Campaign**
  - **Joined in 2010**
  - **SEACFMD 2020 Roadmap**





- **In 2012, a systematic epidemiological survey will be held across the border area in Xinjiang Autonomous Region.**



Needs

- **More information of FMD situation and strains**
  - **Strengthen disease information sharing**
  - **risk evaluation**
  - **FMD surveillance, especially ecological distribution of virus and disease prevalence**
- **Cooperation (Epidemiology/Information exchange, Joint control, Research/Project…)**
- **Training (lab diagnostic methods, field epidemiology training…)**


Thank you
Welcome to Lanzhou
Veterinary Research
Institute