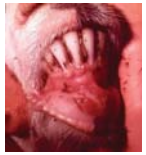


2nd Coordination Committee meeting of OIE/JTF Project on FMD Control in Asia

Wild Horse Center, Hustai National Park, Mongolia, 6 - 7 October 2013

Gideon Brückner

President: OIE Scientific Commission for Animal Diseases

Towards Global Control and Eradication of FMD

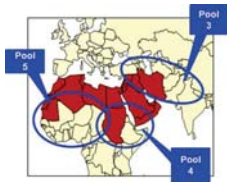
- FMD control is not an utopia: we can do much better with existing means and methods
- Only regional and risk-based approaches will be successful as history has shown (Europe, South America, SE Asia)
- Regional approaches should take into account regional differences (for instance wildlife issue in Southern Africa)
- FMD-endemic countries should be better aware of the damage caused by FMD and the opportunities lost [clear need for more socio-economic studies]
- FMD control goes hand in hand with improvement of the Veterinary Services (PVS)
- Importance of public-private partnerships – less money made available than for HPAI

Some issues related to the Global Control of FMD

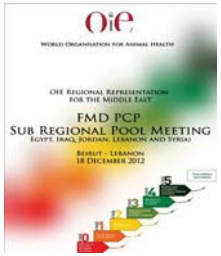
- To achieve PCP-FMD stage 3 remains primarily the responsibility of the national Veterinary Services
- FMD knows no borders – need Regional approach
- Beneficiary for countries (trade and otherwise) who are in stage 3 PCP -> apply for OIE endorsement of Official FMD Control Strategy
- Choice of eventual goal for status (with or without vaccination) should be risk-based
- Choice of vaccination strategy should be risk-based (6PD50 or 3PD50)
- Primary objective should be to detect circulating FMDV and prevent introduction of FMDV

The tools available to us for effective FMD control

- Our training as veterinarians and Para-professionals
- Our ability to think analytical and make decisions
- Success-stories
- Vaccines
- FMDV diagnostics
- OIE Code, PVS Pathway, PCP-FMD
- Support networks – laboratory and epidemiological networks
- International solidarity



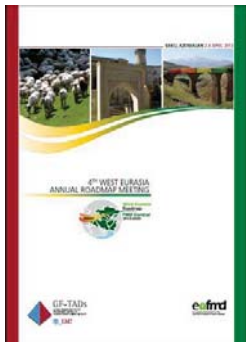
North and Eastern Africa



Middle East

REMESA
Réseau Méditerranéen Santé Animale

North Africa & Mediterranean



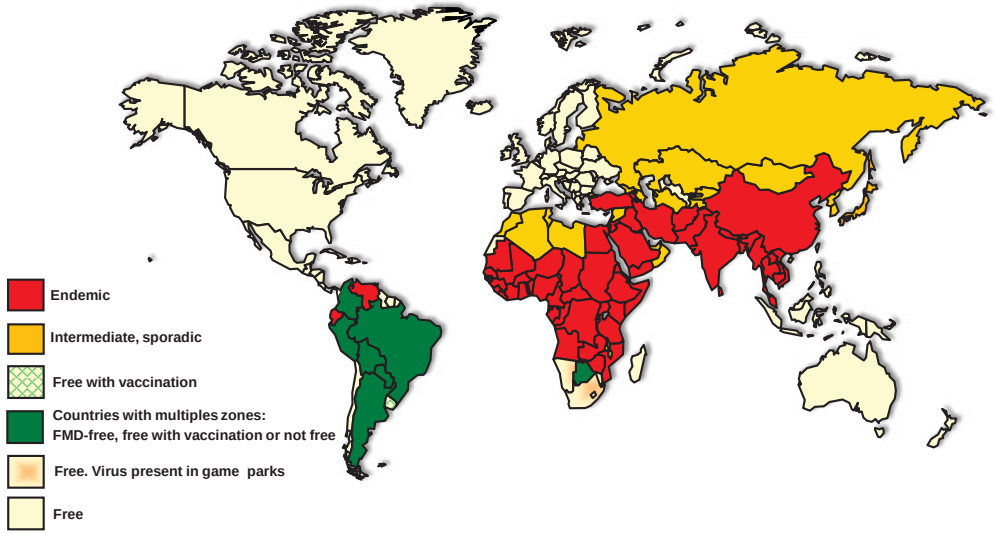
Western Eurasia

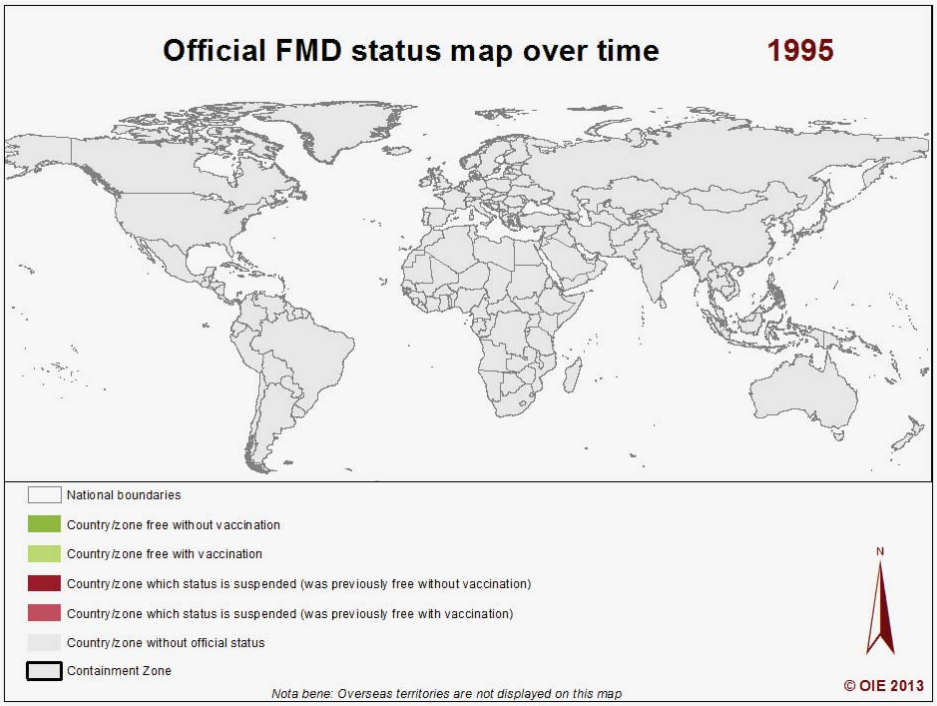
United Arab Emirates

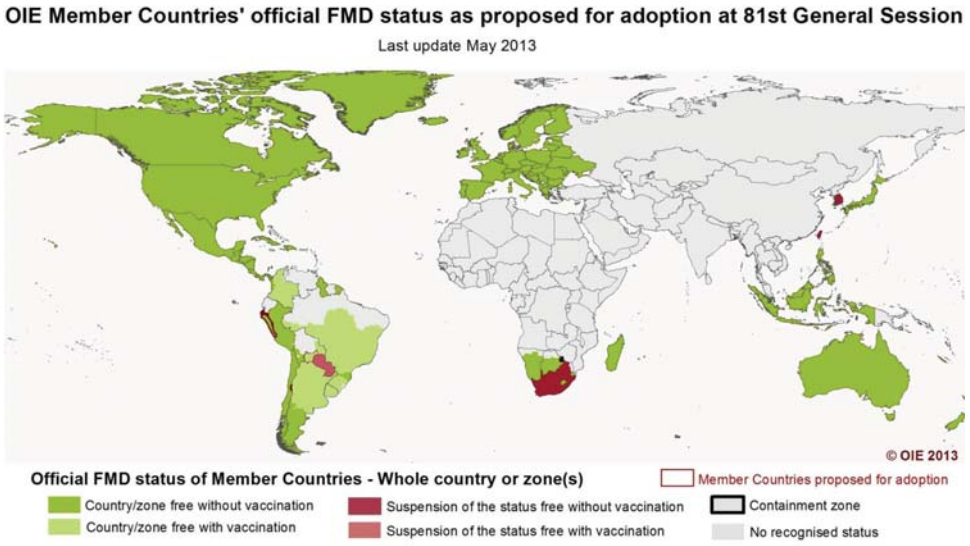
Eastern Asia

Further meetings scheduled in India, Western and Central Africa

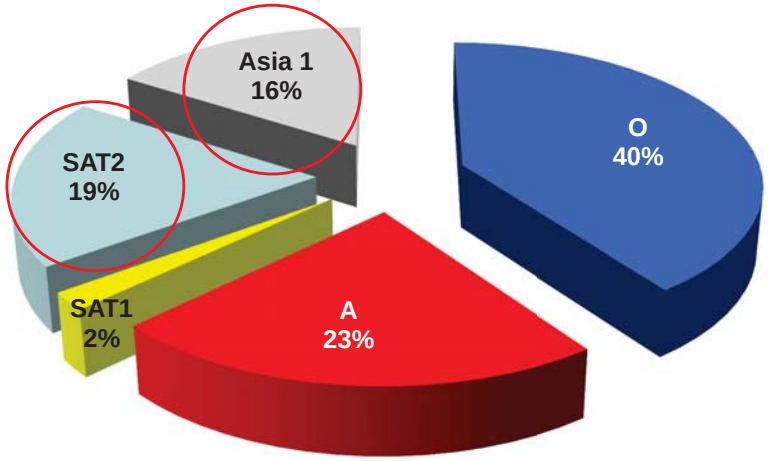
Global Surveillance







WRLFMD® Serotyping results for 2012- upto 3rd Quarter



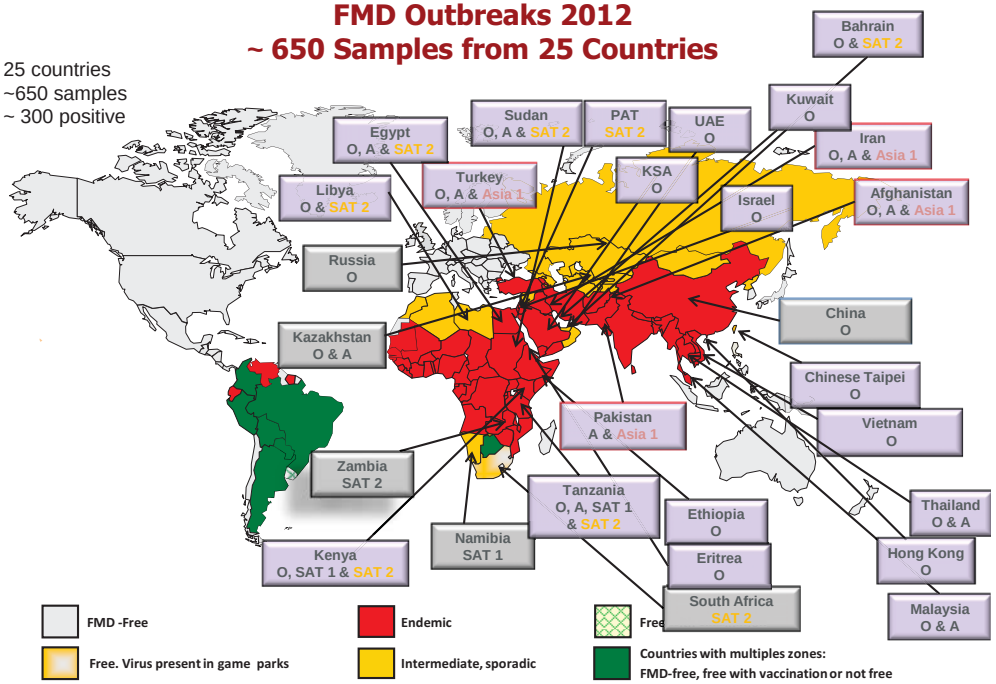
From > 650 samples in 2012 from 25 countries
40% were serotype O

Increased Asia 1 activity
Increased SAT 2 activity

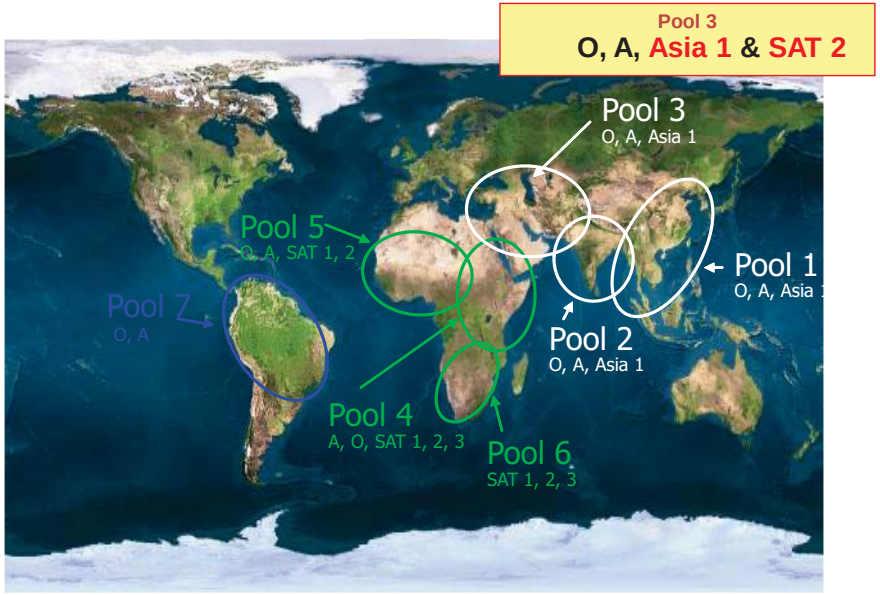
Still No Serotype C (not reported since 2004)

FMD Outbreaks 2012
~ 650 Samples from 25 Countries

25 countries
~650 samples
~ 300 positive

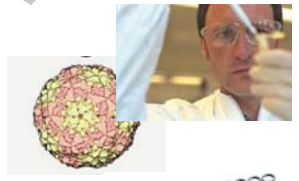


Regional Analysis- 2012
Asia 1 and SAT 2 on the move



Members: OIE/FAO FMD Laboratory network

- **WRLFMD**: Pirbright, UK
- **RRLSEA**: Pakchong, Thailand
- **LVRI**: Lanzhou, China
- **FGI ARRIAH**: Vladimir, Russia
- **PDFMD**: Mukteswar, India
- **RRLSSA**: Gabarone, Botswana
- **FMD-Laboratory**: Embakasi, Kenya
- **PANAFTOSA**: Rio de Janeiro, Brazil
- **LFADLCT**: Argentina
- **ARC-OVI**: Onderstepoort, RSA
- **PIADC**: Plum Island, USA
- **CODA-CERVA-VAR**: Ukkel, Belgium



More than 2500 samples tested during 2011/12

Current FMD Threat Analysis: from reported incidence

Serotype O- widespread circulation

- FMDV type O – ME-SA topotype – PanAsia-2 lineage
- FMDV type O – SEA topotype – Mya-98 lineage

Serotype A- widespread circulation

- FMDV type A – ASIA topotype – Iran-05 lineage
- FMDV type A – ASIA topotype – other

Serotype Asia 1 – limited circulation- BUT risk of further spread

- Reports from 6 countries in 2011 and now more in 2012
- Pirbright Vaccine trial carried out for EU-
- **High potency vaccine protected animals challenged with current isolate**

Serotypes SAT – restricted circulation

- Have not established outside of Africa

But recent spread of SAT 2 into North Africa and Middle East being monitored

Serotype C - No reports of serotype C since 2004

Vaccine Recommendations (National & European Antigen Banks)

HIGH PRIORITY	O Manisa* O PanAsia -2* O BFS or Campos A-Iran-05 A24 Cruzeiro A22 Iraq Asia 1 Shamir* SAT 2 Saudi Arabia (or equivalent - SAT 2 Eritrea)	* or additional strain
MEDIUM PRIORITY	A Argentina 01 A Iran 96 A Iran 99 A Eritrea A Iran 87 or A Saudi Arabia 23/86 (or equivalent) A Malaysia 97 (or Thai equivalent such as A/Sak/97)* O Taiwan 97 (pig-adapted strain or Philippine equivalent)* SAT 1 South Africa SAT 2 Zimbabwe	
LOW PRIORITY	A15 Bangkok related strain A Kenya A87 Argentina related strain SAT 1 Kenya SAT 2 Kenya SAT 3 Zimbabwe C Noville	

Within category: not in order of importance

Current FMD Threat Analysis: Vaccine matching 2012

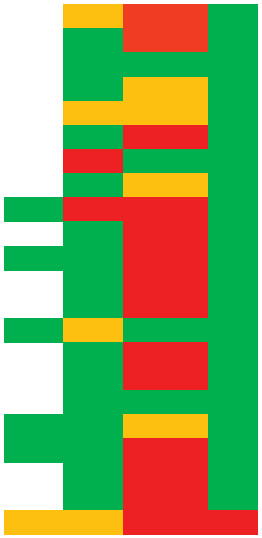
- Vaccine matching carried out on representative isolates from each submission
- 2dm VNT carried out with a variety of Merial, Intervet (MSD) and ARRIAH bovine vaccinal reference sera
- Results presented as traffic light system

Result	WRLFMD® Pirbright vaccine matching by 2dm VNT
	Good match
	Some matches
	No match

Current FMD Threat Analysis: Vaccine matching 2012

Serotype O vaccine matching

Country of Origin	Serotype	Topotype	Lineage/ strain	Sub Lineage	O 3039	O 4625	O Manisa	O PA2
Afghanistan	O	ME-SA	PanAsia-2	ANT-10				
Bahrain	O	ME-SA	PanAsia-2	ANT-10				
Congo	O	ME-SA	PanAsia	-				
Egypt	O	ME-SA	PanAsia-2	-				
Ethiopia	O	EA-3	-	-				
Iran	O	ME-SA	PanAsia-2	ANT-10				
	O	ME-SA	PanAsia-2	FAR-09				
Israel	O	ME-SA	PanAsia-2	ANT-10				
Japan	O	SEA	Mya 98	-				
Kenya	O	EA-2	-	-				
Kuwait	O	ME-SA	PanAsia-2	ANT-10				
Libya	O	ME-SA	PanAsia-2	ANT-10				
	O	EA-3	-	-				
Malaysia	O	SEA	Mya-98	-				
Kingdom Saudi Arabia	O	ME-SA	PanAsia-2	ANT-10				
Sudan	O	EA-3	-	-				
Thailand	O	SEA	Mya-98	-				
	O	ME-SA	PanAsia	-				
Turkey	O	ME-SA	PanAsia-2	ANT-10				
UAE	O	ME-SA	PanAsia-2	ANT-10				
Vietnam	O	ME-SA	PanAsia	-				



Current FMD Threat Analysis: Vaccine matching 2012

Serotype Asia 1 vaccine Matching

Country of Origin	Serotype	Topotype	Lineage/strain
Afghanistan	**Asia 1**	Asia	Sindh-08
Iran	**Asia 1**	Asia	Sindh-08
Pakistan	**Asia 1**	Asia	Sindh-08
Turkey	**Asia 1**	Asia	Sindh-08

	Good match
	Some matches
	No match

Veterinary services are global public goods

Thank you for your attention

Organisation Mondiale de la Santé Animale

World Organisation for Animal Health

Organización Mundial de Sanidad Animal

OIE/JTF Project on FMD Control in Asia: Mid term Report (2011-2013)

Chantanee Buranathai

OIE Asia-Pacific

Expected 4 Achievements

1. Coordination the project and Promote the information sharing on FMD in Asia
2. Developing strategies and a Roadmap for FMD control in East Asia
3. Strengthen the capacity of surveillance for and diagnosis of FMD
4. Improve the FMD control measures in the region

Expected 4 Achievements

1. Coordination the project and Promote the information sharing on FMD in Asia
   - regional
2. Developing strategies and a Roadmap for FMD control in East Asia
   - regional
3. Strengthen the capacity of surveillance for and diagnosis of FMD
   - national / regional
4. Improve the FMD control measures in the region
   - national / regional

Achievement 1: Coordination the project and Promote the information sharing on FMD in Asia

- **Objectives:**

  To provide coordination platform for MS to discuss, and decided cooperative activities of the project and share experience and information

- **Activities:**

  1.1) Organise the First Regional Workshop (Inception meeting) of the project

  1.2) Organise Annual Coordination Committee Meeting (starting 2012)

  1.3) Organise the Scientific meeting to strengthen lab network among FMD researchers in Asia

  1.4) Share scientific information including the circulating virus and vaccines

Achievement 1:
Coordination the project and Promote the information sharing on FMD in Asia

2011	**Inception Meeting** • National coordinators for the project were officially proposed by CVOs • The proposed project framework was endorsed by the meeting • Conclusion and Recommendation document was produced, has been circulated for comments	13-14 Dec 2012
2012	1st National Contact Person (NCP) Meeting • Process to develop the Roadmap • Outline of the Roadmap, self evaluation exercise for PCP stage • Suggestions to improve or develop national strategies 1st Coordination Committee Meeting • Endorse of revised project framework • Validate process to develop Roadmap, outline and PCP stage • Validate NCP Meeting recommendations	14-15 Aug 2012 13-14 Nov 2012
2013	2nd National Contact Person (NCP) Meeting 2nd Coordination Committee Meeting 1st FMD Scientific Meeting for East Asia	6 Oct 2013 7 Oct 2013 8 Oct 2013





Participate in Mongolia-China-Russia Tripartite FMD Control Activities


1st Meeting in Beijing


2nd Meeting in UB + Russia


3rd Meeting in Vladimir

Achievement 2 :
Developing strategies and a Roadmap for FMD control in East Asia

● Objectives:

To develop a Roadmap for FMD control in East Asia by using, among others, the Progressive Control Pathway for FMD (PCP) while ensuring to be in line with the Global Strategy for FMD Control and in coordination with SEACFMD.

● Activities:

2-1) To analyze national FMD control Strategy in each country

2-2) To develop a Roadmap for FMD control in East Asia

2-3) To define regional cooperation

Achievement 2 :
Developing strategies and a Roadmap for FMD control in East Asia

2011		
2012	1st National Contact Person (NCP) Meeting • Process to develop the Roadmap • Outline of the Roadmap, self evaluation exercise for PCP stage • Suggestions to improve or develop national strategies	14-15 Aug 2012
	1st Coordination Committee Meeting • Endorse of revised project framework • Validate process to develop Roadmap, outline and PCP stage • Validate NCP Meeting recommendations	13-14 Nov 2012
2013	2nd National Contact Person (NCP) Meeting ➢ Propose 1st Draft of Roadmap ➢ Updated information ➢ Discuss on National FMD Control strategies and FMD Control Plan	6 Oct 2013
	2nd Coordination Committee Meeting ➢ Endorse 1st Draft of Roadmap ➢ Endorse report and recommendation of NCP Meting including development / update of National FMD Control strategies and FMD Control Plan	7 Oct 2013

	2012	2013	2014	2015	2016
China	3	3	3	3	4
Taipei	3	3	3	4	4/5
Hong Kong	1	1/2	2	2/3	3
Japan	6	6	6	6	6
Korea	3	4	4	4/5	5
Mongolia	3	3	4	4	4

Achievement 3 :
Strengthen the capacity of surveillance for and diagnosis of FMD

- **Objectives:**

  To improve FMD surveillance and diagnosis capacity at a national level and harmonize diagnosis capability at the regional level

- **Activities:**

  3-1)To select target countries after assessing the needs for capacity building

  3-2)To conduct or support training programmes for FMD surveillance and diagnosis for the target countries by OIE Collaborating Centres/Reference Laboratory.

Achievement 3 :
Strengthen the capacity of surveillance for and diagnosis of FMD

2011		
2012	FMD Diagnosis Training for Mongolia	May-November 2012
2013	Advance FMD Diagnostic Training in Japan	3-14 June 2013

FMD Diagnosis Training for Mongolia
(May-November 2012)

Advance FMD Diagnostic Training
in Japan
3-14 June 2013

Achievement 4 :
Improve the FMD control measures in the region

- **Objectives:**

  To assist regional Members to improve FMD control measures by providing technical supports

- **Activities:**

  4-1) To select target countries after feasibility study, based on submitted proposal by the countries

  4-2) To assist the target countries to plan and implement field work on FMD

  4-3) To study circulating FMD viruses in Asia and share the information

Achievement 4 :
Improve the FMD control measures in the region

2011	• Feasibility study in Myanmar	October 2011
2012	• Feasibility study in Laos • 1st FMD vaccination campaign in Xieng Khoung Province of Laos • 2nd FMD vaccination campaign in Xieng Khoung Province of Laos	October 2012 November 2012 December 2012
2013	• FMD vaccine efficiency study in Laos • Feasibility study in Myanmar	Nov 2012 – February 2013 July 2013

DECREE OF THE PRESIDENT
OF THE LAO PEOPLES DEMOCRATIC REPUBLIC
On the Labour Medal Presentation

Labour medal Class II presentation is to the World Organization of Animal Health (OIE) to commemorate significant contribution to socio-economic development in Xiengkhoung Province

Planed Time Table of the Project

Achievements	Activity	2011	2012	2013	2014	2015	2016
			1	2	3	4	5
1. Coordination the project and promote the information sharing on FMD	Coordination Committee mtg	★	✓	✓	✓	✓	✓
	Scientific mtg			✓		✓	
2. Developing strategies and Roadmap for FMD control in East Asia	National Contact Person mtg		✓	✓	±	±	
3. Strengthen the capacity of surveillance for diagnosis of FMD	Training in Japan		✓	✓	±	±	
	In-country training			✓	✓		
4. Improve the FMD control measures in the region	Feasibility study (upon proposal)	✓	✓	±	±	×	
	Field Implementation		✓	✓	✓	✓	

Actual activity time-table

Achievements	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016
1. Coordination the project and promote the information sharing on FMD	•Inception mtg	•1st CC Mtg	•2nd CC Mtg •Scientific Mtg	•3nd CC Mtg	•4th CC Mtg •Scientific Mtg
2. Developing strategies and Roadmap for FMD control in East Asia	•NCP identified •NCP Mtg for Roadmap	•1st NCP Mtg for Roadmap	•2nd NCP Mtg for Roadmap		
3. Strengthen the capacity of surveillance for diagnosis of FMD	•Training for (Mongolia)	• In-country training •Training in JP (Thailand)	•Training in JP (Myanmar) •Regional training	•In-country training •Training in JP	•In-country training
4. Improve the FMD control measures in the region	•Feasibility study (Myanmar, Laos)	•Field implementat^{n} (Laos)	•Feasibility study (Myanmar) •Field implementat^{n} (Laos)	•Field implementat^{n} (Myanmar)	•Field implementat^{n} (Myanmar)

Summary Midterm Progress

Achievements	Activities	Output
1. Coordination the project and promote the information sharing on FMD	went well as planed	• Information sharing among members • Common vision and understanding of the Roadmap
2. Developing strategies and Roadmap for FMD control in East Asia	went well as planed	• 1st draft of Regional Roadmap • Updated country profile • Development of National FMD Strategies and FMD Control Plan
3. Strengthen the capacity of surveillance for diagnosis of FMD	+/-	• Enhanced FMD diagnostic capacity at the central level (Mongolia and Thailand)
4. Improve the FMD control measures in the region	went well as planed	• Enhanced FMD prevention, animal identification and public awareness in Xiengkhouang (one of SEACFMD hotspot) • FMD Campaign in Xiengkhouang can be a model for other countries / region • Information sharing on circulating FMDV and vaccination

THANK YOU FOR YOUR ATTENTION

FMD situation in the mainland

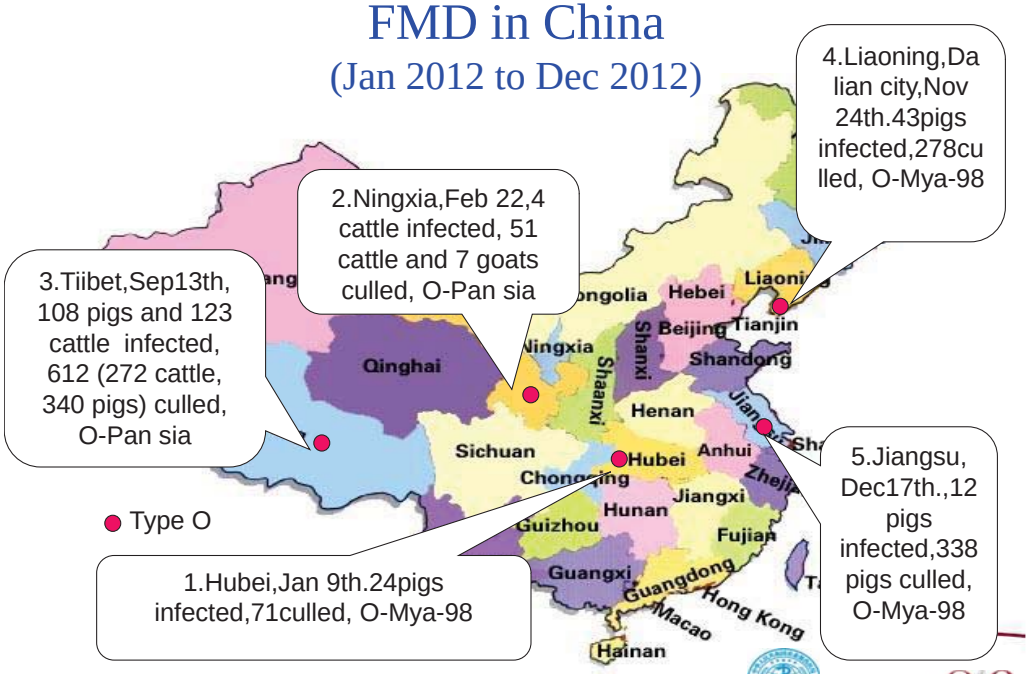
年份（Year）	疫情起数(No. of outbreaks	发病数（头只）（No. of sick animals）	扑杀数（头只）（No. of animals culled）
2005	10（亚洲I型）（Type Asia I）	612	4744
2006	17（亚洲I型）（Type Asia I）	836	2424
2007	8（亚洲I型）（Type Asia I）	157	1077
2008	3（亚洲I型）（Type Asia I）	123	464
2009	8（亚洲I型）（Type Asia I）	217	918
	7（A型）（Type A）	572	12847
2010	2（A型）（Type A）	54	206
	18（O型）（Type O）	3983	29193
2011	7（O型）（Type O）	823	7753
2012	5（O型）（Type O）	365	3557
合计	85（其中46起亚洲I型，9起A型，30起O型）(46 for Type Asia I, 9 for Type A and 25 for	7742	63596

2nd National Contact Person Workshop and the 2nd Coordination Committee Meeting of the OIE/JTF Project on FMD Control in Asia

Country Report

Veterinary Bureau
Ministry of Agriculture, P.R. China

FMD in China
(Jan 2012 to Dec 2012)



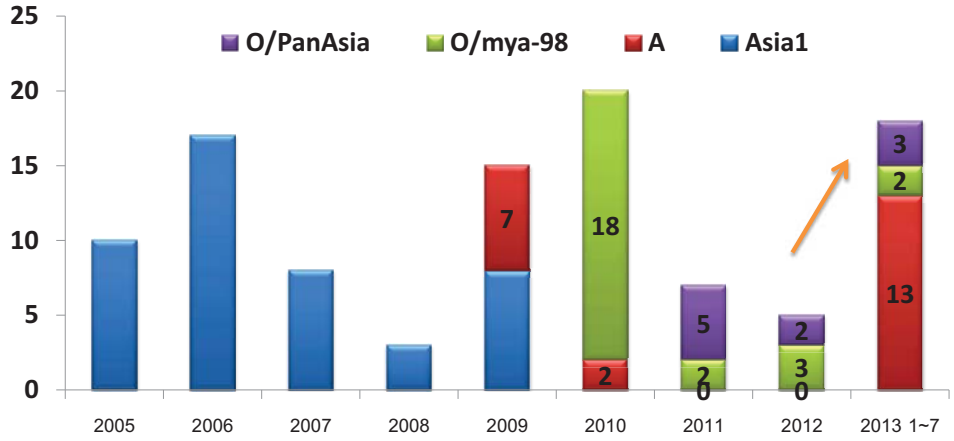
Outline

1. FMD Status
2. FMD Control Activities
3. Difficulties & Challenges
4. Future Activities

FMD Status in 2013

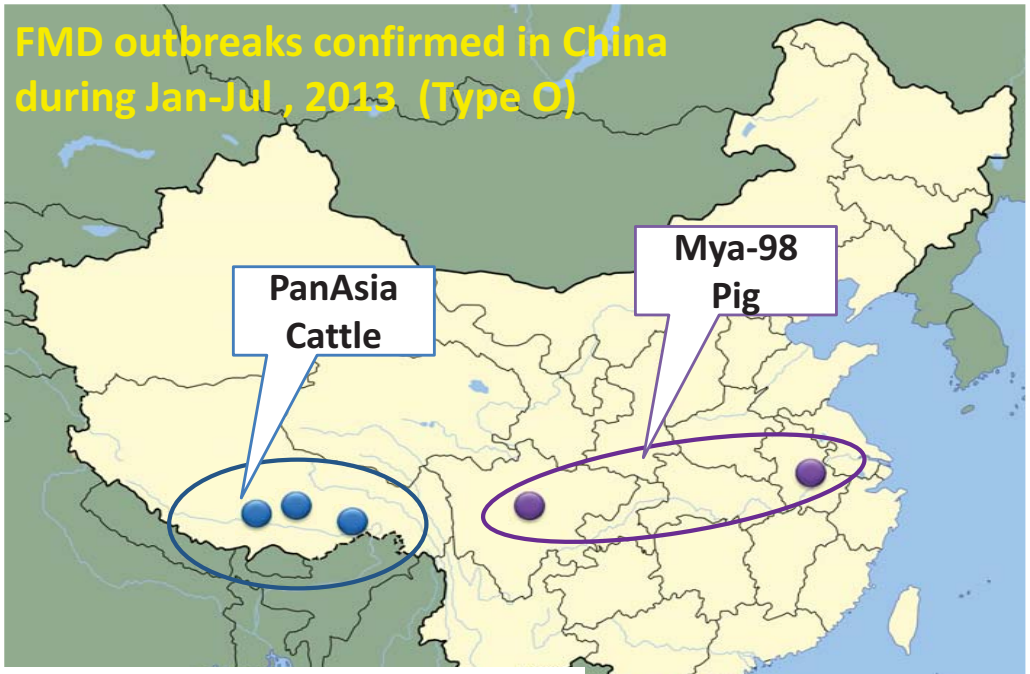
- 5 outbreaks of Type O in 3 provinces: Sichuan, Jiangsu and Tibet, 365 infected animals, 3557 culled
- 13 outbreaks of Type A in 5 provinces: Guangdong, Qinghai, Xinjiang, Tibet and Yunnan, 828 infected animals, 4887 culled

FMD outbreaks in China from 2005 to 2013

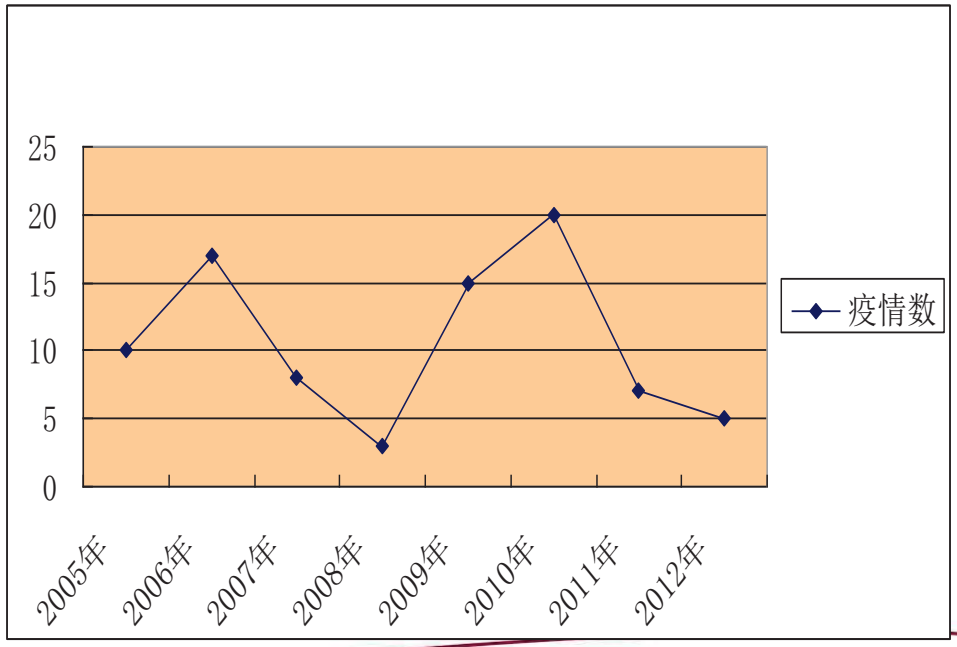


- **Asia1: n=46, Strain=Group V**
- **A: n=21, Strain=Sea-97**
- **O: n=35, Strain=Mya98+PanAsia**

FMD outbreaks confirmed in China during Jan-Jul , 2013 (Type O)

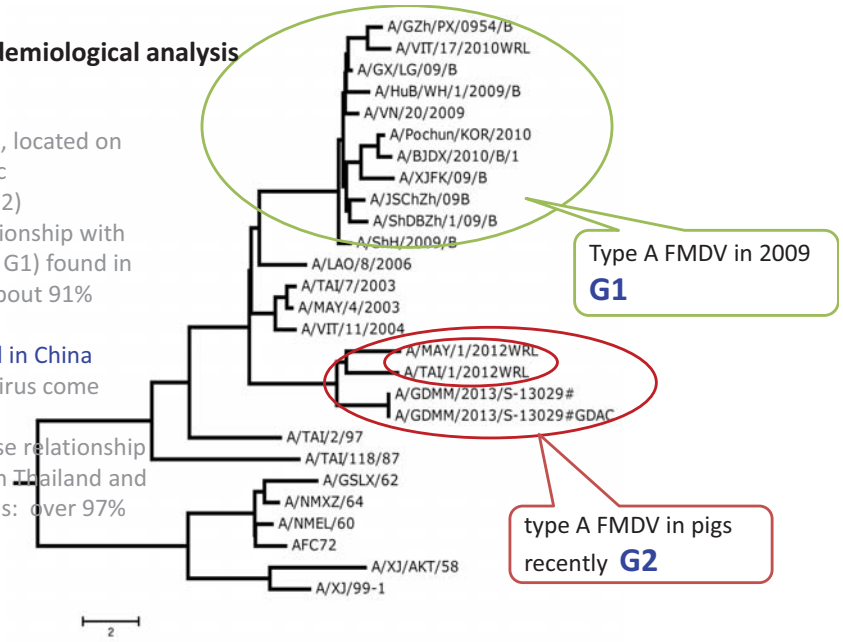


- **5 FMD type O outbreaks confirmed**
- **Mya-98 n=2, found in Sichuan and Jiangsu**
- **PanAsia n=3, found in Tibet**

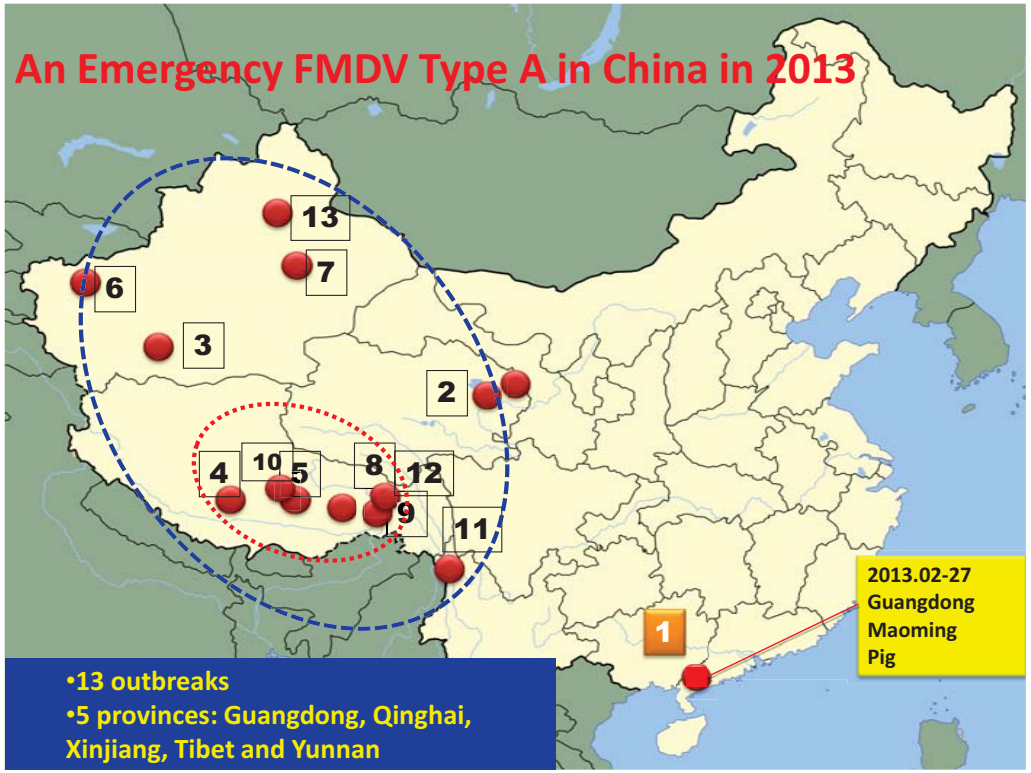


Molecular epidemiological analysis

- A/Sea-97 strain, located on the other genetic branch(named G2)
- no genetic relationship with the virus(named G1) found in China in 2009: about 91% homology
- new virus found in China
- where did the virus come from?
- Shared very close relationship with viruses from Thailand and other SEA nations: over 97% homology



The relationship with different FMDV found in China in 2009 and 2013



FMD Control Activities

1) Effective planning and organization

MOA releases 3 annual national plans on compulsory vaccination, surveillance and epidemiological investigation of animal diseases.

Working conference on major animal disease control is held twice a year (spring & autumn)

Date	Animal	Susceptible	Cases	Deaths	Destory	Province
01/03/2013	Swine	948	88	0	948	GUANGDONG
18/03/2013	Cattle	63	2	0	63	QINGHAI
16/04/2013	Cattle	12	12	0	12	XINJIANG
22/04/2013	Cattle	125	32	0	125	TIBET
	Sheep / goats	31	0	0	31	
03/05/2013	Cattle	527	145	0	527	TIBET
07/05/2013	Cattle	63	16	0	63	XINJIANG
	Sheep / goats	176	0	0	176	
10/05/2013	Cattle	25	11	0	25	TIBET
	Sheep	28	0	0	28	
	Swine	3	0	0	3	
15/05/2013	Cattle	331	106	0	331	XINJIANG
24/05/2013	Cattle	207	51	0	207	TIBET
30/05/2013	Cattle	70	8	0	70	TIBET
09/06/2013	Cattle	1213	283	0	1213	YUNNAN
	Swine	554	0	0	554	
10/07/2013	Cattle	181	51	0	181	TIBET
	Swine	308	21	0	308	
24/09/2013	Cattle	22	2	0	22	XINJIANG
Total		4887	828		4887	

Information of type A FMD outbreaks occurred in China in 2013

FMD Control Activities

- Animal disease control authorities at different levels monitor breeding animal farms, large scale farms, abattoirs and trading markets.
- National reference laboratories monitor animals in high risk areas, such as previously infected areas and border areas.

FMD Control Activities

- In 2012, 3.9 million FMD samples were collected in China, 11 tested positive. The pathologically positive animals were handled immediately according to relevant regulations.
- The positive samples were collected in 5 abattoirs in Sichuan, Fujian, Hubei and Anhui and some backyard farms in Chengduo county, Yushu prefecture, Qinghai.

FMD Control Activities

2）Surveillance and epidemiological investigation

4-tier surveillance system (central, provincial, prefecture, county); 304 national monitoring stations in major animal farming areas and 146 at borders for direct reporting.

FMD Control Activities

- 3.04 billion ml of FMD vaccines used in China in 2012
- On-spot and laboratory tests showed that vaccination coverage was above 90

FMD Control Activities

- **3) Compulsary vaccination**
- **Policy of overall vaccination, with costs shared by central and local budgets.**

*** all pigs shall be vaccinated against FMD Type O.**

***all cattle, sheep/goats shall be vaccinated against Type O and Asia I.**

FMD Control Activities

- **4) Emergency response**
  Contingency Plan
  National level: *National Contingency Plan for Major Animal Diseases; Contingency Plan for Prevention and Control of Foot and Mouth Disease*, etc
  Local plans: Provincial level, Prefecture levet, Country level 。

  *** Stock of emergency supplies**:
  protective clothing, masks, gloves, disinfectants, syringes, etc.

  ***Simulation exercises**:
  3 national exercises from 2009-2011; non-periodic provincial exercises

FMD Control Activities

*all dairy cattle and breeding bulls shall be vaccinated against Type A.

*the cattle and sheep/goats in border areas of Guangxi, Yunnan, Tibet, Xinjiang and Xinjiang Production and Construction Corps shall be vaccinated against Type A.

**Efficacy is monitored 28 days after vaccination for pigs and 21 days for other animals

Response process and measures upon outbreaks

outbreak reporting

- confirmation
- blockade culling &safe disposal
- Emergency epidemiological investigation
- Tracing the source
- Emergency vaccination
- Restricting contact between wild and domestic animals if necessary
- Removal of blockade

FMD Control Activities

6) Movement control

Animals are inspected before inter-provincial movements, and local veterinary authorities of the destination must be notified upon arrival.

For breeding and dairy animals and animals moved to DFZ to be raised: movement approval & quarantine upon arrival.

Slaughtering inspection

Distribution inspection

FMD Control Activities

- **5) Zoning-based administration**
- *Management Rules on Evaluation of DFZs*, *Technical Code on Management of DFZs*
- In Aug. 2012, Liaoning FMD free zone with vaccination passed national evaluation and become the first province-wide DFZ in inland China. Its DF status was suspended due to an outbreak in Dalian city in Dec. 2012, and resumed after passing evaluation conducted according to regulations.

➢ A型 Type A

- **Nation-wide no clinical cases by 2015**

  Nation-wide disease freedom with vaccination by 2020

➢ 亚洲I型(Asia-1) Type Asia-1

Nation-wide disease freedom with vaccination by 2015

Nation-wide disease freedom without vaccination by 2020

➢ O型 Type O

- **Zoning in inland China**

Challenges

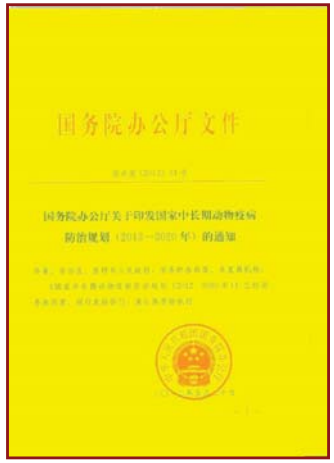
- Traditional farming models. For example, in the pig farming sector, 65% are backyard or non-specialized farms that produce less than 500 pigs a year. High densities, poor disease control infrastructure and poor management are huge health hazards.
- Frequent inter-provincial movement of live animals. To cater to Chinese people's preference for warm meat, live animals are frequently transported for long distances, especially before holidays.
- Weak local veterinarian teams. Only a few village disease control workers have a professional background and most of them are not very professional. Disease control service providers in the private sector are insufficient.

- 海南省非免疫无疫
- Disease freedom without vaccination in Hainan
- 辽东半岛、胶东半岛免疫无疫
- Disease freedom with vaccination in Liaodong and Jiaodong peninsulas
- 其他区域达到控制标准
- Controlled in the rest

YOUR LOGO

Future Activities

- ***National Medium and Long-Term Program for Animal Disease Control (2012-2020)*** **lists FMD as a priority disease.**



Future Activities

- For Type Asia-1:
  - Compulsory vaccination with high-quality vaccines for all susceptible animals coupled with immune antibody monitoring;
  - Pathological surveillance to get rid of animals tested pathologically positive;
  - Culling of animals tested positive for infection antibody;
  - Exit from vaccination when appropriate and sustaining of DF status through inspection and other measures for the ultimate goal of disease freedom without vaccination.
- For Type A: basically the same technical roadmap as that for Type Asia-1

- 海南省、胶东半岛、辽东半岛非免疫无疫
  Disease freedom without vaccination in Hainan, and Jiaodong and Liaodong peninsulas
- 黑龙江、吉林、辽宁、北京、天津、上海免疫无疫
  Disease freedom with vaccination in Heilongjiang, Jilin, Liaoning, Beijing, Tianjin and Shanghai
- 其他区域达到控制标准
  Controlled in the rest

- For Type O: phased and zoning-based control strategy. Establishing and expanding DFZs with or without vaccination through high-quality compulsory vaccination, strict movement control, continuous surveillance and shrinking of the population of positive animals, etc., in order to achieve the target nation-wide.

Future Activities

- Stronger risk management against major exotic diseases, e.g. FMD types not existing in China (C and SAT1/2/3), by raising awareness of border disease control and establishing national border protective barriers.
- Following the principle of prevention-focused, type-and-location-specific and zoning-based control; implementing an integrated control strategy that combines vaccination, surveillance, movement control, emergency response, bio-safety disposal and inspection.

Thank You !

FMD prevention and control in Chinese Taipei

Yang, Wen-Yuan

2013.10.07

Bureau of Animal and Plant Health Inspection and Quarantine (BAPHIQ), Council of Agriculture

Outline

- **General aspects**
- **History of cases**
- **FMD prevention and control**
  - **Veterinary services and infrastructure**
  - **Vaccination**
  - **Monitoring and surveillance**
  - **Prevention**
  - **Control measures**
- **Developments/activities on national FMD control in 2013**

General aspects

- Pigs:
  - the main population of livestock.
- Pig adopted (O-Taiwan) strain is the predominated since 1997.
- O-SEA strain detected in off-shore island (Kimen) in 2012 was accidental.

Table. Livestock population in 2012

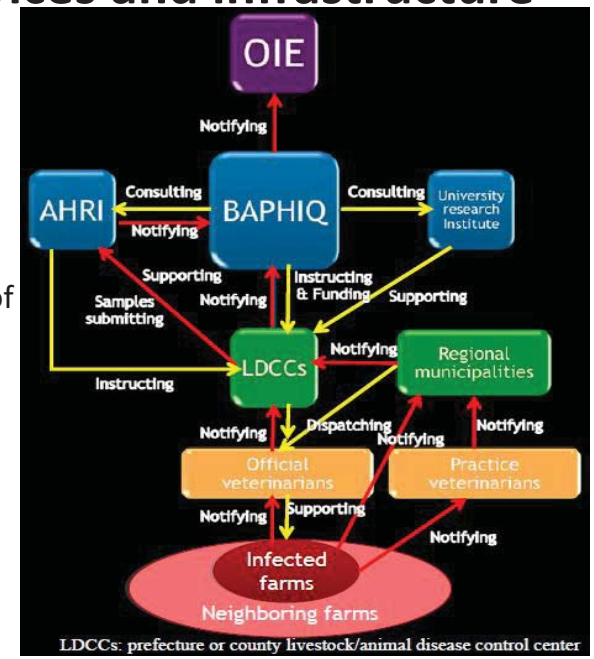
Species	Buffalos	Cattle	Goats	Sheep	Deer	Pigs	Total
Number	3,177	143,009	167,103	200	22,778	6,004,717	6,340,984

General aspects

- **FMD prevention and control :**
  - In accordance with:
    - Statute for Prevention and Control of Infectious Animal Disease. (law)
    - Regulations on Management of Vaccine Types for HC and FMD Elimination (regulation).
- **Goal:**
  - To return to FMD free country with vaccination, finally to upgrade to FMD free country without vaccination.
  - all susceptible animals on the premises should be vaccinated in order to ensure that over 80% of the population be adequately immunized.

Veterinary services and infrastructure

- FMD:
  - Notifiable disease.
- Disease reporting:
  - Animals suffering from or suspected of infectious diseases.
- Compulsory for :
  - Owners/keepers.
  - Veterinarians.
  - Official vets.



History of cases

- **2009-2013:**

Year	2009		2010		2011		2012		2013 (Jan-Sep)	
Case	NSP	Viral	NSP	Viral	NSP	Viral	NSP	Viral	NSP	Viral
Number	5	3	3	1	7	5	10	5	3	0
Total	8		4		12		15		3	

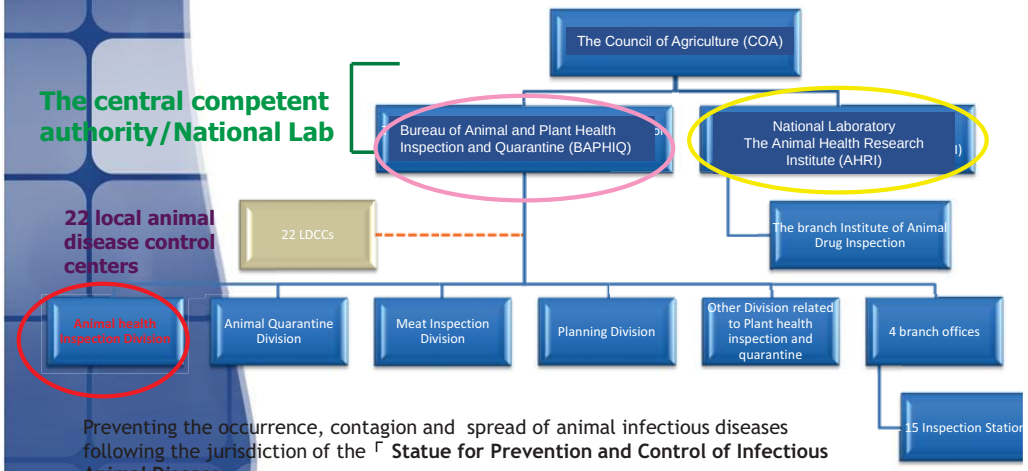
NSP: non structural protein antibody; VI: virus isolation
NSP case: NSP(+), PCR(-) and VI(-)
Viral case: NSP(-), PCR(+) or VI(+)

- **Among the 14 viral cases, 11 cases were infected by O-Taiwan FMDV and the others were infected with O-SEA FMDV.**

Vaccination

- **Blanket vaccination**
  - Empowered by Statute for Prevention and Control of Infectious Animal Disease.
  - All cloven-hoofed animals shall be vaccinated with FMD vaccine.
  - O Taiwan and O manisa strain vaccines (at least 6 PD_{50}) are used (IM route).

FMD prevention and control
Veterinary services and infrastructure



Preventing the occurrence, contagion and spread of animal infectious diseases following the jurisdiction of the 「**Statue for Prevention and Control of Infectious Animal Disease**」

Monitoring and surveillance

- **Active Surveillance**
  - SN titer for evaluating the efficacy of blanket vaccination:
    - SN mean titer shall be
      - >16x in pigs.
      - >32x in ruminants.
    - The testing results below the standard values link to the corresponding penalty.
  - NSP antibody as a precaution action to detect possible viral activity in the field.

Vaccination

- **Vaccination program**
  - Empowered by Regulations on Management of Vaccine Types for HC and FMD Elimination.
  - Pigs:
    - One dose is given at 12-14wks age and another one is vaccinated once half a year.
  - Ruminants (cattle, goats and deer):
    - Basic vaccination shall be done at 4 and 12 months age respectively. Then the other one dose is given once a year.

Monitoring and surveillance

- **On-farm active surveillance**
  - Clinical inspection.
  - Serological testing.
    - Stratified random sampling.
    - 95% probability, 20% prevalence.
    - 600 pig farms/year.
    - 300 ruminant farms/year.
      - 15 serum samples/farm.
  - **The mean SN titer value obtained in Jan-Sep, 2013**
    - **86% of tested pig farms were > 16x.**
    - **96% of tested ruminant farms were > 32x.**

Vaccination

- **Penalty:**
  - The owner or keeper will be fined NTD 10,000-50,000 for
    - violation of compulsory vaccination.
    - Anti- violating operation conducted by verification team every day.
      - 67 owners or keepers were punished for the violation in 2013.
    - mean titer of FMD SN antibodies from tested animals ≦4.
      - 12 owners or keepers were punished for the violation in 2013.
  - The owner or keeper shall make a booster to animals kept in the farm when
    - mean titer of FMD SN antibodies from tested animals is <16
      - 169 farms in 2013.
  - The farm with SN titer results below 16 shall be re-tested after 3-5 weeks to obtain herd level protection.

Prevention

- **Application of vehicle control, transportation vehicle and establishment disinfection at auction markets and slaughterhouses**
  - Supervised by LDCCs and veterinary meat inspectors.



Monitoring and surveillance

- **Active surveillance on meat markets**
  - Clinical inspection.
  - Serological testing for NSP antibody.
    - On a daily basis. (40-50 thousands samples/year)
    - 1-2 animals per original farm.
  - Clinically suspected case shall be traced back to the original farm
    - movement restriction.
    - follow-up serological and virological surveys.

Control Measures

- **Movement restriction on the infected farm.**
- **Clinical infected animals and their pen mates (exposed animals) shall be depopulated.**
- **Disposal of carcasses.**
- **Disinfection would be carried out on the affected premises, areas and epidemiological-linked establishments.**
- **Clinically healthy animals within the index farm shall be vaccinated to improve the protection.**
- **Surveillance on surrounding cloven-hoofed animal farms within 3 km radius area around the infected farm.**

Prevention

- **Application of biosecurity principles at the farm level**
  - onto and off farms control.
  - Personal and vehicle biosecurity.
    - Changing outer clothes and footwear when moving between different pens and age groups, with the frequent use of disinfection baths and separate equipment, minimizes the spread of infectious diseases.
  - Routine cleaning and disinfection.
  - Selective purchasing and quarantine.
    - The origin of newly acquired animals should be known as healthy. Recently purchased animals should be quarantined at a distance from the remainder of the herd for a period of 14 days to provide added security.
  - Self monitoring and reporting suspicious case.

Developments/activities on national FMD control in 2013

- **Cease the subsidization for FMD vaccines since 2013.**
  - Percentage of herd immunity at farm level is rose.
- **Subsidize one person to conduct the disinfection of transportation vehicles at every auction markets since 1st April 2013.**
  - to block the possible viral transmission.
- **Make and announce the regulation to reward executing organizations with good achievements on FMD prevention and control.**
  - Higher percentage of matching funds will be provided by the central government for the top three executive organizations.
  - The competition is held once a year.

Control Measures

- **Emergency use of vaccination**
  - Mono-valent inactivated serotype O vaccines (O-Taiwan and O-manisa strain) were used for blanket vaccination.
  - Commercial vaccines and antigen bank of serotype Asia-1, A and O (about 100 thousand and 750 thousand doses in commercial products, respectively) are stockpiled for emergency use for the incursion of other serotype strain of FMDV.
- **Public awareness.**

Thanks for your attention~

Post-outbreak activities

- Epidemiological investigation and study are conducted to determine the potential source of outbreak or infection routes to block the pathway.
- Executing vaccine matching test to evaluate the efficacy of the vaccine if necessary.
- Implementing targeted surveillance to check viral activities in the field.
- Conducting studies or research on FMD.

The swine sector in the agricultural economy

	2011	2012
Local production (%) accounted for consumed in HK	7.0 % of live pigs	7.1 % of live pigs
Number of Live pigs slaughtered Local pigs Imported pigs	 90,000 1,460,000	 94,037 1,544,078
The imported pork (weight) Chilled pork: Frozen pork:	 about 15,539 tonnes about 250,206 tonnes	 about 11,720 tonnes about 235,583 tonnes

FMD Control in Hong Kong

Dr. Veronica Yin-Ming LEONG
Agriculture, Fisheries and Conservation Department

Agriculture Profile

Swine production systems

- **Total number of licensed pig farms:** **43 farms**
- **Total maximum rearing capacity:** **74640 pigs**
- **Licensed rearing capacity:** **250- 6000 pigs / farm**
- **Pigs rearing on farms in Aug 2013:** **61260 pigs (range from 4 - 5445 pigs/ farm)**
- **Total number of breeders in Aug 2013:** **9236 breeders including:**
  - **7868 sows**
  - **357 boars**
  - **1011 gilts**

Hong Kong SAR Profile

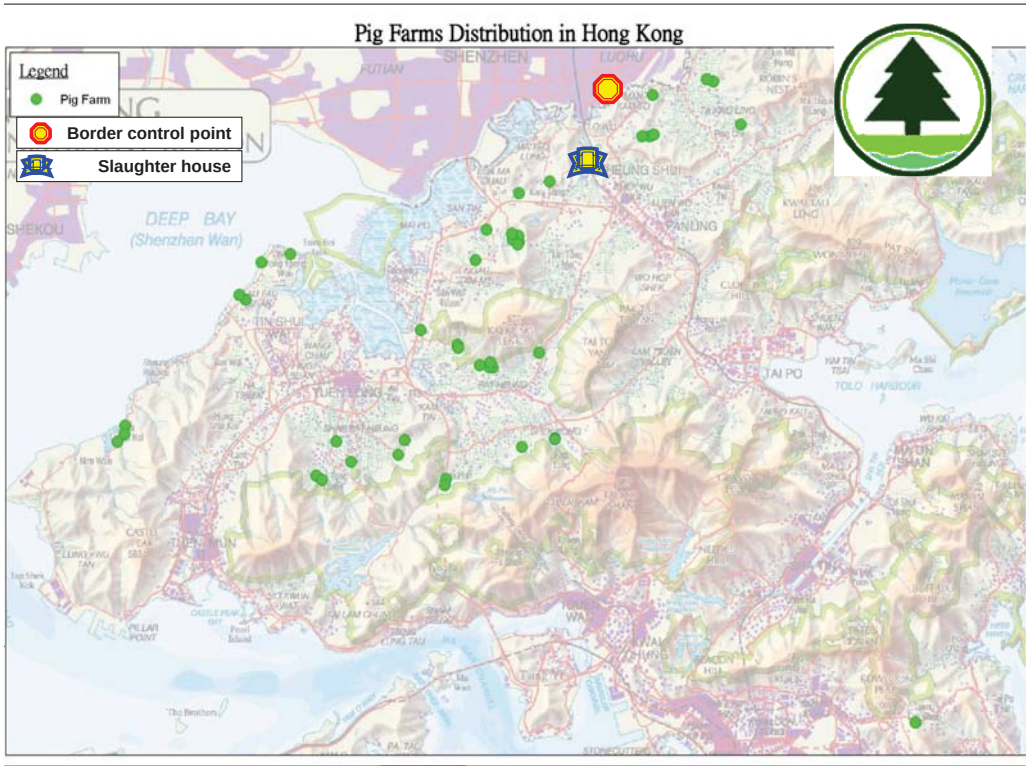
- Hong Kong,with a population of seven million people, is located on China's south coast, 60 km east of Macau on the opposite side of the Pearl River Delta.
- The territory's 1,104 km^2 area consists of Hong Kong Island, the Kowloon Peninsula, the New Territories, and over 200 offshore islands, of which the largest is Lantau Island.
- The territory has little arable land and few natural resources, so it imports most of its food and raw materials outside HK; for example from the Mainland China.

Reference:
http://www.afcd.gov.hk/misc/download/annualreport2006/big5/appendices.html
http://zh.wikipedia.org/wiki/%E9%A6%99%E6%B8%AF%E8%BE%B2%E6%A5%AD

Import control

- Almost all pig breeding stocks are imported from the Mainland
- There is one breeder batch (116 head) imported from Taiwan in 2013

Year	2010	2011	2012	2013
Total Quantity (head)	1477	1281	1158	1072 (Jan to Aug)

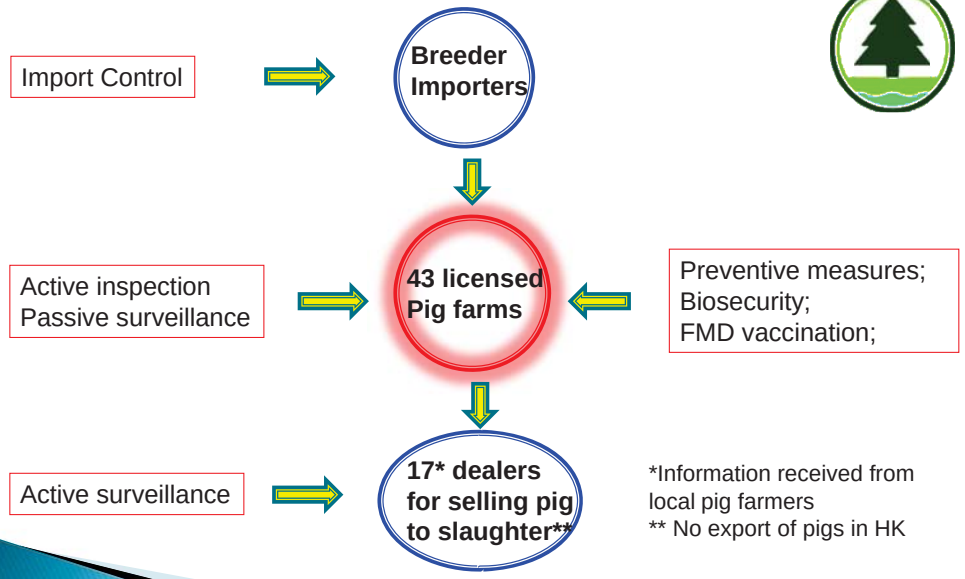


Import control

- Certified that the imported pigs were free from FMD in the last 12 months
- Quarantine period for breeding pigs on local farm is 28 days after importation.


中华人民共和国出入境检验检疫
ENTRY-EXIT INSPECTION AND QUARANTINE OF THE PEOPLE'S REPUBLIC OF CHINA
ORIGINAL
动物卫生证书
ANIMAL HEALTH CERTIFICATE

Swine industry players, supply chain and FMD control



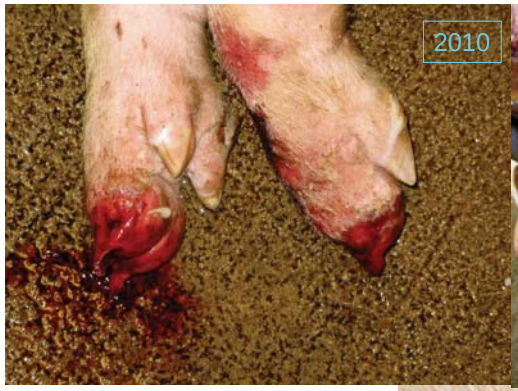
FMD outbreaks

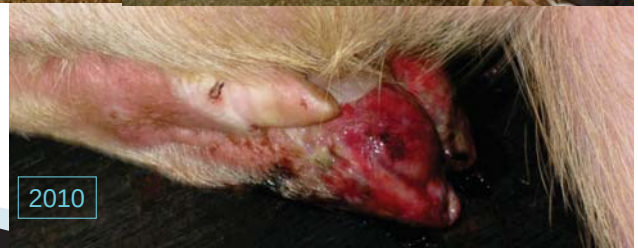
- FMD is a notifiable disease in Hong Kong under Cap 139B Public Health (Animals and Birds) Ordinance
- Report to OIE

Local control

- Active inspection
- On a monthly basis
- One farm a day
- Passive surveillance
- Disease investigation

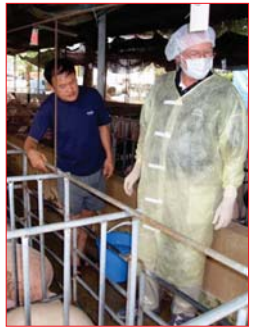
FMD outbreaks





Swine health surveillance & monitoring

- **Active surveillance**
  - Slaughterhouse (Veterinary) Section of FEHD submit 7 ,0 ,1 samples to TLVL a year for the surveillance of FMD in 2011, 2012, 2013 (up to 12/9/2013)
- **Passive surveillance**
  - Upon receipt of farmer's notice, live sick animals or carcasses or tissue samples will be submitted by AFCD officers to TLVL for swine disease testing and diagnosis.
- **Disease diagnosis**
  - Samples (vesicular epithelium or vesicular fluid) will be taken and submitted to Tai Lung Veterinary Laboratory
  - In case of dead pig, carcass will be submitted for necropsy.



Post Outbreak Investigation

- Veterinary inspection on farm for disease investigation
- Sampling for diagnosis
- Serotyping of FMDV field strain
- Risk communication and advice for farmers
  - Biosecurity and vaccination advice
  - Movement and access control
  - Foot baths, shower,... etc.
  - Enhance FMD vaccination

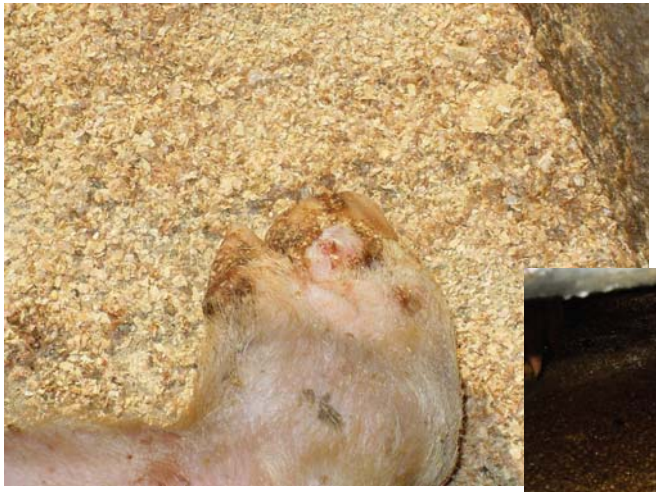
FMD Disease Status

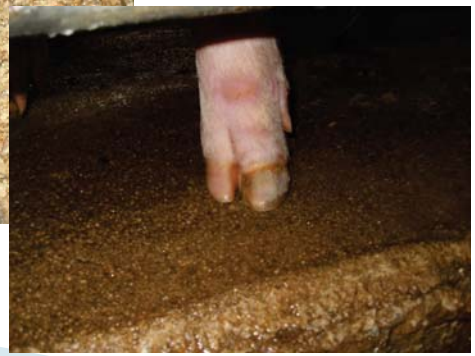
Year	2010	2011	2012	2013
No. of notified FMD cases	4	3	1	1
Location(s) - Slaughter house - Local farms	 0 4	 2 1	 0 1	 0 1
Species/ Serotype	Pig/ FMDV-O	Pig/ FMDV-O	Pig/ FMDV-O	Pig/ FMDV-O
Topotype(s)	SEA (3) CATHAY (1)	SEA (1) (local farm) CATHAY (2) (2 slaughter house cases)	No Typing	CATHAY (1)

Control Status

- The current vaccine (Serotype O – Manisa +3039), and
- vaccination practice (mass vaccination)
- is effective in the control & prevention of on farm FMD outbreaks

FMD Recovery Status





Constraints

- HK market is very small and vaccine manufacturer has low interest in supplying vaccine
- There are more than one topotypes circulating in HK and it is not easy to tailor-make a FMD vaccine to protect multiple topotypes for a small market
- No downtime and mixed sources in the slaughterhouse
- Disinfection facilities and infrastructure of the slaughter house to be enhanced and improved
- Movement of pigs and dealers' vehicles between slaughter house and local farms increased the chance of cross contamination

Control Status

- The current vaccine (Serotype O – Manisa +3039) and vaccination practice (mass vaccination) is effective in the control and prevention of on farm FMD outbreaks at the moment
- Vaccine recommendation is based on topotyping of local strain(s) and vaccine matching results from Institute for Animal Health (IAH) Pirbright
- Since FMD is endemic in Hong Kong, there is no specific strategic plan for the eradication of FMD

Thank You

FAO World Reference Laboratory for Foot-and-Mouth Disease (WRLFMD)

Genotyping Report

Report Date for this Batch: 21 June 2013

FMDV type O
Country: Hong Kong SAR, P.R. China
Period: 2013
No. of samples: 1

BATCH: WRLFMD/2013/00010

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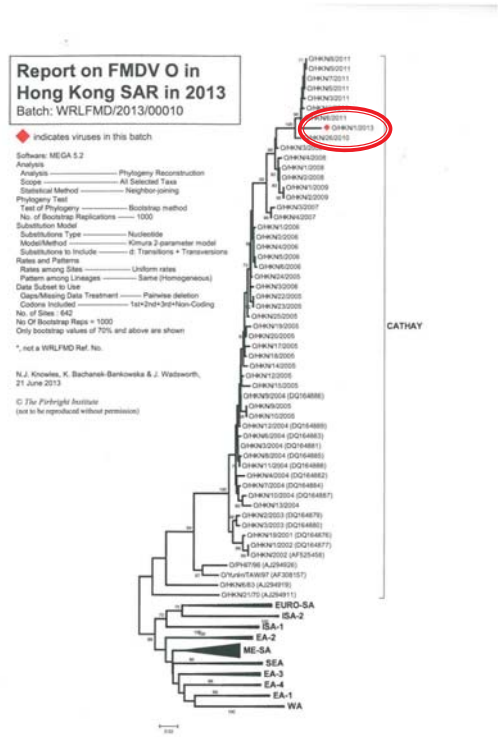


THE REVISED GUIDELINES ON FMD PREVENTION AND CONTROL

COUNTRY PRESENTATION JAPAN

NORIYOSHI OJIMA
DEPUTY-DIRECTOR OF ANIMAL HEALTH DIVISION
MINISTRY OF AGRICULTURE, FORESTRY AND FISHERIES
JAPAN

CONTENTS

OUTLINE OF FMD OUTBREAKS IN 2010

- On 20 April 2010, an FMD outbreak was confirmed in Miyazaki and the total number of affected animals reached 211,608 heads at 292 farms.
- In order to control the rapid spread of the disease, emergency vaccination was applied for the first time in Japan (a total of 87,904 vaccinated animals were destroyed).
- The disease was consequently controlled and no case has been confirmed since 4 July 2010. All movement restrictions were lifted on 27 July 2010.

BASIC POLICIES

3. In case of FMD outbreaks, it is important to make best efforts to prevent spreading of FMD and to contain them by prompt and appropriate initial responses.
4. The central government should promptly review the control policies or develop appropriate emergency guidelines for FMD control, if the initial responses based on the established control policies could not prevent the disease from spreading.

BASIC POLICIES

1. The most important elements for FMD control are:
   - Prevention of the outbreak;
   - Early detection and notification; and
   - Rapid and appropriate initial responses.

PREVENTION AND PREPAREDNESS

- Ministry of Agriculture, Forestry and Fisheries (MAFF) should ensure that animal quarantine officers put import quarantine on animals and animal products into effect and disinfect the soles of shoes and boots of people visiting Japan at international borders.
- MAFF should regularly organize and hold FMD control exercises for prefectural governments and find and iron out problems.
- MAFF should collect information about effective FMD vaccines against FMD viruses isolated in surrounding countries, examine what vaccines can be used when necessary, and store necessary and sufficient amounts of FMD vaccines for emergency.

BASIC POLICIES

2. It is the most important among others that livestock owners or managers follow the biosecurity standards as well as ensure that they immediately notify prefectural governments of suspicious cases showing clinical signs of FMD as a routine work.

PREVENTION AND PREPAREDNESS

- Prefectural governments should promptly inform all livestock owners or managers and concerned organizations of recent global situations of FMD when they receive them from the central government.
- In order to develop awareness of FMD control in livestock owners and managers and to ensure they follow the biosecurity standards, prefectural governments should regularly conduct on-the-spot inspections at least once a year and hold seminars for them.
- Prefectural governments should give advice, recommendations and orders to livestock owners or managers who do not follow the biosecurity standards.

DISINFECTION OF THE SOLES OF SHOES AND BOOTS AT INTERNATIONAL AIRPORTS




INITIAL RESPONSE WHEN FOUND TO BE FMD POSITIVE

- Ministry of Agriculture, Forestry and Fisheries (MAFF) should establish a task force for FMD control.

(Director General: the Minister)

- MAFF should dispatch to FMD affected prefectures liaisons, experts, emergency support teams and epidemiological survey teams.

FMD CONTROL EXERCISE IN 2013

- Period: 4-8 February 2013
- Method
  - Exercise 1:Prefectural veterinary officers of each prefecture visit the farm for inspection on the assumption that a cattle farm notified them of suspicious FMD cases; take pictures of the site where the lesions most commonly occur; conduct epidemiological investigations on the farm.
  - Exercise 2: Each prefectural government makes basic documents necessary for initial control response on the assumption that three outbreaks are confirmed at the same day.
- Results
  - Some prefectures took too indistinct pictures to diagnose FMD.
  - Some prefectures did not coordinate securing necessary human resources and materials in advance.

ESTABLISHMENT OF DISINFECTION STATIONS

- Prefectural governments should establish disinfection stations promptly after confirmation of FMD outbreaks, placing great importance on prevention of spread of FMD infection to surrounding farms and to the outsides of movement and shipment restriction zones.

CONTROL MEASURES TAKEN AT AFFECTED FARMS

- The culling should be promptly completed within 24 hours.
- They should be buried within 72 hours.
- Prefectural governments should bury livestock-derived products, excretions, bedding, feed and other possible contaminated goods in affected farms or the surroundings.

SURVEILLANCE

- Prefectural governments should collect epidemiological information on livestock, people and vehicles that visited the affected farms, and trace the epidemiologically-related farms.
- When outbreaks of FMD are confirmed, prefectural governments should conduct investigation by telephone, on-the-spot inspections and FMD freedom surveillance.

ESTABLISHMENT OF MOVEMENT/SHIPMENT RESTRICTION ZONES

- Prefectural governments should establish movement restriction zones where movements of livestock and others are prohibited, within a radius of 10 km around affected farms .
- Prefectural governments should establish shipment restriction zones where carrying-out of livestock and others are prohibited, circumscribing movement restriction zones, within a radius of 20 km around affected farms.

CONCLUSION:
BASIC PRINCIPLE FOR FMD CONTROL

- Stamping out to maintain FMD free status
  - No vaccination
  - 100% compensation
  - border control
  - biosecurity of farms

SURVEILLANCE

- **On-the-spot inspections**:
  - Farms within at least 1 km from affected farms within 24 hours after the diagnosis
  - Subsequently all farms in movement restriction zones
  - Clinical inspections, PCR and serological antibody tests
- **FMD freedom surveillance**:
  - All farms in movement restriction zones
  - After 10 days have passed since completion of all control measures at every farm.
  - Clinical inspections and serological antibody tests

~ Thank you for your attention ~

PRECAUTIONAL CULLING

- MAFF should determine to take precautional culling if it is difficult to prevent FMD infection from spreading only by culling and movement control, taking into account the followings:

① Time lags of notifications (conditions of lesions, the number of affected livestock and others);

② Spread of the infection (the number of epidemiologically related farms and presence or absence of swine cases);

③ Environmental factors (the number of surrounding farms, density of livestock, existence of mountains and rivers, and others); and

④ State of progress of control measures including destroying by burial.

FMD CONTROL STRATEGY

Establishment of control zones
Outbreak zone, protection zone and disease free zone

Quarantine
Restriction or prohibition of animal, civil and traffic movement

Stamping-out
Compensation of 90 % market value for S-out livestock

Vaccination: Compulsory and free of charge

Others: training, public awareness and contingency planning, coordination and implementation

Country report

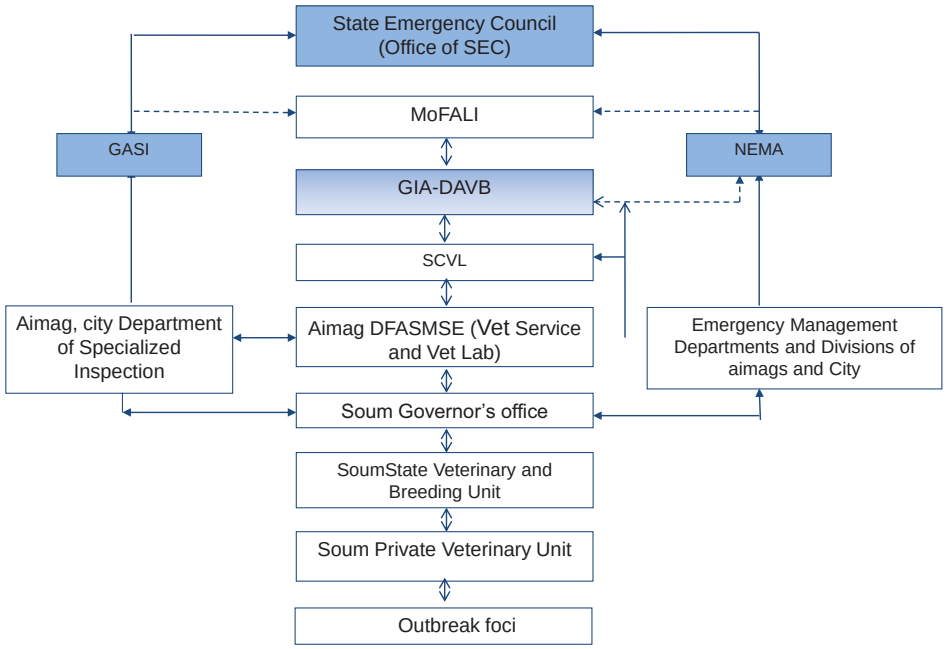
MONGOLIA

Second Coordination Committee Meeting of the
OIE/JTF Project for FMD Control in Asia

Hustai national park, Mongolia
07 October, 2013

Ts. Purevkhuu, B. Batsukh, T.Baatar

Agencies or organization responsible for FMD prevention and control



Legal documents

- June 7th, 1993. on 'Livestock Health and Gene Potection' (will change Animal Health law draft) ;
- Law of June 20th, 2003 on 'Disaster Protection' ;
- Law of December with State and Local Funds' ;
- Drugs Act of May 7th, 1998, Law of Mongolia ;
- Law of November 28th, 2003, on 'State Boundary Quarantine Control of Animals, Plants, Raw Materials and Products of Animal and Plant Origin' ;
- Government Decree No 305 of July 29th, 2008, 'Procedure on Confirmation of Highly Infectious Animal Disease, Establish Quarantine and Restriction Zones, Operations in these Zones' ;
- Ministerial Decree No A/67, Annex 1, of April 5th, 2010, from Minister of Food, Agriculture and Light Industry, 'Guideline on FMD Control Measures;
- Foot and mouth disease national contingency plan, 2011 ;
- Foot and mouth disease control strategy, 2012 (under processing) ;

Timing and number of FMD outbreaks of 2000-2013.

Year/month	2000	2001	2002	2003	2004	2005	2006	2010	2013
January									
February		19			13				
March		4			5				
April	1	1			2		1	1	
May	1	1						1	
June								1	
July			3						1
August						1		2	
September								11	1
October								2	
November								6	
December									
TOTAL	**2**	**25**	**3**	**0**	**20**	**1**	**1**	**24**	**2**

Source: VABA, NEMA

TAD CONTROL MANAGEMENT AND RESOURCE

Veterinary Service, MoIA

- Disease diagnosis and confirmation;
- Work out control strategies in accordance with OIE rule and specificity of livestock husbandry system in different geographical zones;
- Implementation of control measures;

Emergency Management Agency

- Harmonize all control actions in line with MoAI and SSIA guidance;
- Mobilize forces of military, police and civil contingent;
- Assign required fund for control;
- Assist local authorities in disease controlling;

State Specialized Inspection Service

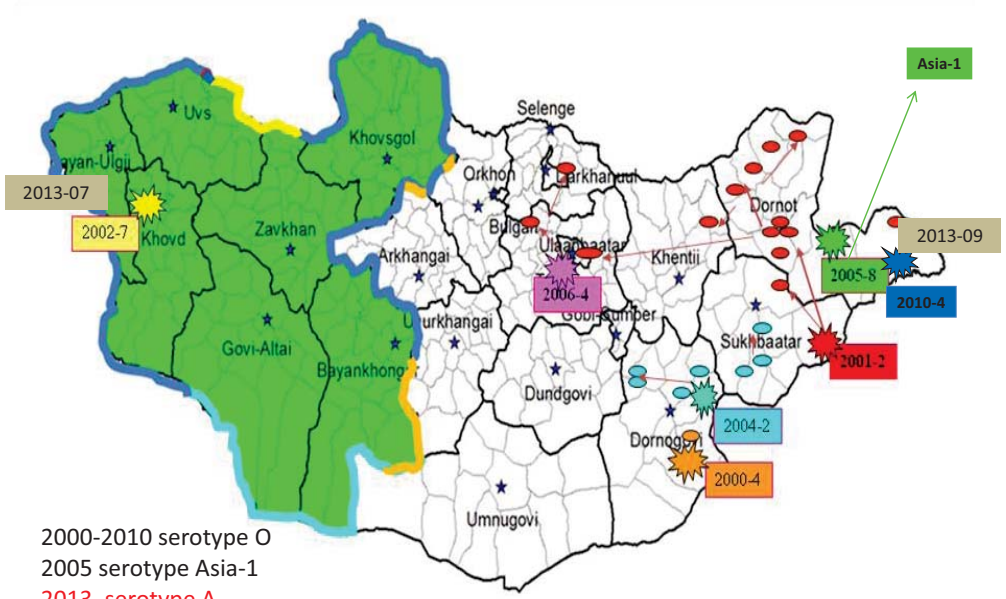
- Issue degree of designating the quarantine zones;
- Inspection over implementation of control measure;

Number of culled livestock in FMD outbreaks of 2000–2013

Years	Province	Soum	Number of culled livestock	Expenses for compensation (thousand tugrug)
2000	1	2	916	48,456.00
2001	6	16	1,201	96,720.00
2002	2	3	485	36,804.00
2004	3	8	2,317	254,325.00
2005	1	1	235	17,700.00
2006	1	1	24	774.00
2010	6	24	25,933	2,894,200.00
2013	2	2	1283	828,396.00
Sum	**22**	**57**	**32,394**	**4,177,375.00**

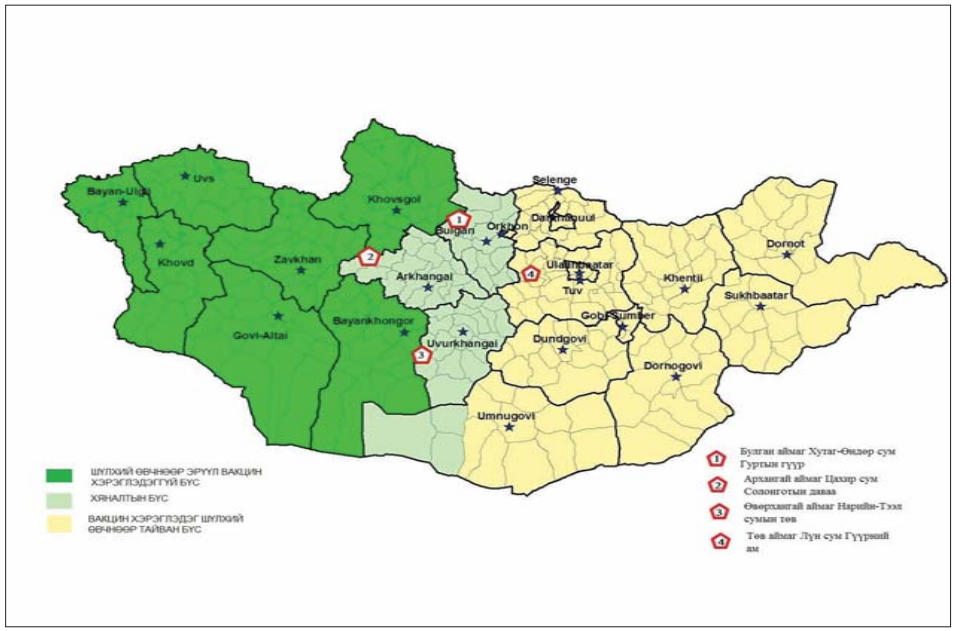
Source: VABA, NEMA

FMD history in Mongolia



2000-2010 serotype O
2005 serotype Asia-1
2013, serotype A

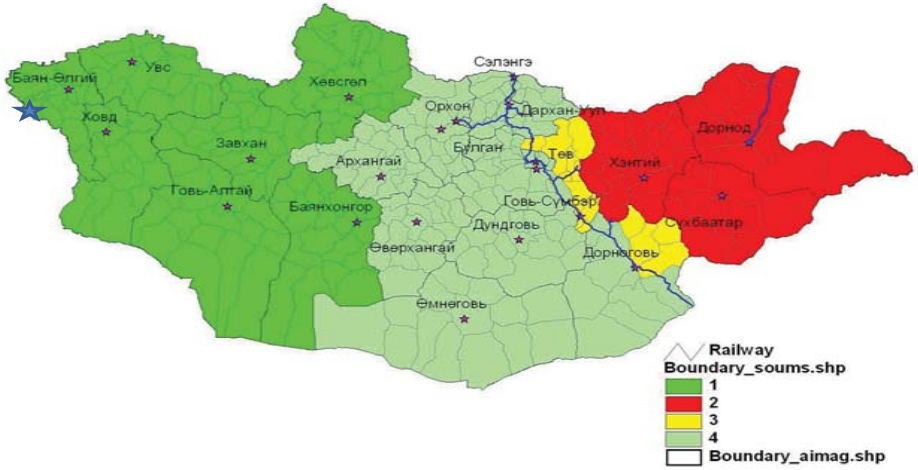
FMD zones 2012 and Government regulation № 247, 17 August, 2011



Adhering principle to creating the zones

- Geographical barriers (high mountains, wide rivers, broad steppe, desert) ;
- Movement of human, live animals and livestock originated raw materials ;
- Society, economy, health, education and infrastructure development;
- Status and situation of livestock infectious diseases;

FMD zones in Mongolia 2013-2015



Adhering principle to creating the zones

- Foot and mouth disease Chapter 8.5 of Terrestrial Animal Health Code;
- Procedures for self declaration and for official recognition by the OIE;
  - Members may wish to make a self declaration as to the freedom of a country, *zone* or *compartment* from an OIE *listed disease*. The Member may inform the OIE of its claimed status and the OIE may publish the claim. Publication does not imply endorsement of the claim. The OIE does not publish self declaration for bovine spongiform encephalopathy (BSE), foot and mouth disease (FMD), rinderpest, contagious bovine pleuropneumonia (CBPP) and African horse sickness (AHS).
  - When requesting official recognition of disease status, the Member should submit to the OIE Scientific and Technical Department a dossier providing the information requested (as appropriate) in Articles 1.6.3. (for BSE), 1.6.4. (for FMD), 1.6.5. (for rinderpest), 1.6.6. (for CBPP) or 1.6.7. (for AHS).
  - Trade partnership

Dossier 2009

MINISTRY OF FOOD, AGRICULTURE AND LIGHT INDUSTRY OF MONGOLIA
VETERINARY AND ANIMAL BREEDING AGENCY

DOSSIER FOR RECOGNITION OF FOOT AND MOUTH DISEASE FREE ZONE WITHOUT VACCINATION

BACKGROUND AND RESULTS OF THE CONTROL AND SURVEILLANCE OF FOOT AND MOUTH DISEASE IN MONGOLIA TO BE SUBMITTED TO THE OIE

ULAANBAATAR
August, 2009

1

Dossier 2011

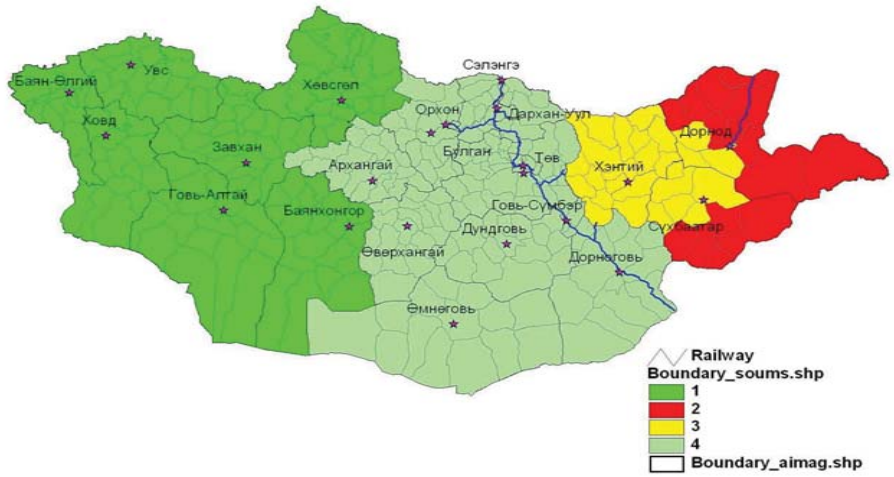
MINISTRY OF FOOD, AGRICULTURE AND LIGHT INDUSTRY OF MONGOLIA
VETERINARY AND ANIMAL BREEDING AGENCY

DOSSIER FOR RECOGNITION OF A FOOT AND MOUTH DISEASE FREE ZONE WITHOUT VACCINATION

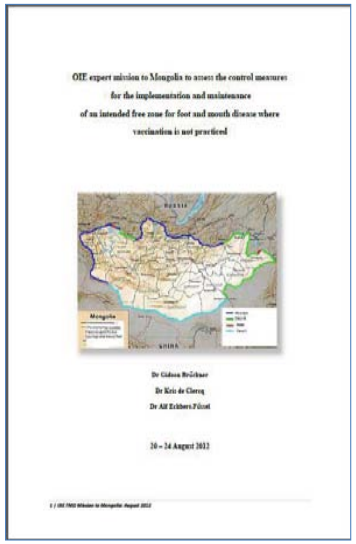
BACKGROUND AND RESULTS OF THE CONTROL AND SURVEILLANCE OF FOOT AND MOUTH DISEASE IN THE WESTERN ZONE OF MONGOLIA TO BE SUBMITTED TO THE OIE

ULAANBAATAR
October, 2011

FMD zones in Mongolia 2016-2017



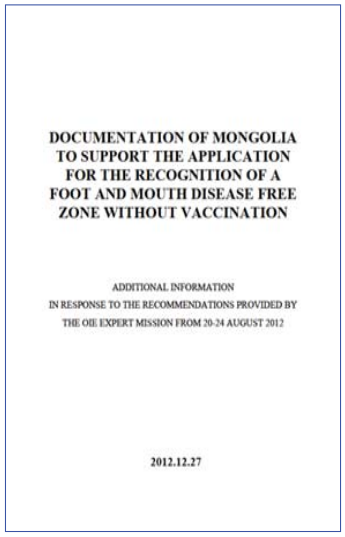
OIE expert mission for FMD free zone in Mongolia


OIE expert mission to Mongolia to assess the control measures for the implementation and maintenance of an intended free zone for foot and mouth disease where vaccination is not practiced

Dr Gideon Brückner
Dr Kris de Clercq
Dr Alf Eribert Fürst

20 – 24 August 2012

Action plan created based on OIE expert's report


DOCUMENTATION OF MONGOLIA TO SUPPORT THE APPLICATION FOR THE RECOGNITION OF A FOOT AND MOUTH DISEASE FREE ZONE WITHOUT VACCINATION

ADDITIONAL INFORMATION
IN RESPONSE TO THE RECOMMENDATIONS PROVIDED BY THE OIE EXPERT MISSION FROM 20-24 AUGUST 2012

2012.12.27

FMD zones and FMD PCP Level 2013-2017

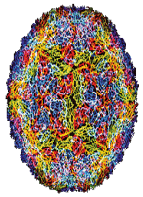
	Western Mongolia: free zone without vaccination	Central FMD free zone : II free zone without vaccination	FMD transition zone	Eastern Mongolia: FMD free zone with vaccination
2013 он				
Actual PCP level	PCP 5	PCP 4	PCP3	PCP2
PCP level to be achieved	Free zone without vaccination official status	PCP5	PCP4	PCP3
2014 он				
Actual PCP level	Free zone without vaccination official status	PCP 5	PCP3	PCP3
PCP level to be achieved	Free zone without vaccination official status	PCP5	PCP5	PCP3
2015 он				
Actual PCP level	Free zone without vaccination official status	PCP 5	PCP3	PCP3
PCP level to be achieved	Free zone without vaccination official status	Free zone without vaccination official status	PCP5	PCP3
		2016 он		
Actual PCP level	Free zone without vaccination official status	Free zone without vaccination official status	PCP5	PCP3
PCP level to be achieved	Free zone without vaccination official status	Free zone without vaccination official status	PCP5	PCP3
		2017 он		
Actual PCP level	Free zone without vaccination official status	Free zone without vaccination official status	PCP5	PCP3
PCP level to be achieved	Free zone without vaccination official status	Free zone without vaccination official status	PCP5	PCP4

Major constraints to implement control for FMD measures are following:

- Chain command of CVO is not possible to be enforced. Structure of national veterinary service should be improved)
- Information sharing network. In some area (especially summer place for herders) mobile or internet network doesn't work.
- Epdemiological situation of FMD in neighboring countries is sporadic.
- Laboratory capacity on daignosis of FMDV. Therefore we can not do vaccine matching test in our national laboratory.
- FMD vaccine protection for circulating virus in the country and neighboring countries.
- Strengthening quarantine measures. Because Mongolian herding system is based of nomadic that makes difficult to control animal movement within zone.







Thank you for your attention





ABSTRACT

MOLECULAR VARIABILITY CONFERS PHENOTYPIC DIFFERENCES TO BIOLOGICAL PROPERITIES OF PANASIA-1 STRIANS OF FMDV SEROTYPE O IN CHINA

*Xing-Wen Bai**, *Hui-Fang Bao, Ping-Hua Li, Wei Wei, Meng Zhang, Pu Sun, Yuan-Fang Fu, Yi-Mei Cao, Zeng-Jun Lu, Bao-Xia Xie, Ying-Li Chen, Dong Li, Yong-Lu Wang, Yong-Guang Zhang, Xiang-Tao Liu, Hong Yin, Jian-Xun Luo**, *Zai-Xin Liu**

State Key Laboratory of Veterinary Etiological Biology, OIE/National Foot-and-Mouth Disease Reference Laboratory, Engineering Research Center of Biological Detection of Gansu Province, Lanzhou Veterinary Research Institute, Chinese Academy of Agricultural Sciences, Lanzhou 730046, Gansu, China

Introduction:

In May and September of 1999, the PanAsia-1 lineage of FMDV serotype O caused outbreaks of FMD, which occurred in Tibet, Hainan and Fujian provinces of China. In total, 1280 susceptible animals (68 cattle, 1212 swine) were destroyed for the epidemic control. The biological properties of the virus strains were studied to understand the molecular basis for plaque phenotypes and cell receptor usage, as well as genetic diversity in the evolutionary process.

Materials and methods:

A set of the chimeric and mutant full-length cDNAs containing each of the capsid protein coding region and amino acid mutations in VP1-VP4 of the selected PanAsia-1 strains, were generated by using exchange-cassette strategy and site-directed mutagenesis. Several chimeric viruses and FMDV mutants were rescued from BHK-21 cells co-transfected with the *Not*I-linearized cDNA constructs and pCT7RNAP, respectively. Viral plaque assays and IFA were performed according to the standard protocols, to identify phenotypic and receptor binding properties. One FMDV mutant was passaged in BHK-21 cells and suckling-mice for determination of hereditary stability.

Results:

Two 2079H-rescued viruses formed small plaques on BHK-21 cells, as compared to those of 2079Y-rescued viruses. The plaque formation of two chimeric viruses on WT-CHO cells could be abolished by Q80L in VP2 and K83E in VP1, respectively. Interestingly, Q80-determined PanAsia-1 strain can use only RGD-dependent receptor(s) to establish an efficient infection in BHK-21 cells. Three rescued viruses are preferentially RGD-independent that found to be sensitive to heparin in infection of BHK-21 cells, whereas the HS-binding capacity of these indicated viruses to WT-CHO cells may not be sufficient to support the viral life cycle. The virus populations in mice

remained K1083E that formed large plaques on BHK-21 cells and were unable to produce plaques on WT-CHO cells. However, reverse mutation of E to K at position 83 of VP1 was detected in the populations of K1083E mutant collected from 3^{rd}-8^{th} passage in BHK-21 cells, which formed small and large blend plaques and acquired the ability to utilize HS as a receptor for viral infection in WT-CHO cells. The Schematic representation of the evolution of PanAsia-1 strains has been mapped in detail, based on reverse genetic technology and comparative analysis of amino acid sequences of the capsid proteins.

Discussion:

A single amino acid mutation at position 79 of VP2 might have a potential influence on structural modification with functional change in virulence of FMDV. No plaques produced by two E1083K mutants suggest the fixation of second-site amino acid substitutions in VP1 to tend to predominate in the response to the introduction of the primary E1083K mutation that testified against the interaction of FMDV with HS interaction to infect WT-CHO cells. The critical amino acid residues of VP1 are involved in FMDV-receptor interaction and specific factors should be expressed in BHK-21 cells but no definite expression is necessary in WT-CHO cells to facilitate the binding of FMDV, which, in turn, could initiate RGD-independent infection in BHK-21 cells. The orders of amino acid variants residues could be responsible for the generation of infectious progeny virus.

Biography Xing-Wen Bai (1981—), PhD, Assistant Researcher

Dr. Bai is a member of Gene and Molecular Targeting Research Group, FMD laboratory, Lanzhou Veterinary Research Institute (LVRI), Chinese Academy of Agricultural Sciences (CAAS). He was one of the earliest practitioners to carry out the reverse genetic manipulation and build *in vivo* transcription system of reverse genetics for FMDV serotypes A, O and Asia 1 in China. In 2002-2007, he focused mostly on gene function analysis and epidemiological survey of FMDV. He obtained PhD at Graduate School of CAAS in 2012 on "Viral Genetic Engineering" of "Preventive Veterinary Science". Since 2008, he has been worked mainly in the areas of innate immune response, host tropism, phenotypic characterization, acid resistant, receptor usage, differential diagnosis and marker vaccine development of FMDV. Over the years, he has also been engaged in basic research and applied research of PPV, PCV, CSFV and PRRSV. He was one of the peer reviewers for "African Journal of Microbiology Research", "Molecular and Cellular Probes", and "Virology Journal". He has been involved in "China-EU training to improve prevention and control of FMD".

Dr. Bai (second from left), Dr. Guo (third from left), Dr. Zheng (first from right) This photo was taken on 25th Jun, 2006.

Dr. Bai and his daughter (Early September, 2013)

IN VITRO ASSEMBLY OF FMD VIRUS-LIKE PARTICLE AND ITS APPLICATION

Hui-Chen Guo, Shi-Qi Sun, Ye Jin, Shun-Li Yang, Yan-Quan Wei, De-Hui Sun, Shuang-Hui Yin, Jun-Wu Ma, Zai-Xin Liu, Jian-Hong Guo, Jian-Xun Luo, Hong Yin, Xiang-Tao Liu

[1]*State Key Laboratory of Veterinary Etiological Biology, National Foot and Mouth Disease Reference Laboratory, Lanzhou Veterinary Research Institute,Chinese Academy of Agricultural Sciences, Xujiaping 1, Lanzhou, Gansu 730046, China*

Introduction:

Foot-and-mouth disease virus (FMDV) causes a highly contagious infection in cloven-hoofed animals. The virus-like particles (VLP) are composed of multiple copies of one or more recombinant expressed viral structural proteins which spontaneously assemble into particles without incorporation of the viral genome. They display antigens in an ordered and repetitive way, thus inducing rapid, robust humoral immune responses as well as efficient T-cell responses. The format of FMD VLPs as a non-replicating particulate vaccine candidate could be a promising alternative to conventional inactivated FMDV vaccines.

Materials and methods:

In this study, VLPs composed entirely of FMDV (Asia1/Jiangsu/China/2005) capsid proteins (VP0, VP1 and VP3) were simultaneously produced as SUMO fusion proteins by an improved SUMO fusion protein system in E. coli. Extracts containing the coexpressed SUMO fusion proteins were purified and then treated with SUMO protease to remove the His6-Sm moieties. The cleavage products contained three water soluble polypeptides, which assembly the FMD VLPs, were analyzed by sucrose gradient and TEM. The VLPs were prepared and used as an immunogen in guinea pigs, swine and cattle. FMDV-specific antibody response, neutralizing antibody response, T-cell proliferation response and secretion of cytokine IFN-γ were detected by different methods.

Results:

After removal of the SUMO moiety from the fusion proteins, the three capsid proteins could be assembled into VLPs with size and shape resembling the authentic FMDV. Immunization of guinea pigs, swine and cattle with FMD VLP by intramuscular inoculation stimulated the FMDV-specific antibody response, neutralizing antibody response, T-cell proliferation response and secretion of cytokine IFN-γ. In addition, immunization with one dose of the VLP resulted in complete protection of these animals from homologous FMDV challenge. The 50% protection dose (PD50) of FMD VLP in cattle is up to 6.34.

Discussion:

Our present results show the potential of using FMD VLP produced in E. coli as a vaccine candidate. Vaccination with a single injection of 50μg of proteins could elicit a high level of immune response, which is sufficient to protect guinea pigs, swine and cattle from virulent virus infection.

Biography Huichen Guo, PhD

Dr. Guo is an associate professor of the Lanzhou Veterinary Research Institute, Chinese Academy of Agricultural Sciences, P.R China. In 2001,09- 2006,08 ,she has studied for her PhD degree in Genetic Engineering and Biotechnology of Animal Virology Laboratory of Ministry of Agriculture, Lanzhou Veterinary Research Institute, CAAS. Here, she did research on the DNA vaccine against Foot-and-Mouth Disease. In 2006.8-2010.4, she went to the National University of Singapore. Here, she worked on the biology function of animal virus nonstructural protein and the biology application of nanoparticles, respectively. In 2010, 4-present, she joined in the Lanzhou Veterinary Research Institute again and mainly focus on synergism in virus-virus and virus-host interactions (such as FMDV, CSFV and CPV), virus novel gene functions, development of new type vaccines(such as VLPs vaccine) and rapid, high efficient diagnostic technique with virus-like nanoparticles.

Engineering Foot-and-Mouth Disease Virus with Improved Properties for the Development of Effective Vaccine

Haixue Zheng, Fan Yang, Ye Jin, Jianhong Guo, Jijun He, Lvlv, Xuepeng Cai, Xiangtao Liu, Hong Yin

State Key Laboratory of Veterinary Etiological Biology, OIE/National Foot and Mouth Diseases Reference Laboratory, Lanzhou Veterinary Research Institute (LVRI), Chinese Academy of Agricultural Sciences (CAAS)

Introduction:

To improve properties of the candidate vaccine strain of foot-and-mouth disease viruses for the development of effective vaccine, such as growth properties, broader spectrum of protection, longer duration of protection, faster onset of protection, More potent immunity to prevent viral replication and development of viral carriers, better discrimination of vaccinated animals that go on to become infected, thermostable- no/reduced cold chain, safer to make and easier to administer, and so on, using reverse genetics technology, we finished the fellow works, the following are progress reports of presentation.

Materials and methods:

Construction of the chimeric candidate vaccine strain by a novel plasmid-based reverse genetics system. Evaluation of the growth properties of the chimeric strain by $TCID_{50}$ and the growth curve. Evaluation of immune responses in cattle after vaccination by liquid-phase ELISA (lpELISA) and 3ABC-ELISA. Evaluation of the vaccine matching by virus neutralization test (VNT) and liquid-phase ELISA (lpELISA). Evaluation of cattle protection experiment by challenging with the field strain.

Results:

Successfully developed some novel reverse genetic systems (RGS) for FMDV. One of these systems is a plasmid expressing infective FMDV in vivo, the results shown that we exploited reverse genetics is efficient for various virus rescue. Importantly, the virus can be recovered from model and host animal directly injected with the plasmid, which implied to fit to rescue the viruses with lack of a suitable cell culture system.Used this RGS, we finished the fellow works:

1. Engineering Foot-and-Mouth Disease Viruses with Improved

Growth and Protective Potency for Vaccine

No licensed vaccine is currently available against serotype A foot-and-mouth disease (FMD) in China, despite the isolation of A/WH/CHA/09 in 2009, partly because this strain does not replicate well in baby hamster kidney (BHK) cells. A novel plasmid-based reverse genetics system was used to construct a chimeric strain by replacing the P1 gene in the vaccine strain O/CHA/99 with that from the epidemic stain A/WH/CHA/09. The chimeric virus displayed growth kinetics similar to those of O/CHA/99 and was selected for use as a candidate vaccine strain after 12 passages in BHK cells. Cattle were vaccinated with the inactivated vaccine and humoral immune responses were induced in most of the animals on day 7. A challenge infection with A/WH/CHA/09 on day 28 indicated that the group given a 4-μg dose was fully protected and neither developed viremia nor seroconverted to a 3ABC antigen. Our data demonstrate that the chimeric virus not only propagates well in BHK cells and has excellent antigenic matching against serotype A FMD, but is also a potential marker vaccine to distinguish infection from vaccination. These results suggest that reverse genetics technology is a useful tool for engineering vaccines for the prevention and control of FMD.

The recombinant vaccine has been authorized to manufacture by Ministry of Agriculture in China.

2. Selection or Engineering O type Foot-and-Mouth Disease Viruses with Broaden Coverage of Antigen for the Development of Improved Vaccine

After the outbreak affected with O/Mya-98 strain, a new vaccine strain (Re-O/Mya-98) had been constructed successfully by LVRI last year. The vaccine strain has been broaden coverage of antigen and high protective potency against PanAsia, Mya-98 and Cathy strains.

The vaccine has been authorized to manufacture by Ministry of Agriculture in China.

3. FMDV RGS (reverse genetics system)-based DNA vaccine

Construct a RGS (reverse genetics system)-based DNA plasmid of FMDV, the plasmid with deletion of the gene of immunity inhibitor and of pathway site of infection of FMDV; Evaluation of the DNA vaccine efficacy in pigs and bovine.

Animals are intranasally/intramuscularly immunized and challenged; Specific antibodies analysis, lymphocyte proliferation assay, cytokine assay will be performed.

The DNA vaccine has strong T cell response and and high protective potency against Mya-98 (19/21) and Cathy (8/10) strains.

4. Engineering RSD-containing Foot-and-Mouth Disease SAP-mutant virus with higher level of biosecurity is potential vaccine candidate strain

Construction of the RSD-containing Foot-and-Mouth Disease SAP-mutant virus strain by a novel plasmid-based reverse genetics system. Evaluation of the growth properties of the strains in BHK-21, SK6 and BTY cells. Evaluation of the Pathogenic characteristics of the strains in pigs and cattle. Immune responses in cattle after vaccination by liquid-phase ELISA (lpELISA) and 3ABC-ELISA. Evaluation of the vaccine matching by virus neutralization test (VNT) and liquid-phase ELISA (lpELISA). Evaluation of pig and cattle protection experiment (PD50 test) by challenging with the field strain. The vaccine induces early immune responses and protection against disease.

5. The development of effective vaccine against A/Iran-05, O/MESA/PanAsia-2 and Asia1GVII trains (if cooperation with Pirbright institute) (continue to do it during 2013-2014)

A/Iran-05, O/MESA/PanAsia-2 and Asia1GVII trains New threatened strains are widespread circulation, and several reports in 2011 associated with poor laboratory vaccine matching this is being closely monitored by OIE FMD reference laboratory at Pirbright. Construction of the A/Iran-05, O/MESA/PanAsia-2 and Asia1GVII chimeric strain by a novel plasmid-based reverse genetics system. Evaluation of the growth properties of the chimeric strains. Immune responses in cattle after vaccination by liquid-phase ELISA (lpELISA) and 3ABC-ELISA. Evaluation of the vaccine matching by virus neutralization test (VNT) and liquid-phase ELISA (lpELISA). Evaluation of pig and cattle protection experiment by challenging with the field strain.

6. Developing marker vaccine to distinguish infection and vaccination (DIVI)

Based on the Foot-and-Mouth Disease SAP-mutant virus strain,

construction of vaccine strain bearing negative marker (The antigen site of the recombinant vaccine strain will be changed into negative site that the strain do not produce the mAb against the antigen site , however all field strains can produce the mAb in host). Evaluation of the growth properties of the strains in BHK-21, SK6 and BTY cells. Evaluation of the Pathogenic characteristics of the strains in pigs and cattle. Immune responses in cattle after vaccination by liquid-phase ELISA (lpELISA) and 3ABC-ELISA. Evaluation of the vaccine matching by virus neutralization test (VNT) and liquid-phase ELISA (lpELISA). Evaluation of cattle protection experiment by challenging with the field strain. Established the ELISA to distinguish infection and vaccination based on the mAb

Discussion:

we have gotten some engineering foot-and-mouth disease candidate vaccine strain with improved properties for the development of effective vaccine, these results shown that reverse genetics technology is a potential tool to engineer a vaccine candidate for FMD prevention and control.

Biography **Haixue Zheng**, PhD, Associate research fellow

Dr. Haixue Zheng is the head of Viral Gene Engineering Research Group , National FMD reference laboratory, State Key Laboratory of Veterinary Etiological Biology, Lanzhou Veterinary Research Institute, Chinese Academy of Agricultural Sciences (CAAS).

September 2004 – June 2007, he studied in the postgraduate school, Chinese Academy of Agriculture Science (CAAS), He obtained PhD on "Development in reverse genetics system for recovery of animal RNA viruses" in 2007.

May 2008 to February 2009, as a visiting scientist, he worked for Pirbright Laboratory, Institute for Animal Health. Main research was focused on molecular pathogenesis of foot-and-mouth disease virus.

May 2009 to present,he is the head of Viral Gene Engineering Research Group, National FMD reference laboratory, State Key Laboratory of Veterinary Etiological Biology, Lanzhou Veterinary Research Institute, CAAS. Main research was focused on revealing the rule of phenotypic variation and its molecular basis of foot-and-mouth disease virus (FMDV), engineering foot-and-mouth disease viruses with improved properties for vaccine and marked vaccine development, clarifying molecular basis underlying host

tropism variation of FMDV and mechanisms of innate immune.

Experimental infections in animals using a foot-and-mouth disease virus isolated from the 2010 epidemic in Japan

Katsuhiko Fukai, Kazuki Morioka, Manabu Yamada, Seiichi Ohashi, Kazuo Yoshida, Rie Kitano, Reiko Yamazoe, Toru Kanno

Exotic Disease Research Station, National Institute of Animal Health, National Agriculture and Food Research Organization

6-20-1 Josui-honcho, Kodaira, Tokyo 187-0022, Japan

Introduction:

An outbreak of foot-and-mouth disease (FMD) occurred in Japan in 2010. It was the first outbreak since 2000. Two hundred and ninety-two cases were confirmed during this period. In our institute, several experimental infections in animals using an FMD virus (FMDV) isolated from the 2010 epidemic in Japan have been carried out to analyze clinical manifestations, virus shedding patterns, antibody responses and pathological features in the animals. In this presentation, I will introduce results of the experimental infections.

Materials and methods:

In this study, two cattle, two goats and two pigs were inoculated intradermally with approximately 10^6 $TCID_{50}$ of the isolate at tongues, at coronary bands of heels and at heel bulbs, respectively. At 1 day post-inoculation (dpi), two cattle, two goats and four pigs cohabitated with the inoculated animals of the same species, respectively. Clinical signs were observed daily. Clinical samples were collected routinely from the animals. Virus isolation and titration were carried out using the IB-RS-2 cells and the ZZ-R 127 cells. Detection and quantification of viral genes were carried out by an RT-PCR assay and a real-time RT-PCR assay, respectively. Antibody titers were determined by a neutralization test and a liquid-phase blocking ELISA.

Results:

Vesicular development was observed on snouts, tongues, lips and feet in the inoculated and the direct contact animals. They also showed elevations in body temperatures, salivation, depression, reduced appetites and lameness. Viral genes were detected from sera, saliva, nasal swabs, feces and oropharyngeal fluids collected from the animals. Viruses were also isolated from the clinical samples. Antibodies were observed in the inoculated and the direct contact animals.

Discussion:

The results of the experimental infections showed that the FMDV isolated from the 2010 epidemic in Japan was virulent in cattle, goats and pigs, producing synchronous diseases in the inoculated animals and efficient spread to the direct contact animals.

Biography: Katsuhiko Fukai, Ph.D., D.V.M.

Dr. Fukai is a Senior Researcher at the National Institute of Animal Health. He obtained Ph.D. at the Nihon University in 2002 on “Study on molecular epidemiology of bovine group A rotavirus”. He has been engaged in studies of FMDV. He has also been in charge of emergency diagnoses of FMD in Japan.

Characters of FMD DIVA tests and Verification of Efficacy of Expired FMD O Type Vaccines

Manabu Yamada[1], Katsuhiko Fukai[1], Kenichi Sakamoto[1], Takehisa Yamamoto[2], Kazuki Morioka[1], Toshiyuki Tsutsui[2], Norihiko Muroga[2], Noriyoshi Ojima[3], Josuke Mago[4], Yoshito Katagiri[5], Chantanee Buranathai[6], Syseng KHOUNSY[7]
1 Exotic Diseases Research Division, NIAH, NARO, Japan. 2 Viral Diseases and Epidemiology Research Division, NIAH, NARO, Japan. 3 DAH, MAFF, Japan. 4 AQS, Yokohama, Japan. 5 AHC, Okinawa, Japan. 6 OIE. 7 Laos.

Introduction:

Both verification of efficacy of vaccines and differentiation between FMD-infected animals and non-infected, vaccinated animals plays important role in vaccination strategy of FMD control. The inactivated FMDV for vaccine is concentrated and is purified by industrial ultrafiltration and chromatography in order to remove cellular protein contaminants and viral nonstructural proteins (NSPs). Therefore, we can differentiate between FMD-infected animals and vaccinated animals by examining antibodies to NSPs.

In 2012, expired FMD O Type vaccine (200,000 doses) was given to Laos from Japan according to the request from Laos. In order to verify the efficacy of this expired FMD vaccine, we examined antibody titer in cattle and buffalos vaccinated twice in the suburb of Xiangkhouang in Laos. In addition the verification of efficacy of the vaccine, we examined antibodies to NSPs in serum samples from animals that had high titer in screening with Liquid-Phase blocking ELISA (LPBE) for FMD antibodies in this study.

Materials and methods:

After numbering in cattle and buffalos, first serum samples were collected before first vaccination. One month post first vaccination, second vaccination and serum sampling were obtained in those cattle and buffalos. Finally, third serum samples were collected from those cattle and buffalos on one month post second vaccination. The first serum samples of 90 cattle and 31 buffalos that were successful in collecting samples in all three times in this period were examined to screen for antibodies against FMD by LPBE (Institute for Animal Health, Surrey U.K.). Second and third serum samples of animals (19 cattle and 6 buffalos) that judged negative in screening using the first blood sample by LPBE (32 >) were sequentially examined antibody titer by LPBE. Animals that had high LPBE titer (45 <, 71 cattle and 25 buffalos) were examined in differentiation between the FMD-infected animal and vaccinated animal by indirect ELISA (DIVA, PrioCHECK FMD NS). This DIVA test is blocking ELISA for detection of antibodies to nonstructural protein (NSP) of FMDV.

Results:

By screening for FMD antibody using first serum samples by LPBE, 78.9% in cattle and 80.6% in buffalos showed high titer. In the result of titration for FMD antibody using second and third serum samples of animals that showed negative in screening test, high antibody titers were detected as 1:45-1:1448 in the second serum collected one month post first vaccination and as 1:362-1:5792 in the third serum collected one month post second vaccination. Based on the result of DIVA test, examined animals of 76.1% in cattle and 88% in buffalos that had high LPBE titer were judged as FMD-infected animals.

Discussion:

The results indicated that expired FMD O Type vaccine in this study worked well to prevent FMD infection in both cows and buffalos. In this study, FMD DIVA test can differentiate well between FMD-infected animals and non-infected vaccine animals using the serum samples from both cows and buffalos in the field.

Biography Manabu Yamada, PhD, DVM

Dr Yamada works in the Exotic Diseases Research Division at National Institute of Animal Health (NIAH), Japan. He has been engaged in diagnostic and pathological studies of viral encephalomyelitis in pigs and highly pathogenic avian influenza in ducks and chickens. He has been collaborated with other NIAH researchers to contribute histopathological, electron microscopical and antigenic information on infectious agents and animal experimental studies of infectious diseases. Recently he has been contributing research into the pathogenesis of FMD in pigs, cows and goat. He also studied on the pathogenesis of Hendra virus in horses and highly pathogenic avian influenza in ferrets at CSIRO Australian Animal Health Laboratory in Australia as veterinary pathologist for about two years from October in 2008 to March in 2010.

Typing for Virus of Foot and Mouth Disease occurred in the DPR. Korea in 2010 and Selection of Vaccine Strain by Genetic Characterization and Antigenic Profiling

Jon Sung Chil

Veterinary Research Institute, Academy of Agricultural Sciences, DPR. Korea

Introduction

Foot and mouth disease(FMD) is the most contagious disease of mammals and has a great potential for causing severe economic loss in susceptible cloven-hoofed animals.

There are seven serotypes of FMD virus(FMDV), namely, O, A, C, Asia1, SAT1, SAT2 and SAT3, and many or several topotypes in each of the serotypes.

FMD occurred in the DPR. Korea in December 2010 and spread to many counties. Typing for FMDV were performed by RT-PCR test and blastn after sequencing. Field virus was reviewed antigenic match to an attenuated virus strain modified in the 1970's by genetic characterization and antigenic profiling.

Materials and methods

An attenuated virus strain of O serotype, attenuated virus strain 0f A serotype, FMDV isolated in vesicular fluid of pig infected by FMD in January 2011, samples like vesicular fluid, esicular skin, O/P fluid saliva, milk, muscle, lymphonodus, epithelial tissue and serum collected from affected or infected animals were used.

Virus isolation was performed by inoculating the sample suspension into 1-day-old suckling mice.

Two kinds of primer sets for distinguishable diagnosis between serotypes of FMDV were used in one-step or two-step RT-PCR.

Complete sequences for 1D gene of attenuated virus and complete sequences for 1D gene of FMDV isolated in the January 2011 were analyzed.

FMDV sequence data in Gene Bank were used.

Blastn was performed by using software in http://www/ncbi/nlm/nich/gov and DNAStar, and antigenic profiling was performed by using DNAStar.

Result

1-day-old suckling mice inoculated the sample suspension were died within 24-48 hours and after 3 passages,and naked bodies of dead mice affected by FMDV were subjected to RT-PCR and gold immunochromatographic strip test, and all of them were interpreted as a positive.

The isolates was investigated to be cohabitation infectious and cohabitation infection was observed and the isolates acquired the pathogenicity killing 30-day-old mice after 5 passages.

FMDV O serotype in sample collected in 2011 was not distinguished in RT-PCR and the touchdown PCR using one kind of primers for typing of FMDV, which was synthesized firstly but not attenuated virus strain and was distinguished in RT-PCR using the another kind of primers for typing of FMDV, which was synthesized secondly.

The substitution of two bases in virus of FMD spread in 2011 was found in designed region of forward primer synthesized firstly for typing of O serotype of FMDV.

C at position 6th and 9th to 3'terminant was substituted to T and this drift was likely to affect the typing of FMDV O serotype by RT-PCR. Identity (below 50%) of amino acid sequences of VP1 deduced from nucleotide acid sequences was lower than identity (57.1-89%) of nucleotide acid sequences and antigenic determinants of VP1 protein between Manisa strain, an attenuated virus strain and the field virus in 2011 have had the very differences.

Discussion

RT-PCR is the method to be able to distinguish between serotypes of FMDV in the condition that there are not several reference virus strains of serotypes, variants in the same serotype and the reference serum.

The serotype of virus of FMD occurred in the DPR. Korea in 2010 according to results of RT-PCR using two kinds of primer sets (one kind of primer set was not to able to distinguish O serotype and another kind of primer set able to distinguish O serotype) and blastn after sequencing was O serotype of FMDV.

It was likely considered that some kinds of specific primer sets used in RT-PCR for distinguishable diagnosis between serotypes of FMDV which are highly variable should be required.

More favorable method for the correct distinguishable diagnosis was sequencing for 1D gene, which can distinguish between topotypes in the same serotype of FMDV and also provide with data to be able to perform the genetic characterization and antigenic profiling.

Variability of amino acid sequences of VP1 deduced from nucleotide acid sequences was higher than variability of nucleotide acid sequences and antigenic determinants of VP1 protein between Manisa strain, an attenuated virus strain in the DPR. Korea and the field virus in 2011 have had the very differences.

According to results like it, it was likely consider to select the field virus as another vaccine strain but antigenic matching method by antigenic profiling needs to be repeated to be confident of the result.

Biography: Jon Sung Chil, PHD., Prof.

Dr. Jon Sung Chil is a head of gene-engineering laboratory, a director of the exotic disease research division, Veterinary Research Institute(VRI), Academy of Agricultural Sciences, DPR. Korea.

He obtained PhD at VRI on “Study on the development of pusedorabis virus gene deletion vaccine” in 2002.

He had been engaged to research for diagnosis and prevention of the emergence disease such as FMD,AIV, SIV, PRRS and PCV.

He has also been in charge of emergency diagnosis of emergence and reemergence disease, especially FMD in the DPR. Korea.

He is a member of the DPR. Korea Veterinary Scientific Commission since 2003.

Vaccination for Control of Foot-and-Mouth Disease in the DPR. Korea

Hong Thae Sik

Biological Product Research Institution (BPRI), Ministry of Agriculture, DPR. Korea.

Introduction

During the past few years, the world has witnessed a global re-emergence of dangerous diseases like food and mouth disease (FMD) that have had, and are still having, significant impact on both the social and economy. The outbreaks of FMD were recorded two times(2007 and 2010) in the DPR. Korea since 2000.

Whenever FMD was occurred, emergency state was declared. Although FMD was occurred in many farms in all of the country from December 2010 to March 2011, dissemination of FMD has been able to stopped by veterinary anti-epidemic measures including enhancing of border inspection, quarantine, animal movement restriction, biosecurity, culling, isolation and treatment for secondary infections of animals suffered from FMD, traffic blocking, disinfection and surveillance were implemented without vaccination.

It was decided to vaccinate for all susceptible animals under the emergency assistance of FAO to decrease economic losses and not to re-infect. Animals was vaccinated binary vaccine(O and Asia-1) in 2007 and O serotype vaccine in 2011. Vaccination was carried out in late autumn once a year because FMD was only occurred in winter and spring in the DPR. Korea.

After vaccination, it was performed surveillance for FMD, which was not found and re-occurred.

Materials and methods

The vaccine trail aimed at assessing the efficacy of vaccine. Cattle, pigs, goat and sheep were vaccinated for vaccine trail. The vaccination campaign was realized in pilot in one province(South Phyongan province) for obtaining experience in vaccine and instrument distribution, vaccination organization. Lessons learn from the pilot vaccination campaign were diffused to the entire country.

The main vaccination campaign was simultaneously carried out in the whole country at a time. Post vaccination surveillance consisted of sero-surveillance by LPB-ELISA and NT to evaluate the vaccination efficacy and viro-surveillance by RT-PCR and gold immunochromatograhic strip test to detect FMD virus.

Result

90% of cattle, goat and sheep but 80% of pigs inoculated O and Aisia-1 serotype binary vaccine were seropositive at one month after vaccination in 2007. Additionally, 95% of cattle, goat and sheep but 85% of pigs inoculated O serotype vaccine were seropositive at one month after vaccination in 2011.

15 to 20 days after vaccination, some animals were suspected or infected as FMD positive animals by RT-PCR(0.6%), gold immunochromatograhic strip test(1.2%) and NSP-ELISA(7.8%) in farms affected by FMD. 3 months after vaccination, suspected animals in farms affected by FMD were not detected. In pilot vaccination campaign, more than 90% of animals were seropositive and in the main vaccination campaign more than 85% of animals were seropositive.

The suspected animals were not found in surveillance for all susceptible domestic animals vaccinated for 3 years after outbreak of FMD

Discussion

Its most dramatic effects are observed in previously virus-free areas where it rapidly spreads through fully susceptible animal populations and causes significant financial losses. There are direct losses due to deaths in young animals, loss of milk, loss of meat and a decrease in productive performance. The costs due to eradication or control are high, and there are major indirect losses due to imposition of trade restriction. A large variety of animals including cattle, swine and sheep are susceptible to the FMDV and was economically very important. Therefore, it is difficult to adopting slaughtering policy in large scale for control of FMD. Not only to decrease economic losses but also to prevent FMD, vaccination for all susceptible animals was performed.

The trail of the vaccine showed that immune efficacy by univalent vaccine was higher than bivalent vaccine. Additionally, immunogenicity of vaccine for herbivorous animals like cattle, goat and sheep was likely higher than it for omnivorous animals like pigs.

15-20 days after vaccination, some animals infected and suspected FMD were remained and therefore, it was indicated whether vaccinated animals had low immune response in early of vaccination or normal matching vaccine was used. After vaccination for all susceptible animals, the infected and suspected animals were not found in surveillance for 3 years and FMD was able to control.

Biography: Hong Thae Sik, PHD., Prof.

Dr. Hong Thae Sik is a head of animal cell culture laboratory, a director of the virus disease research division, Biological Product Research Institution (BPRI), Ministry of Agriculture, DPR. Korea.

He obtained PhD at BPI on “Study on the establishment of production method of serum-free culture medium” in 2005.

He had been engaged to research for epidemiology and prevention of the disease such as FMD, AIV and animal virus diseases.

He is a member of the DPR. Korea Veterinary Scientific Commission since 2007.

Epidemiological Characteristics of Foot-and Mouth Disease occurred in the DPR. Korea in 2010

Ri Kyong Gun

Director, Veterinary and Anti-Epizootic Department, Ministry of Agriculture, DPR. Korea

Introduction

Foot and mouth disease(FMD) was firstly occurred in of draught cattle in Lihyon co-operative farm, Pyongyang city and then FMD spread to 168 of farms in 41 of cities or counties of 8 provinces rapidly from December 2010 to March 2011.

Epidemiological characteristics was investigated by observation of mainly clinical signs and serological test. Areas where FMD was occurred and FMD virus-free areas was confirmed. FMD viruses are temperature-sensitive, and stable at low temperature, but are rapidly inactivated above 50℃. The numbers of outbreaks rapidly increased in winter and decreased in spring. FMD was not occurred in summer after implementation of veterinary anti-epidemic measures.

Materials and methods

After FMD was occurred, morbidity and mortality of FMD were investigated according to old, animal species and seasons.

Samples like serum collected from affected or suspected animals were used in test such as NSP-ELISA, RT-PCR and gold immunochromatograhic strip test for the confirmation of infection of FMDV.

Clinic signs of FMD like fever, anorexia, foot lesions and the appearance of vesicles on the mucous membranes of the mouth including the tongue, the dental pad, gums and lips were investigated. According to epidemiological characteristics, 3 kinds of areas like area to be able to contaminate by FMD within 10km in diameter to outbreak point, area to be able to affect by FMD within 50-80km in diameter in the condition that the mountains are occupied more than 80% of territory and FMDV-free area were divided.

Result

The clinical signs of FMD were found in many cattle and pigs but a few goat and sheep around area occurred FMD. By the test results, percentage of infected goat and seep was 6.8% and 6.4%, respectively.

Morbidity and mortality of FMD in cattle and pigs was varied according to old, animal

species and seasons. When FMD was occurred in animals in previously virus-free areas, morbidity of FMD was very high, up to 78-85%, even 100% but mortality of FMD was low, 4 to 8% in cattle. Additionally, morbidity of FMD was up to 45-68% in the pigs but mortality of FMD was 80 to 90% in the suckling piglets and 12% in the weaning piglets. With passing the course of disease, mortality of FMD was increased 30-40% in weaning piglets. Morbidity and mortality of FMD in cattle and pigs increased in winter, and decreased from March, and the clinical signs of FMD were not found from April. Especially, in summer FMD has not spread to other new area.

Discussion

There were two FMD outbreaks reported in the DPR. Korea after 2000. Serotype of FMDV in 2007 was Asia-1 type and serotype of FMDV in 2010 was O type. FMD in 2007 was only occurred a cattle farm entered imported cattle and area affected by FMD was very limited.

Additionally, morbidity and mortality of FMD in cattle was normal or low, and FMD was not infected to another farm and animals like pigs, goat and sheep in 2007.

Morbidity of FMD was very high and mortality of FMD in the young animals was high in 2010. Morbidity and mortality of FMD was likely varied according to serotypes of FMDV. It was first time when FMD was occurred in the large areas in 2010 and dissemination of FMDV was likely affected by seasons in the DPR. Korea.

Biography: Ri Kyong Gun

Mr. Ri Kyong Gun is a Director, Veterinary and Epizootic Department, Ministry of Agriculture, DPR. Korea

He has been in charge of organization to investigate epidemiology and prevent of emergence disease, especially FMD in the DPR. Korea and is a nation contact person.

He is a vice director of the DPR. Korea Veterinary Scientific Commission since 2005.

MOLECULAR EPIDEMIOLOGY OF RECENT FMD OUTBREAKS IN THE REPUBLIC OF KOREA

Kwang-Nyeong Lee[1], Su-Mi Kim[1], Young-Joon Ko[1], Hyang-Sim Lee[1], In-Soo Cho[2], Byounghan Kim[1], Jong-Hyeon Park[1]

Foot and Mouth Disease Division[1], Foreign Animal Disease Division[2], Animal and Plant Quarantine Agency, Anyang, 430-757, Republic of Korea

Introduction:

Despite regaining FMD-free status from OIE on 27 September 2010, another FMD outbreak of serotype O was confirmed in pig farms in Gyeongbuk province of the Republic of Korea (ROK) on 29 November of 2010, where after the disease spread almost nationwide; the last case was reported on 21 April 2011.

Materials and methods:

Clinical samples were used directly for nucleotide sequencing of the VP1 protein coding region to monitor evolution during the outbreak. From each infected premise (n >100), more than one sample was sequenced and compared to increase the reliability of the sequence data at the farm level. These VP1 sequences were aligned with closely related isolates from other countries for constructing a phylogenetic tree. At population level, gene genealogies on these VP1 sequences were estimated and drawn as a graph using the TCS 1.21 software (2000).

Results:

The outbreak was caused by FMDV O SEA topotype(Mya-98 lineage) from 2010 to 2011. Unexpectedly, within one month after the first case in November 2010, several genetic clusters that differed approximately 1% along the VP1 protein coding region appeared across the ROK. Some isolates were found to be very closely related to the isolates of other country.

Discussion:

There were five small genetic clusters among the isolates collected from Nov. 2010 in the ROK that appeared within one month of the start of the outbreak without immune pressure from vaccination. It has not been concluded yet whether the different genetic lineages were from multiple introductions or rapid evolution during transmission within the ROK.

Biography Kwang-Nyeong Lee, PhD

Dr. Lee is the research scientist of Foot-and-mouth Disease Division, Animal and Plant Quarantine Agency (QIA). He studied the Molecular Epidemiology for FMD in Pirbright Laboratory, IAH, UK for five months in 2003. He served as an instructor in the field of diagnostic techniques and principles for foreign trainees in KOICA project several times from 2008 to 2013. He obtained his PhD at Seoul National University in 2011 on "Molecular

epidemiology and evolution of FMD in Asia″. As a principal investigator, he had lead two recent international collaborative research projects with NCVD (Vietnam) to study the molecular epidemiology of the circulating viruses in FMD endemic area and with ARS (USA) to study the pathogenesis of FMDV strains isolated in 2010 from the Republic of Korea.

Serological responses after vaccination of growing pigs with foot-and-mouth disease trivalent (type O, A and Asia1) vaccine

Hyang-Sim Lee[1],Young-Joon Ko[1] , Min-Goo Seo[1], Yeun-Kyung Shin[1], Nak-Hyung Lee[2], Joong-Bok Lee[2], Dongseob Tark[1], Byounghan Kim[1]

[1]Foot and Mouth Disease Division, Animal and Plant Quarantine Agency, Anyang, Republic of Korea

[2]College of Veterinary Medicine, Konkuk University, Seoul 143-701, Republic of Korea

Introduction:

Korea experienced the fifth FMD outbreak since 1934 from November 2010 to April 2011[1]. The Korean government started emergency vaccination for all FMD-susceptible domestic animals in December 2010, using FMD type O vaccines. Trivalent FMD vaccines (types O, A, and Asia1) were supplied for routine vaccinations beginning in September 2011, with the consideration of FMD outbreaks in surrounding countries. Although two vaccinations with an interval of 4 weeks at ages between 2 and 3 months has been recommended for cattle and pigs, growing piglets were vaccinated only once between 8 and 12 weeks of age for reasons of cost and vaccine supply. This study was performed to identify the appropriate time for FMD vaccination in growing pigs when vaccination is applied only once (at either 8 weeks or 12 weeks of age). Differences in serological responses between vaccination times (once or twice with a one month interval in growing pigs) were also studied to compare the efficiency of vaccination with or without boosting.

Materials and methods:

From November 2011 to August 2012, approximately 526 growing pigs were kept on seven farms in Gyeonggi, Chungnam and Gyeongbuk provinces in Korea. At the beginning of this study, all of the pigs were approximately 7 weeks of age. Sows that gave birth to these pigs had been vaccinated at least twice with FMD type O monovalent vaccine and once with FMD trivalent (types O, A and Asia1) vaccine 3−4 weeks before parturition. Blood samples from the pigs were taken at 7 weeks of age and tested for maternally derived antibodies (MDA) against FMD type O. According to the MDA levels, pigs were evenly distributed into groups I−III on each farm (Table 1) for different vaccination regimens to minimize any effects from different MDA levels among groups. All pigs in group I were vaccinated with FMD vaccine against FMD

types O, A and Asia 1 (Aftopor®, Merial Animal Health Ltd.) at 8 weeks of age. Pigs in group II were vaccinated at 12 weeks of age. Group III pigs were vaccinated twice, once at 8 weeks of age and again at 12 weeks of age. PrioCHECK FMDV Type O (Prionics, Switzerland) was employed to detect type O antibodies.

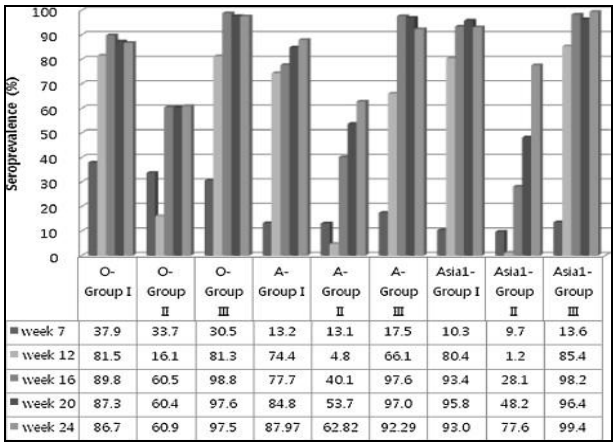
For statistical analyses, the *Z* test was performed using the Minitab® 16 program (Minitab®, USA). If the *P*-value was more than 0.05 (95% confidence interval (CI)), the null hypothesis was accepted.

Table 1. Number of pigs tested at 7 weeks of age

	Group I	Group II	Group III	Total
Farm 1	32	34	33	99
Farm 2	33	33	33	99
Farm 3	32	33	35	100
Farm 4	32	30	31	93
Farm 5	15	15	15	45
Farm 6	15	15	15	45
Farm 7	15	15	15	45
Total	174	175	177	526

Results:

Average MDA levels were not high in all three types, although type O showed slightly higher levels than type A and type Asia1 (Figure 1). All three types showed similar patterns in the changes in the antibody levels among the same groups. Groups I and III pigs, which received vaccinations at 8 weeks of age, showed a rapid increase in levels of antibodies at 4 weeks after vaccination for all types. Group I maintained a continual increase in antibody levels until market age. Meanwhile, group II pigs showed decreased levels of antibodies for all types at 12 weeks age.



	O-Group I	O-Group II	O-Group III	A-Group I	A-Group II	A-Group III	Asia1-Group I	Asia1-Group II	Asia1-Group III
week 7	37.9	33.7	30.5	13.2	13.1	17.5	10.3	9.7	13.6
week 12	81.5	16.1	81.3	74.4	4.8	66.1	80.4	1.2	85.4
week 16	89.8	60.5	98.8	77.7	40.1	97.6	93.4	28.1	98.2
week 20	87.3	60.4	97.6	84.8	53.7	97.0	95.8	48.2	96.4
week 24	86.7	60.9	97.5	87.97	62.82	92.29	93.0	77.6	99.4

Figure 1. Average seroprevalences (%) in groups of pigs from 7 weeks of

age to market age on seven farms. Average levels of seroprevalences in all three types were shown in groups I, II, and III respectively at 7, 12, 16, 20 and 24 weeks of age.

Discussion:

If vaccination using trivalent FMD vaccine (Aftopor®, Merial Animal Health Ltd.) is administered only once in growing pigs, it is preferable to vaccinate at 8 weeks of age rather than at 12 weeks of age. In addition, vaccination of growing pigs at both 8 and 12 weeks of age resulted in higher seroprevalences than did a single vaccination at 8 weeks of age.

Biography Hyang-Sim Lee, DVM

Hyang-Sim Lee is the member of the Foot-and-Mouth Disease Division, Animal and Plant Quarantine Agency (QIA). She has been in charge of the Serological Surveillance of FMD in Korea. She has also been involved in many KOICA Project such as "Establishment of diagnostic for highly contagious animal diseases(FMD, AI) in Mongolia" (2006-2007), "Strengthening the National Capacity for Foot and Mouth Disease (FMD) Control Program in the Republic of Union of Myanmar " (2012-2013).

STUDY ON THE INDUCED ANTIBODIES DURATION OF SINGLE DOSE FMD VACCINATION IN COMMERCIAL PIGS IN TAIWAN

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Introduction:

After Foot-and-Mouth Disease (FMD) first outbreak in 1997, FMD vaccine was adopted to control FMD in Taiwan. The previous studies indicated that a single FMD vaccination might induce a complete protection in fatting pigs. Nevertheless, Levels of the antibody titers induced by FMD vaccines is the key factor in determining a successful FMD vaccination. Therefore, an efficacious vaccination program is needed to establish for implementing the policy of the single FMD vaccination.

Materials and methods:

Experiment A: The objective was to evaluate the safety of the FMD vaccines in pregnant sows. Sows were assigned into three groups; group 1 containing 10 sows was vaccinated with one dose ($6PD_{50}$, O/Tai/98) in the 30th day of pregnancy; 7 sows of group2 and group 3 were vaccinated at the 60th and 90th day of pregnancy, respectively.

Experiment B: The purpose was testing the maternal antibody in vaccine efficiency. Four farrowing-to-finish pig farms with the feeding number between 12,000~18,000 were selected. 37 sows were selected randomly from 4 farms and vaccinated one dose after weanling. 4 weeks after vaccination, serum samples of sows and their offspring were collected for neutralizing antibody analysis. In addition, to understand whether the neutralizing antibody can interfere the FMD vaccine efficacy or not, the piglets were divided into 4 groups according to their NS titer. After single vaccination at 12 weeks of age, the sera of piglets at 16, 20, and 24 weeks of age were collected for antibody analysis.

Results:

In experiment A of vaccine safety in pregnant sows, three sows were observed on abortion or stillborn and only one sow appeared slightly relevant to FMD vaccination. No significant difference was observed in antibody titer rising and farrowing litter numbers among each group either in the early, middle and late stages of vaccinations as comparing with that of pre-artificial insemination

group.

In experiment B of the role of maternal antibody in determining vaccine efficacy, the geometric mean of sow NS titers were 6.58, 8.6, 9 and 8.38(log_2) of A, B, C and D farm respectively. The antibody titers of offspring were 4.66, 7.82, 8.21 and 7.97(log_2) at 4 weeks of age, respectively. Regarding the maternal antibody interference to vaccination, offsprings with lower NS titer levels exhibited higher extent of the NS tiers rising. Despite of differences in the primary antibody titers among each group, the final NS titer levels were approximately identical in finishing pigs.

Discussion:

FMD vaccine is a good tool in disease control, but the correct vaccination timing is the key point for vaccine use. According to the farm, the neutralizing antibody titer of sow serum exist a different proportion, this also interference the neutralizing antibody titer of offspring. Therefore, we want to setup an appropriate vaccination program on sows and piglets. The results showed FMD vaccines are safe in pregnant sow in the early, middle or late stage of pregnancy. In addition, the levels of maternal antibody of piglets declined and reached the base line levels at 12-14 weeks of age that was the best timing for vaccination. Therefore, an appropriate schedule for the FMD vaccination program on sow and piglets are important and necessary.

Biography Ming-Chung DENG, PhD, DVM

Dr. Deng is an associated research fellow of the Hog Cholera Research Division, Animal Health Research Institute (AHRI). He obtained PhD at National Chung Hsing University in 2008; his study topic is “Molecular analysis of classical swine fever viruses in Taiwan and the development of diagnostic technology”. In his institute, he is responsible for porcine viral disease diagnosis such as Classical Swine Fever, Foot and Mouth disease, Swine vesicular disease etc., and also does the emergency foreign diseases diagnosis like African Swine Fever. The topics of his research focus on the development of new diagnostic method and FMD control strategy.

COMPARISON OF THE EFFICIENCY BETWEEN SINGLE AND DOUBLE DOSES FMD VACCINATION IN PIGS IN TAIWAN

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Introduction:

FMD is a sporadic disease in Taiwan, and is prevented and controlled by conducting mandatory vaccination policy. In the mandatory vaccination policy, pigs are received single shot of FMD vaccine at 12 to 14 weeks old. Previous research demonstrated that the induced antibodies could persist as long as 6 months after one-shot with 6 PD50 FMD vaccines. However, basing on the results of active serological surveillance, antibody levels in approximately 20% of vaccinated pigs were not satisfied (antibody titer less than criterion, 4 $\log_2$). The aim of this study is to understand the fluctuations of antibody levels in pigs after single and double shots of FMD vaccination through continuous monitoring.

Materials and methods:

Five farrowing-to-finish pig farms were selected in this study, and 60 pigs in each farm were randomly selected and divided into two groups. Thirty pigs in group 1 were received single dose of commercial FMDV/O/TW/98 vaccine (containing 6 PD50) at 12 weeks old. The pigs of group 2 were vaccinated twice by using the same vaccine as group 1 at 12 weeks old and 16 weeks old respectively. The serum samples of all pigs were separately collected at 12, 16, 20, 24 and 28 weeks of age.

The antibody titers of serum samples were measured by serum neutralization test. Two fold series diluted serum samples were neutralized with 100 $TCID_{50}$ O/TW/97 FMDV in 96 well microplate, and approximately $2.5x10^5$/100μL of BHK21 cell were subsequently added into each well. The microplates were incubated at 37℃incubator with 5 % CO_2 for 48 hours. The cytopathic effect was examined with an inverting microscope, and the SN titers of serum samples were expressed as the reciprocal of the highest serum dilution neutralizing the virus at the 50% end point.

Results:

Before vaccination, the maternal antibody (Ab) ranged from 0.1~2.3 log2 and from 0.4~3.8 log2 were in pigs of group 1(received one shot of FMD vaccine)

and group 2 (received double shots of FMD vaccine) respectively. In group 1, Pigs showed seroconversion (ranged from 5.0~6.9 $\log_2$) at 16 week-old, and the Ab titers were fluctuated until marketing-age (ranged from 5.8~7.3 $\log_2$). In group 2, the Ab level reached to the peak at 20 week-old (ranged from 7.7~8.7 $\log_2$), and the Ab titer of the marketing-age pigs ranged from 6.7~8.0 $\log_2$ in five farms.

Discussion:

Pigs were received either single or double shots of FMD vaccine, the induced Ab could persist to marketing-age (the Ab titers of geometric mean were greater than criterion, 4 $\log_2$, in five farms). However, a higher percentage of pigs with Ab titer less than 4 $\log_2$ were observed in single shot group. They ranged between 3% and 22%. For those in double shots group were lower with ranging between 3% and 4%. It revealed that the efficacy of double vaccinations was better than that of single vaccination, even though the efficacy of single vaccination could approach to the herd immunity.

Biography Shu-Chia Hu, DVM

Dr. Hu is the assistant research fellow of the Hog Cholera Division, Animal Health Research Institute, Council of Agriculture, Executive Yuan, R.O.C. In 2009~2011, Dr. Hu focused on the study of the pathogenesis of porcine teschovirus. Since 2011, the research of foot and mouth disease became the major part of Dr Hu's works.

REPEATEDLY VACCINATION DOES NOT INDUCE DETECTABLE ANTIBODIES TO NON-STRUCTURAL PROTEIN OF FOOT-AND-MOUTH DISEASE VIRUS IN PIGS

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Introduction:

Foot-and-Mouth Disease (FMD) was prevented by vaccination in many countries. A purified inactivated FMD virus (FMDV) vaccine was used. It was very important to distinguish the antibodies induced by vaccination or infection for the serological surveillance in farm animals in epidemic countries. In Taiwan, mandatory vaccination was conducted in pigs and ruminants. The aim of this study is to evaluate whether or not repeated vaccination could induce the antibodies against the non-structural protein (NSP) of FMDV in pigs.

Materials and methods:

Four 8-week-old SPF pigs that were free of FMD-antibody were vaccinated repeatedly with the FMD vaccine that was prepared from O/TW/98 FMDV by a vaccine manufacturer. The interval of repeated vaccination was 4 weeks. The serum samples were collected at 4 weeks after each vaccination and were detected the serum neutralization antibodies by virus neutralization assay and the antibodies against NSP of FMDV by using PrioCHECK FMDV-NS kit respectively.

Results:

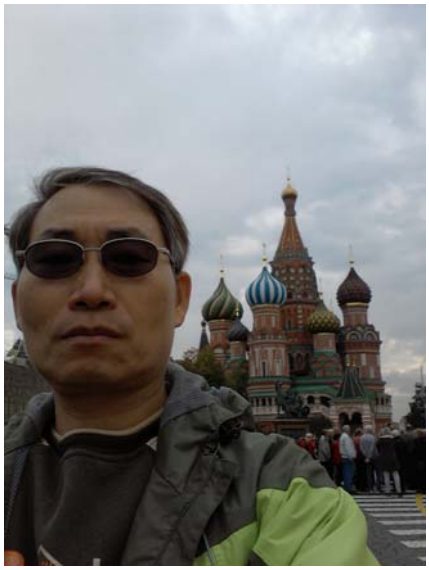
The serum neutralization antibodies of 20 serum samples that were collected at 4 weeks after each vaccination were shown seroconversion. The result of the NSP antibodies detection for these serum samples showed negative.

Discussion:

The result of serum neutralization test showed seroconversion in the vaccinated pigs. It revealed that the vaccine, which was used in this trial, possessed its potency to induce detectable neutralization antibodies in vaccinated pigs and was suitable to be used for the evaluation of NSP antibody induction. The result of the NSP antibodies detection showed negative. It demonstrated that the vaccine we used has reached high level of purity and does not induce detectable antibodies to the NSP of FMDV within pent-vaccination in pigs.

Biography Yeou-Liang LIN, PhD, DVM

Dr. Lin is the Director of Hog Cholera Research Division, Animal Health Research Institute, Council of Agriculture, Executive Yuan. He has started the diagnosis and research of Food-and-Mouth Disease since 1991. He has been to Animal Diseases Diagnosis Center in Plum Island, New York, U.S.A. several times for studying the diagnosis of exotic diseases (including FMD). He has also been to Pirbright FMD World Reference Laboratory, London, U.K., for studying the diagnostic techniques of ELISA for FMDV in 1997. In 2007, he has participated the Swine Production Immersive Knowledge Experience (SPIKE) intern in Iowa State University, U.S.A.. Dr Lin obtained PhD at National Chung-Hsien University in Taiwan in 2010 on " Control technology and molecular epidemiology of foot-and-mouth disease in Taiwan". He has also been involved in OIE activities such as the 2nd-3rd OIE meeting of FMD in East Asia (2001, 2004) and is the Focal point of Chinese Taipei "OIE/JTF Project on FMD Control in Asia".



THE CURRENT SITUATION ON FMD CONTROL IN MONGOLIA

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Introduction:

Foot-and-mouth disease (FMD) is a highly infectious viral disease which affects cloven hoofed animals such as camels, cattle, yaks, sheep and goats as well as wild animals (gazelles etc.) and it has a high impact on the economy. Its impact causes direct and indirect economic impacts on the country, such as through eradication and control measures and reduced exportation of animal and animal products from Mongolia. Over the last decade there have been several FMD occurrences in Mongolia especially in the eastern part.

FMD outbreaks is nowadays still widespread in many countries around the world and were recorded in the years 1931-1935, 1941-1948, 1963-1974, 2000-2002, 2004-2006, 2010 and 2013 in Mongolia.

Over the last decade there have been several FMD occurrences in Mongolia especially in the eastern part of the country. Mainly FMDV type O occurred in almost all cases of outbreaks except for an outbreak with Asia-1 type of virus in eastern part of Mongola in 2005.

Most recent FMD outbreak was re-occurred in Bayan Ulgii in July 2013 after 11 years (last outbreak was occurred in 2002) and Halhgol, Dornod in the middle of September 2013 after 3 years.

FMD control and eradication measures

Legal environment:

The Mongolian Constitution (1992) states ”The Livestock of the country is a national wealth and subject to state protection”.

Mongolia’s strategy for the control any animal diseases is based on the “Law of protection animal health and genetic pool” (1993, 2001, 2007), “Animal and Plant Quarantine” (2002) and “Civil Proctection” (1962, 1994, 2003, 2005). There are certain regulations being enforced by the Veterinary and Animal Breeding Agency (VABA), Government Agency for Specialized Inspection (GASI) and the National Emergency Management Agency (NEMA) such as: transboundary animal disease control procedures, import, export, quarantine and movement of animals and animal products.

According to the above mentioned laws and legislations, the veterinary authorities have right to do clinical examination for isolated animals, laboratory test and vaccinate susceptible animalsand even destroy infected animals without delay whenever a disease outbreak occurs.

According to the law of “Protection Animal Health and Genetic Pool”, herders can get 90% of the market value of their animals as compensation when their animals are culled due to foot and mouth disease.

Disease reporting system in Mongolia:

The reporting of TAD is mandatory for all veterinary staff and livestock owners in Mongolia. The initial

observation of suspected FMD cases is usually made by herders (farmers). According to article 14.1.5 of the law on "Animal health and gene pool protection", herders are obliged to report suspect or any abnormal findings in their livestock to the veterinarian who is responsible for animal health in the area.

Herders and veterinarians in soum (administrative unit) level must report new outbreaks or suspecious case within 24 hours. Mongolia became a member of the OIE in 1989 and State Veterinary Services reports outbreaks of TAD to OIE within 24 hours. Regular monthly disease reports which include all recorded disease events are sent through the provincinal veterinary offices to the State Veterinary Services.

Current situation of FMD in Mongolia:

First case of Foot-and-Mouth Disease (FMD) infection re-occurred in Bayan Ulgii in July 2013 after 11 years (last outbreak was in 2002). FDMV was diagnosed in State Central Veterinary Laboratory of Mongolia as FMDV type A and confirmed as FMDV type A by ARRIAH, Vladimir, Russia and Pirbright, United Kingdom.

Outbreak of FMD was occurred around 30 km from south western border from People's Republic of China in the beginning of July and was diagnosed on 5th of July, 2013 by State Central Veterinary Laboratory. Clinic symptoms were so mild in this case and first mild lameness sign was observed by herders and reported to local veterinarians, provincial veterinarians and national veterinary service.

The outbreak was rapidly spread out to several susceptible animals in mountain valley area which is summer place for local herders and where density of animals and human is high after first exposure. First control measures such as restriction of animal movement were taken place there in Bayan-Ulgy.

In response to the FMD outbreak in Sagsai soum of Bayan-Ulgy province after the official confirmation from the State Central Veterinary Laboratory on 5th of July, 2013, the Government of Mongolia implemented an eradication and control campaign including movement control of animals and animal products, quarantine in outbreak areas, screening for clinical signs in FMD affected herds and surrounding areas, stamping out of infected herds and the vaccination of herds to prevent further outbreaks

The total number of livestock detected was 1256 (cattle 678, sheep 411 and goats 179). All infected animals were destroyed according to the law on the "Protection of Animal Health and Genetic Pool" and guidelines of the OIE.

Second case of FMD outbreak was occurred in the eastern part of Mongolia in the middle of September of 2013. In this area, regular ring vaccination were taken place in the spring (May, June) of 2013. The outbreak area is more plat and clinical signs were much more clear if compared to the FMD outbreak case of Bayan-Ulgy.

In response to the FMD outbreak in Halhgol soum of Dornod province after the official confirmation from the State Central Veterinary Laboratory on 20th of September, 2013, an eradication and control campaigns have been taken place.

The total number of livestock detected was 29 (cattle 20, calves 9) and infection was confirmed by ELISA, PCR for each outbreak occurrence of FMD serotype type "A". All infected animals were destroyed according to the law on the "Protection of Animal Health and Genetic Pool" and guidelines of the OIE.

Key control and eradication measures:

The main components of the current national FMD control and eradication strategy in place are:

- Consideration of the epidemiologic situation: determine the source of infection; break the association between agent and host;
- Quarantine measures in animal outbreak and surrounding areas: outbreak, suspected, protected, and healthy zones have to be established and specific actions implemented in each zone;
- Ban all movements (people, vehicle, animal and animal products);
- Vaccination in the areas where the FMD outbreak has occurred: improve the immunization of susceptible animals;
- Serological and clinical surveillance in domestic animal herds and observation of movements of wild susceptible animals (gazelles) in the affected area. Clinically affected and recovered animals can be detected by conducting clinical examination, virological, genetic and serological methods
- In most outbreak areas, modified stamping out of infected animals is undertaken;
- Improvement of public awareness about all on-going processes;
- Cooperation with OIE; information about disease situation;

Conclusions:

- Epidemiological investigations of affected herds (primary source for disease spread);
- Develop standard data forms for diseases (for infectious and non-infectious diseases) an local to national levels;
- Regular serological surveillance of non-infected susceptible animals in the FMD affected area and surrounding area to determine the current prevalence rate situation;
- To continue vaccination program for livestock in the high risk areas in the nearest years;
- To improve and information sharing and multilaterial cooperation of Russian Federation, People's Republic of China and Mongolia on control efforts to prevent future outbreaks with the long term goal of eradicating the FMD in the region;
- Improve the herders' and local people knowledge about disease consequences;
- To improve multilaterial cooperation with bordering and other countries and international organizations such as OIE, FAO;

Biography *Batsukh BASAN, MS, DVM*

Job position: Officer of Veterinary and Animal Breeding Agency (Implementing Agency of Mongolian Government) and responisble for Transboundary Animal Diseases and Foreign Relation

- ✓ 2010-2013: Studied for a master in Applied Agricultural Sciences of Master Sciences in Life Sciences at the Bern University of Applied Sciences in Bern, Switzerland.
  Topic was "Control and management of FMD after an outbreak"
- ✓ 2009-2010: Studied in Academy of Management, Ulaanbaatar, Mongolia, qualified as a Manager of Civil service
- ✓ 2001-2006: Veterinary Medicine at the Mongolian State University of Agriculture, qualified as a Veterinarian.

FMD remerged and serotype A in Mongolia, 2013

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State Central Veterinary Laboratory

Introduction:

Primary outbreak occurred in the western parts of Mongolia in July, 2013. After 11 years of freedom, FMD re-emerged in Sagsaisoum, Bayan-Ulgii province which is located in FMD free zone. The clinical symptomswere very mild in infected yak, cattle and small ruminants.

A separate outbreak of FMD occurred in September, 2013 in Halhgolsoum of Dornod province, which is in vaccinated zone located at the eastern edge of Mongolia. Also, cattle infected and the serotype was A.

In this particular outbreak, serotype "A"of FMDV havebeen detected in first time in the territory of Mongolia.

Materials and Methods:

The clinical saliva, epithelial and the serum samples were collected by local veterinarian from FMD suspicious cases in western and eastern part of Mongolia. Total RNA was extracted from the clinical samples or using an RNA kit (Qiagen), according to the manufacturer's protocol. The tissue samples were tested by Real-Time RT-PCR with using 3DF, 3DR or TaqMan probe (Takara.bio) for diagnosis all seven serotypes. Subsequent RT and PCR set up were commonly carried out in a reaction volume of 25 µl in a thermal cycler. The melting temperature (Tm) was performed 55^{o}C 30 min of the 1F and 1R primers. The three serotype-specific primer sets and one-step multiplex (iNtRON Biotechnology) RT-PCR kit were used for differentiation on FMDV serotypes O, A and Asia-1. Also, Antigen detection ELISA (Pirbright, BDSL, UK) was performed in those tissue samples for detection typical FMDV. The serum samples were to subjected LPB-ELISA and NSP-ELISA.

Result:

While the antigen ELISA, the O, A, Asia-1 LPB ELISA test gave negative results, the RT-PCR and Real-Time PCR, by which the specific amplified DNA products for FMD were detected, was positive in the initial FMD suspected case. RNA of FMDV was clearly detected on 328 bp of the 1F and 1R primers and differentiated all FMDV samples, yielded distinct PCR products of the expected lengths of 540bp (427bp iNtRON kit) for FMDV serotype A respectively. NSP-ELISA

was performed on the serum samples from affected cattle and they showed high antibody titers to FMDV.

Discussion:

In this particular outbreak, only cattle and yak showed a typical clinical sings. Yak didn't form any vesicles in the mouth, nostrils or on the feet, but clinical signs of pyrexia, salivation, low erosion and ulcers in the mouth and nose. For these reasons, epithelial tissues couldn't be sampled. We sent the tissue and serum samples which we collected from Bayan-Ulgii province that is located in western parts of Mongolia to the ARRIAH institute (RL) in Russia and Pirbright Institute (WRL) in England for confirmation FMD and construction of the phylogenic tree in September. We have received FMD Genotyping report. The present findings showed that the virus was closely related to Sea-97 strains of the virus referred to Asia topotype.

The sequence of the VP1 gene (second outbreak in eastern parts) has not determined in this time.

PATHWAYS FOR TRANSMISSION OF FOOT-AND-MOUTH DISEASE IN MONGOLIA

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Introduction:

Foot-and-mouth disease (FMD) occurred in five provinces and 24 soums (counties) after the FMD incursion into Mongolia during 2010. The study aimed to understand the risk of potential transmission pathways between herder operations and gazelle (Procapragutturosa). In addition the study aimed to understand the rate of silent spread that may have occurred between herder operations both within and outside the quarantine zone; the quarantine zone having been initiated as part of control measures during the 2010 outbreak.

Materials and methods:

A serological survey for FMD in domestic livestock was used to determine whether silent spread (intra and inter-herd prevalence) was likely played a role in the 2010 outbreak both within and outside the quarantine zones used for control of FMD. Herders that had livestock diagnosed clinically with FMD will be matched with those that were unaffected (similar location, similar size herd) during the FMD outbreak (i.e. case and non-case from the same approximate location).

Nine (9/20, 45%) from 20 herders interviewed where animals had clinical signs of FMD detected in one or more ruminant species during the 2010 outbreak. The remainder (11/20, 55%) of herders interviewed indicated that FMD had not been detected clinically.

Results:

When ruminants were tested all 20 of the herder operations had one or more animals positive for FMDV NSP Antibody (20/20, 100%). The median percentage of positive animals, regardless of species, for those herder operations classified as being clinically affected with FMD during the 2010 outbreak was 18% compared to 13% for those classified as non-clinically affected.

The output from a general linear mixed model (herds and flocks clustered by herder) showed that there was a greater odds of serologically positive animals in herder operations located within the quarantine zone (2.5; 95% Confidence interval = 1.2-5.3) compared to outside of it; however the odds was smaller than expected given the assumption that herds and flocks outside of the quarantine zone were free of FMD during the 2010 outbreak.

Eighty percent (57/71) of herders surveyed indicated that they had observed gazelle on regular occasions. There was a median of 22 observations of gazelle made per year by all herders. More respondents indicated that contact between their livestock and livestock of other herders had occurred at water sources (76%, 50/66) in comparison to contact during grazing (52%, 26/50). However for those that indicated contact between livestock had occurred, the median frequency of contacts per year was the same at water sources (median = 39, SD = 12) and during grazing (mean = 39, SD = 23).

Serological evidence for previous exposure to foot-and-mouth disease virus was detected in 43% (36/83; 95% CI = 33-55%) gazelle tested; however, FMD virus was not detected in tissues from 79 gazelle dying from natural causes over the winter period, from live capture and from hunting. The system level sensitivity to detect FMD virus was determined as 16% based on this level of testing.

Discussion:

The relatively low intra-herd prevalence of seropositivity for FMD of susceptible species within herder operations (median 13%) could be explained in part by decay in antibody levels and livestock turnover occurring between the 2010 outbreaks and testing carried out as part of this survey in 2012. However, FMDV NSP antibody titre is considered to be relatively long lived and can be detected for some years after exposure (Peter Moonen 2003). During the 2010 FMD outbreak, the median numbers of

cattle, sheep and goats detected clinically from affected herds was 24%, 6% and 5% respectively. The relative difference in the prevalence of clinically detected animals to positive serology by species supports the conclusion that clinical diagnosis in small ruminant species has relatively poor sensitivity for detecting FMD. There was no difference in the prevalence of livestock serologically positive for FMD, for those classified as having FMD (from clinical diagnosis of FMD during the 2010 outbreak) and those classified as being non-affected. Modified stamping out was used as a response policy during the 2010 outbreak of FMD. The policy involved slaughtering animals detected with clinical signs from herds or flocks identified as being affected. If this policy had been effective, herds classified as being clinically affected would have been expected to have a lower prevalence of serologically positive animals than affected herds where no modified stamping out was instituted (i.e. incorrectly classified as non-clinically affected). Based on this finding it appears that many exposed animals were not detected and subsequently culled.

Import of animals historically exposed to FMD virus during the 2010 incursion into clinically free herds outside of the quarantine zone could explain some of the positive serology observed, but does not necessarily explain seropositivity for seven (7/11, 63%) herders who indicated that they had not bought in animals. Silent spread during the 2010 incursion would be one explanation for positive serology in animals from these seven herders. If this were the case the quarantine zone may not necessarily have completely delimited outbreaks. Another possible explanation is false positive serology; however, this would be unlikely to explain a median prevalence of 16%.

The spatial and temporal patterns of the outbreak foci occurring during spring 2010 (April, May and June) in Dornod province highlight the difficulties in understanding release and exposure of FMD in Mongolia. The three outbreak clusters were each separated by a distance of approximately 200 km and they occurred one moth apart.

A main road connects the first foci to the second; therefore transfer of virus on fomites of illegal transportation of live animals would seem to be the most likely pathway. However, multiple incursions cannot be completely excluded. Despite fomite spread being low risk in

comparison to animal spread the frequency of fomite movements form an infected area is likely to be high.

The natural movement of gazelle at that time of year is to the west and parallels the direction of infection from the first to the second foci. The freedom of movement of gazelle is greater than that for domestic livestock. They can move across country borders and also across province borders without restriction. Be this as it may some transmission to livestock is likely to have occurred from this species during the 2010 outbreak. As our survey seroprevalence was higher than livestock (livestock 13-18%, gazelle 43%) it is likely FMD occurrence were so high among gazelle population. It is possibly that the importance of this species in transmission is dependant on whether infection pressure in the environment from infected livestock is sufficient to result in infection in the first place. There was significant numbers of livestock infected in Sukhbaatar soum during the summer phase. Therefore there is likely to have been large amounts of environmental contamination with FMDV. Hence, it is possible that multiple herds of gazelle were infected, providing a source of virus for further infection of livestock.

Mongolia has a complex nomadic system for managing livestock with multiple pathways for FMD virus release and exposure. This paper has described some factors that maybe associated with exposure between herder operations for an infectious disease such as FMD. Analysis of serological data provided some suggestion that silent spread may have occurred beyond the quarantine zone during the 2010 outbreak of FMD. Regardless of this finding eradication of FMD was successfully carried out in Mongolia indicating that other active response controls and natural environmental factors are likely to have played a part in eradication.