2023 SEACFMD Laboratory Network Meeting

FMD situation and epidemic viruses evolutionary in China

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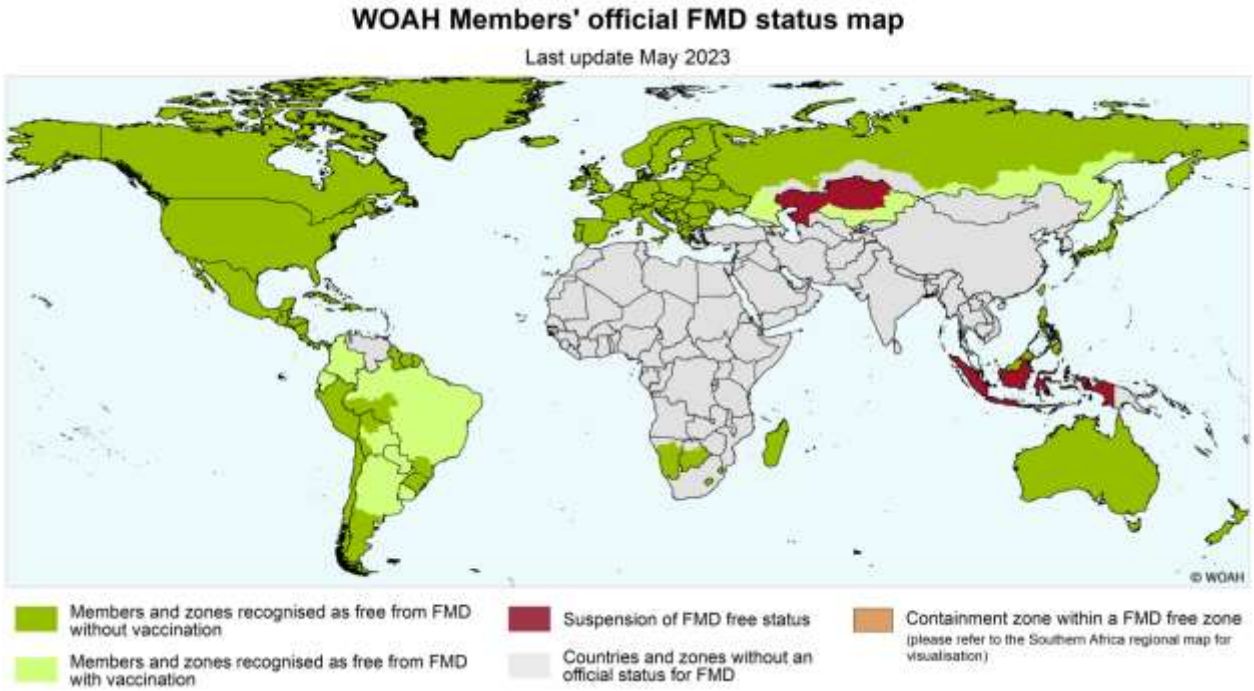
Lanzhou, P.R. China 24-25 Oct, 2023

outlines

- FMD situation in China in recent years
- Epidemic FMDV strains and their characteristic
- Response and measures to FMD viruses evolutionary

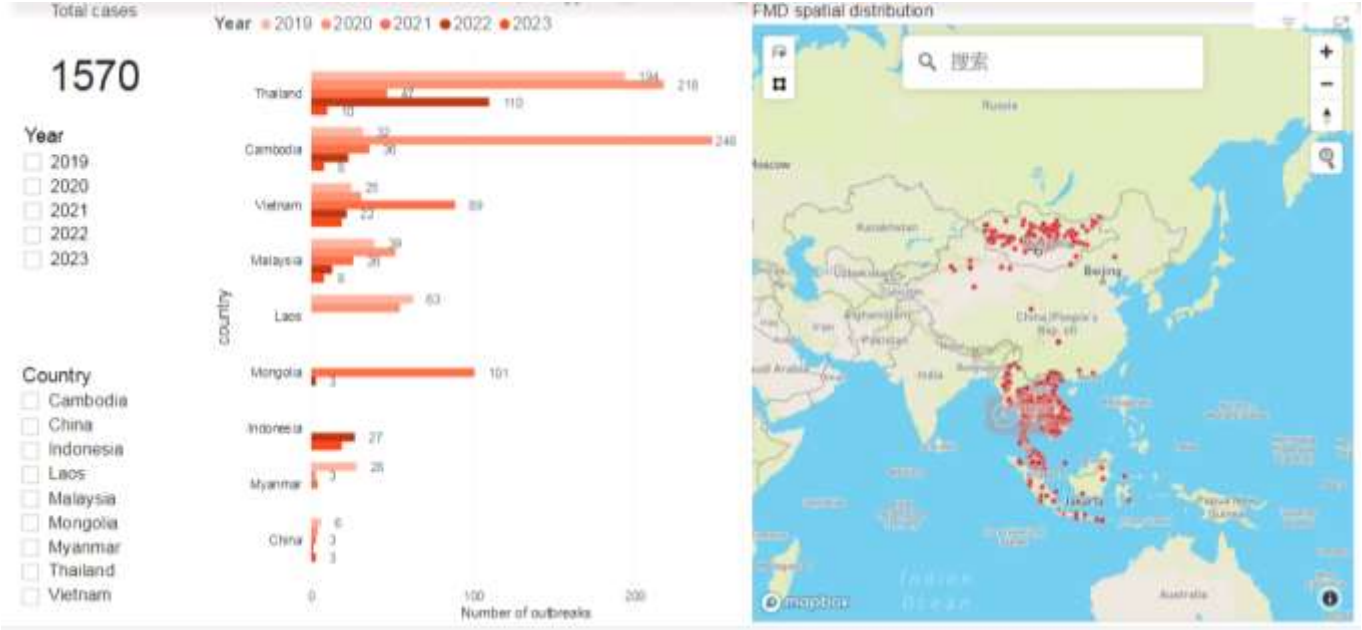
Part 1. FMD situation in China

Global FMD situation



- FMD outbreaks in Africa and Asia
- WOAH member countries, ~1/3 countries = FMD free without vacciantion
- 7 countries signed official endorsment for FMD control plan (CHN, THA)

Regional FMD situation in SEA



- ✓ SEA: prevalent areas
- ✓ FMDV type O and A; Asia1 has not been reported since 2017 (Myanmar)
- ✓ Endemic countries: Vietnam, Thailand, Myanmar, Laos, Cambodia, Malaysia, Indonesia (2022)

FMD situation in China

- From 2005, total 179 outbreaks reported .
- 2019-2022, general epidemic situation is stable and the number of cases is reducing.
- Two serotypes, O type and A type. no Asia1 FMDV found in China since 2009. Type A has been free of epidemics for 4 years
- Three Peak years (2010, 2013,2017-18) : caused by the introduction of foreign strains.

Details of notified outbreaks in China during 2021-2023

Report Date	Type	Species	Location	Province	Strain
29/01/21	O	Cattle	Hami, Xinjiang	XINJIANG	Ind-2001
22/03/21	O	Pig	Huizhou	GUANGDONG	CATHAY
31/10/21	O	Cattle	Zeku, Qinghai	QINGHAI	Ind-2001
27/05/22	O	Pig	Wuzhou	GUANGXI	CATHAY
27/03/23	O	Cattle	Chongzuo	GuangXi	Ind-2001
13/04/23	O	Cattle	Kuche	XINJIANG	Ind-2001
12/05/23	O	Cattle	Heshuo	XINJIANG	Ind-2001

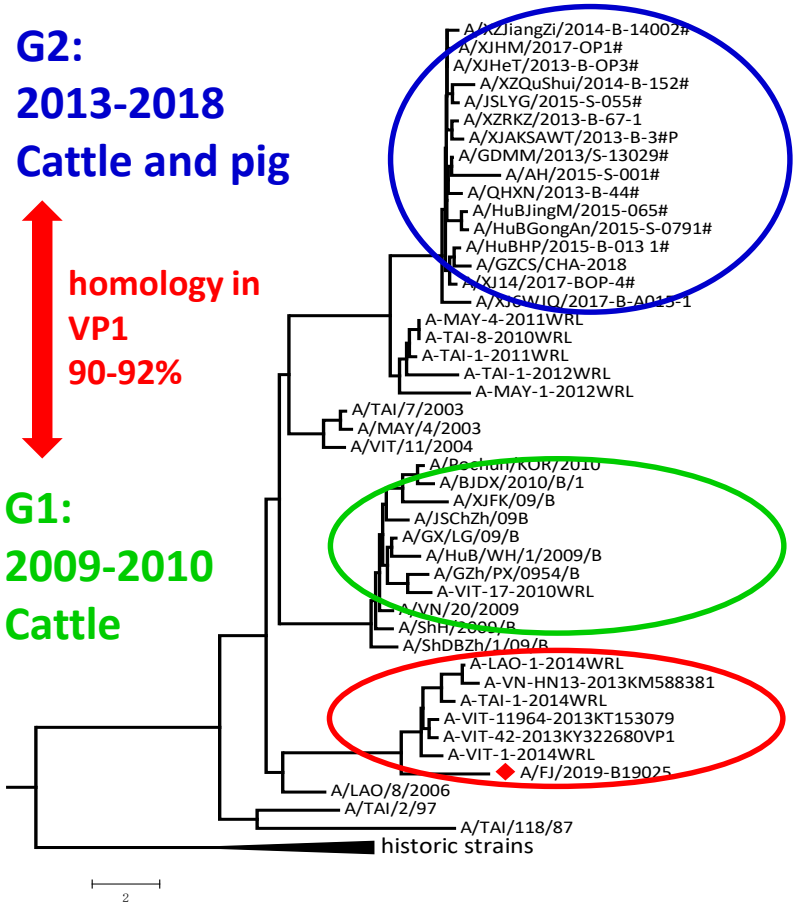
- ✓ 7 FMD outbreaks reported from January 2021 to Sep 2023 in China
- ✓ 2 outbreaks confirmed in pig and 5 in cattle
- ✓ Ind-2001 is dominantly circulating in cattle populations
- ✓ FMD outbreaks mainly occurred with animal movement

Part 2. Epidemic FMDV strains in China

Epidemic FMDVs in China

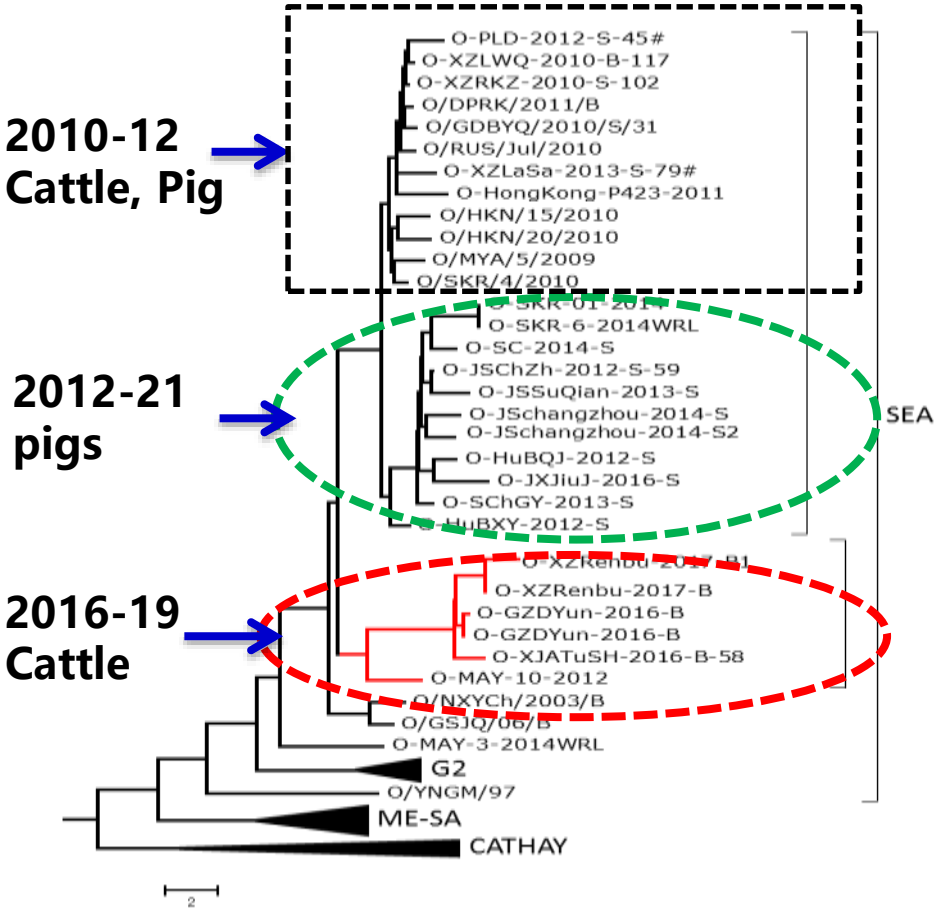
- **Serotype A**
  - **A/Sea/97 since 2009, re-introduced in 2013**
- **Serotype O**
  - **O/Mya-98 since 2010**
  - **O/PanAsia since 2011**
  - **O/CATHAY since 2016**
  - **O/Ind-2001 since 2017**
- **Serotype Asia1**
  - **Asia1/GV**
  - **No Asia1 cases since 2009**

1. A/Sea-97 strain in China



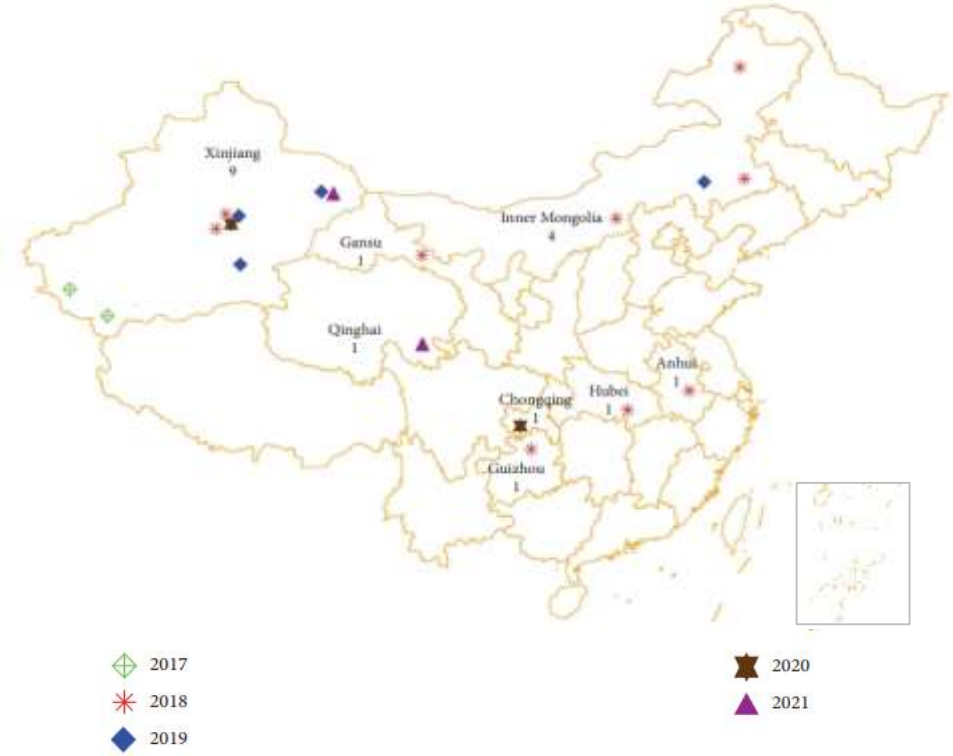
- The viruses introduced into China in 2009 and 2013; we divided the virus into two groups, G1 and G2. ~90-92% percent in VP1 gene between G1 and G2.
- No G2 casese reported since 2019
- In 2019, isolated from clinical healthy cattle OPF
- In 2019, VP1 sequencing: ~88% homology with A/GDMM/2013; ~90% with G1 viruses; ~96% with Vietnam, Thailand and Laos strains during 2013 to 2014(Genbank)
- VNT: using vaccine serum vaccinated with Re-A/WH/09, neutralization titer is 1:1024→vaccine effective

2. O/Mya-98 Strain

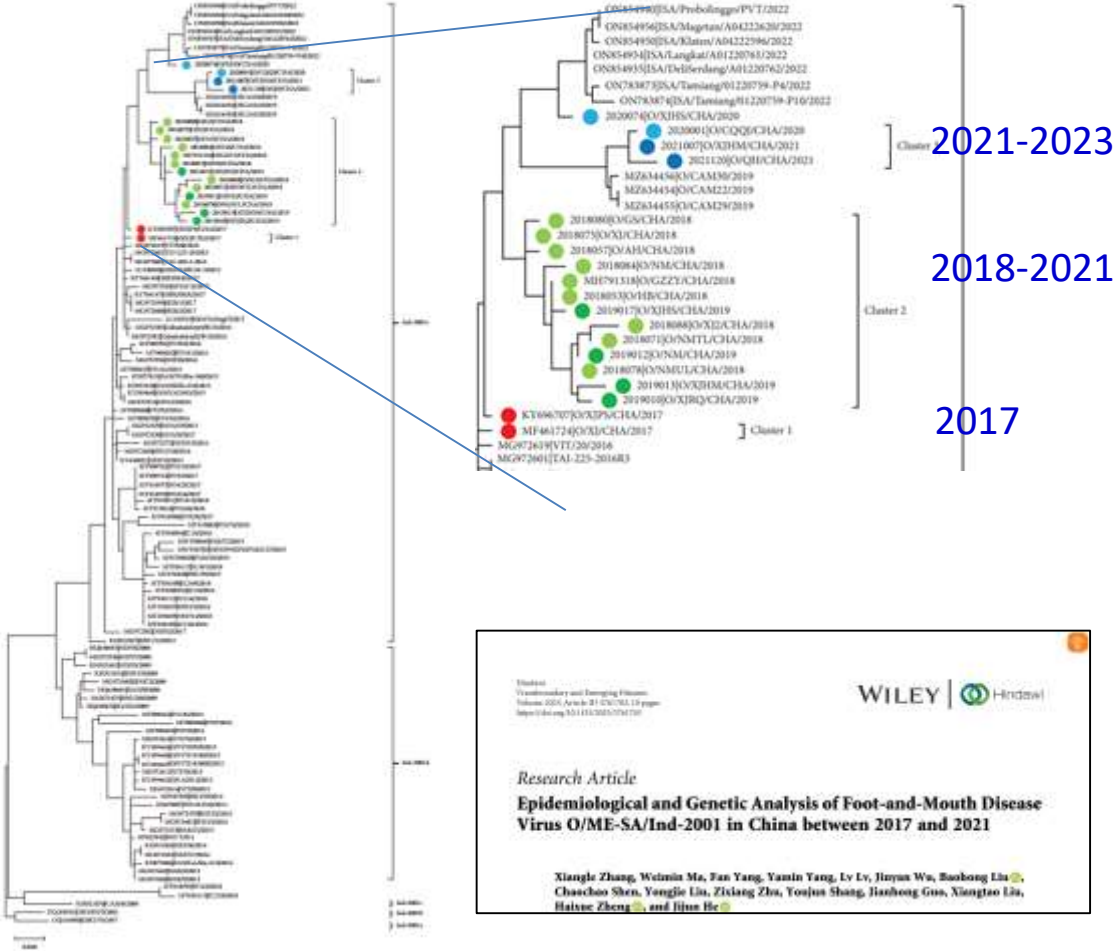


- Introduced into China in 2010
- continuously circulating even no outbreaks reported since 2019
- Multi-directional evolutionary and genetic variation
- There are two genetic groups observed: infecting cattle group and infecting pigs group.
- Basic studies have shown that there are differences in their genomes.
- Vaccine strain of O/MYA/BY/2010 is still protective

3. O/Ind-2001 strain



- First case reported caused by this strain in 2017
- Another new and emergency FMDV strain found in China
- Threaten strains introduced from other countries again
- Main FMDV strain in cattle in China



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Research Article

Epidemiological and Genetic Analysis of Foot-and-Mouth Disease Virus O/ME-SA/Ind-2001 in China between 2017 and 2021

Xiangle Zhang, Weimin Ma, Fan Yang, Yamin Yang, Lv Lv, Jinyun Wu, Baohong Liu, Chaochao Shen, Yongjie Liu, Zixiang Zhu, Youjun Shang, Jianhong Guo, Xiangtao Liu, Haiyue Zheng, and Jijun He

Using VP1 sequences,

- Belonged to O/ME-SA/Ind-2001e
- High identity with those viruses collected in Bangladesh during 2015-2016, with sequences published on Genbank

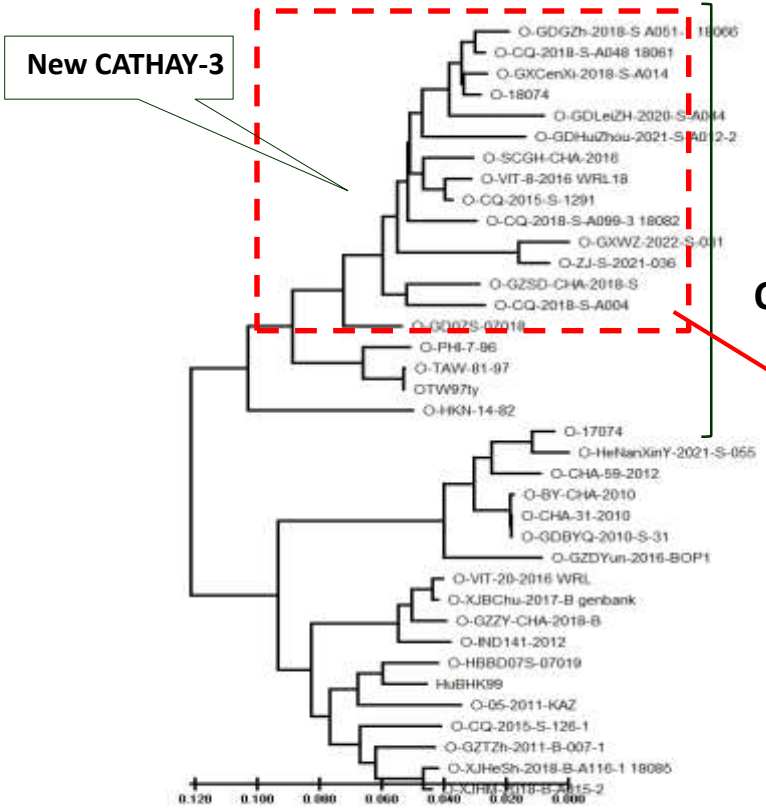
- O/Ind-2001 e formed into three genetic clusters:

Cluster 1: 2017

Cluster 2: 2018-2021

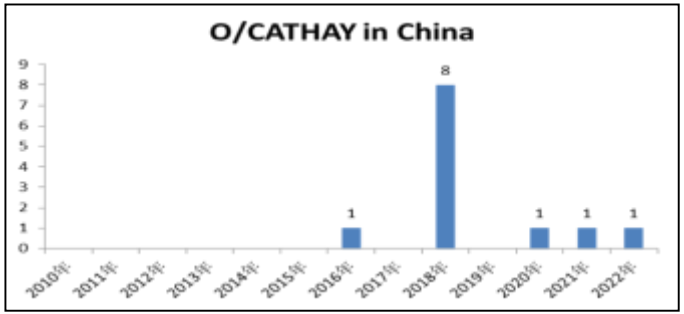
Cluster 3: 2021-now

4. O/CATHAY strain



O/CATHAY

✓Since 2016, CATHAY strain has gradually increased, and become to one of the main circulating strains in pig in China.



✓The CATHAY strain from 2016 was New CATHAY-3

✓Although CATHAY epidemic strains had distant mutation, it could still be protected by vaccine

Summary: FMD epidemiological characteristics in China in recent years

1) The general situation is stable but the strain is complex

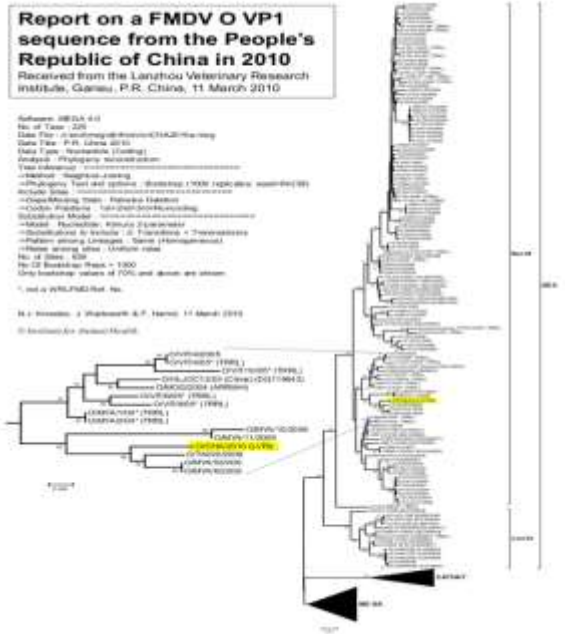
Epidemic Strains	2018	2019	2020	2021	2022	2023
O/CATHAY	8	0	1	1	1	0
O/Ind-2001	9	4	2	2	0	3
O/Mya-98	3	0	2	0	0	0
O/PanAsia	6	1	0	0	0	0
A/Sea-97	1	0	0	0	0	0
Total outbreaks	27	5	5	3	1	3

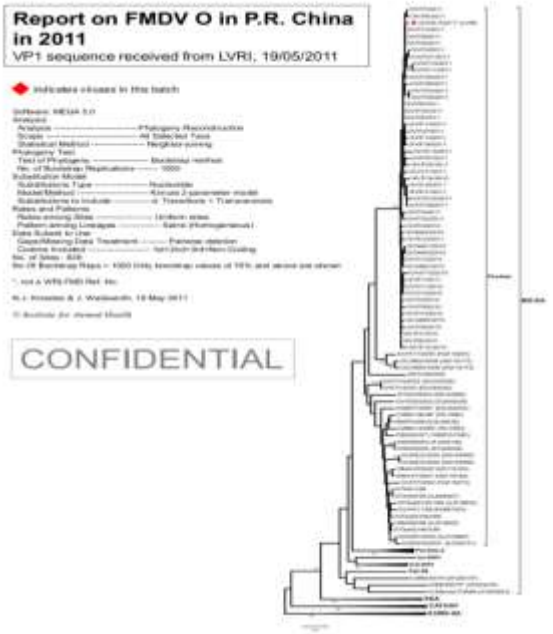
- ✓ Type A is not detected since 2019
- ✓ Generally, total number of clinical cases is decreasing
- ✓ Field strains are also decreasing
- ✓ Active surveilance indicates that O/Ind-2001 is still mainly circulating in China in 2023

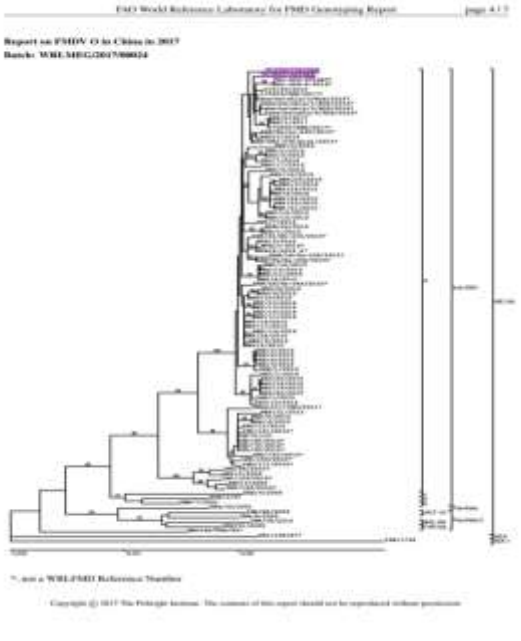
Summary: FMD epidemiological characteristics in China in recent years

2) Epidemic FMD viruses were all from foreign countries

Genotyping report from WRL, Pirbright,UK







Summary: FMD epidemiological characteristics in China in recent years

3) FMD strains and animal susceptibility

generally,

- Asia1 strain: cattle
- O/PanAsia: cattle
- A/Sea-97 G1: cattle
- O/Mya-98 strain: cattle+ Pig
- A/Sea-97 G2: Cattle, pig
- O/Ind-2001: cattle (field); pig(lab)

Part 3. Response and measures to FMDVs evolutionary or variation

1. Surveillance

- **Clinical surveillance**
- **Virological surveillance**

a) confirm clinically suspected cases;

b) follow up positive serological results;

c) characterise isolates for epidemiological studies and vaccine matching;

d) monitor risk for the presence and transmission of FMDV

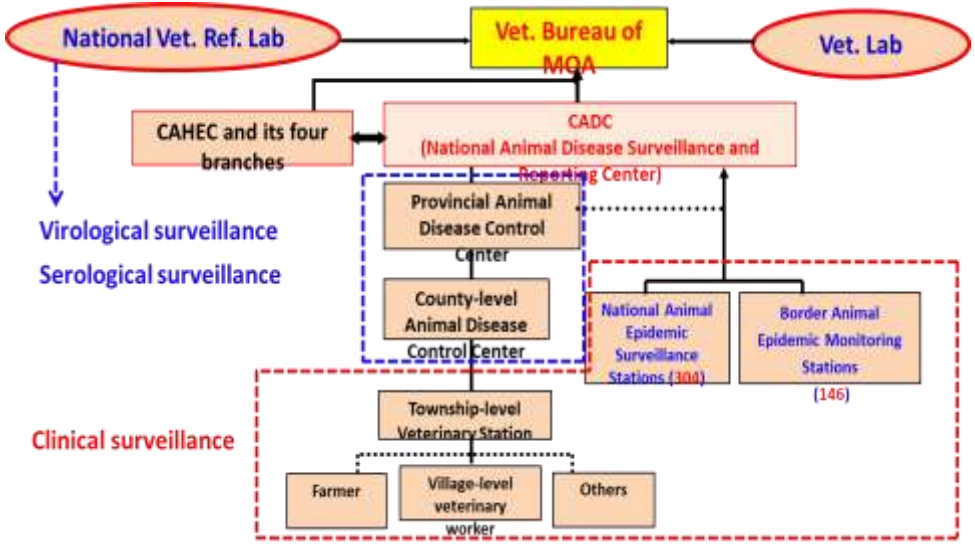
- **Serological surveillance**:

  Serological *surveillance* may be used to:

  a) estimate the prevalence or substantiate freedom from FMDV *infection* or transmission;

  b) monitor population vaccinatioon.

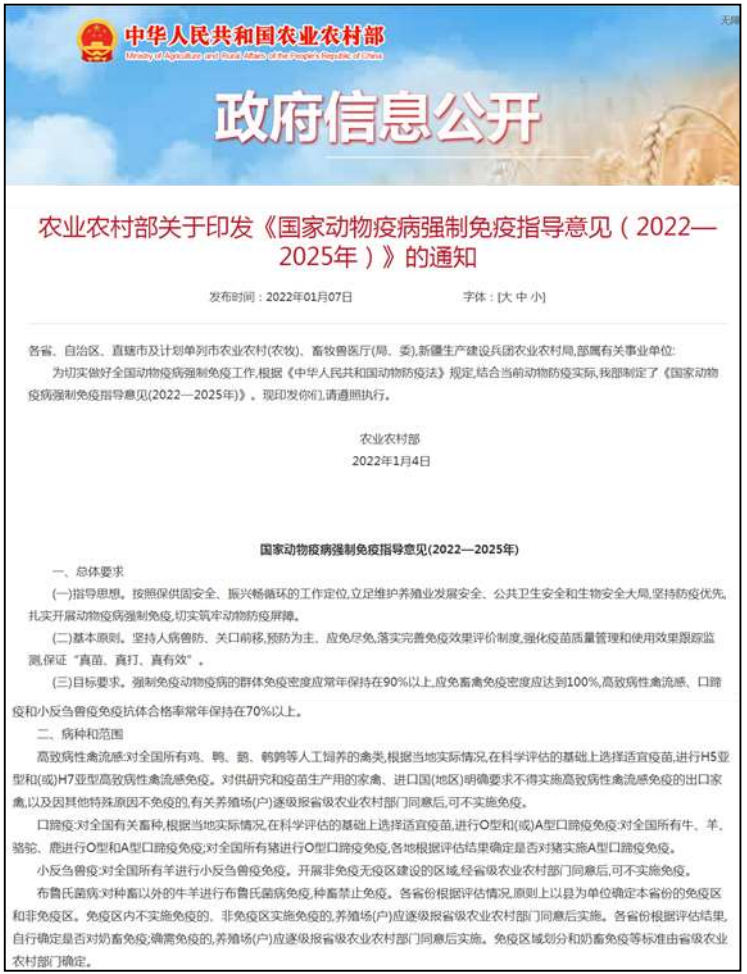
Surveillance system and framework in China



- 450 animal epidemic surveillance stations were established across the country
- surveillance network covers more than 2800 counties in China
- Early detection and warning to FMD outbreaks and viruses variation

2. Compulsory vaccination

- vaccination against FMD type O and/or A for all cattle, sheep, camels and deer
- vaccinated with type O FMD for all pigs, and type A FMD based on the risk evaluation results
- Pushing the policy of “vaccinate first, pay later"



中华人民共和国农业农村部
Ministry of Agriculture and Rural Affairs of the People's Republic of China

政府信息公开

农业农村部关于印发《国家动物疫病强制免疫指导意见（2022—2025年）》的通知

发布时间：2022年01月07日　　字体：[大 中 小]

各省、自治区、直辖市及计划单列市农业农村(农牧)、畜牧兽医厅(局、委),新疆生产建设兵团农业农村局,部属有关事业单位:

为切实做好全国动物疫病强制免疫工作,根据《中华人民共和国动物防疫法》规定,结合当前动物防疫实际,我部制定了《国家动物疫病强制免疫指导意见(2022—2025年)》。现印发你们,请遵照执行。

农业农村部

2022年1月4日

国家动物疫病强制免疫指导意见(2022—2025年)

一、总体要求

(一)指导思想。按照保供固安全、振兴畅循环的工作定位,立足维护养殖业发展安全、公共卫生安全和生物安全大局,坚持防疫优先,扎实开展动物疫病强制免疫,切实筑牢动物防疫屏障。

(二)基本原则。坚持人病兽防、关口前移,预防为主、应免尽免,落实完善免疫效果评价制度,强化疫苗质量管理和使用效果跟踪监测,保证“真苗、真打、真有效”。

(三)目标要求。强制免疫动物疫病的群体免疫密度应常年保持在90%以上,应免畜禽免疫密度应达到100%,高致病性禽流感、口蹄疫和小反刍兽疫免疫抗体合格率常年保持在70%以上。

二、病种和范围

高致病性禽流感:对全国所有鸡、鸭、鹅、鹌鹑等人工饲养的禽类,根据当地实际情况,在科学评估的基础上选择适宜疫苗,进行H5亚型和(或)H7亚型高致病性禽流感免疫。对供研究和疫苗生产用的家禽、进口国(地区)明确要求不得实施高致病性禽流感免疫的出口家禽,以及因其他特殊原因不免疫的,有关养殖场(户)逐级报省级农业农村部门同意后,可不实施免疫。

口蹄疫:对全国有关畜种,根据当地实际情况,在科学评估的基础上选择适宜疫苗,进行O型和(或)A型口蹄疫免疫;对全国所有牛、羊、骆驼、鹿进行O型和A型口蹄疫免疫;对全国所有猪进行O型口蹄疫免疫,各地根据评估结果确定是否对猪实施A型口蹄疫免疫。

小反刍兽疫:对全国所有羊进行小反刍兽疫免疫。开展非免疫无疫区建设的区域,经省级农业农村部门同意后,可不实施免疫。

布鲁氏菌病:对种畜以外的牛羊进行布鲁氏菌病免疫,种畜禁止免疫。各省份根据评估情况,原则上以县为单位确定本省份的免疫区和非免疫区。免疫区内不实施免疫的、非免疫区实施免疫的,养殖场(户)应逐级报省级农业农村部门同意后实施。各省份根据评估结果,自行确定是否对奶畜免疫;确需免疫的,养殖场(户)应逐级报省级农业农村部门同意后实施。免疫区域划分和奶畜免疫等标准由省级农业农村部门确定。

Vaccine matching

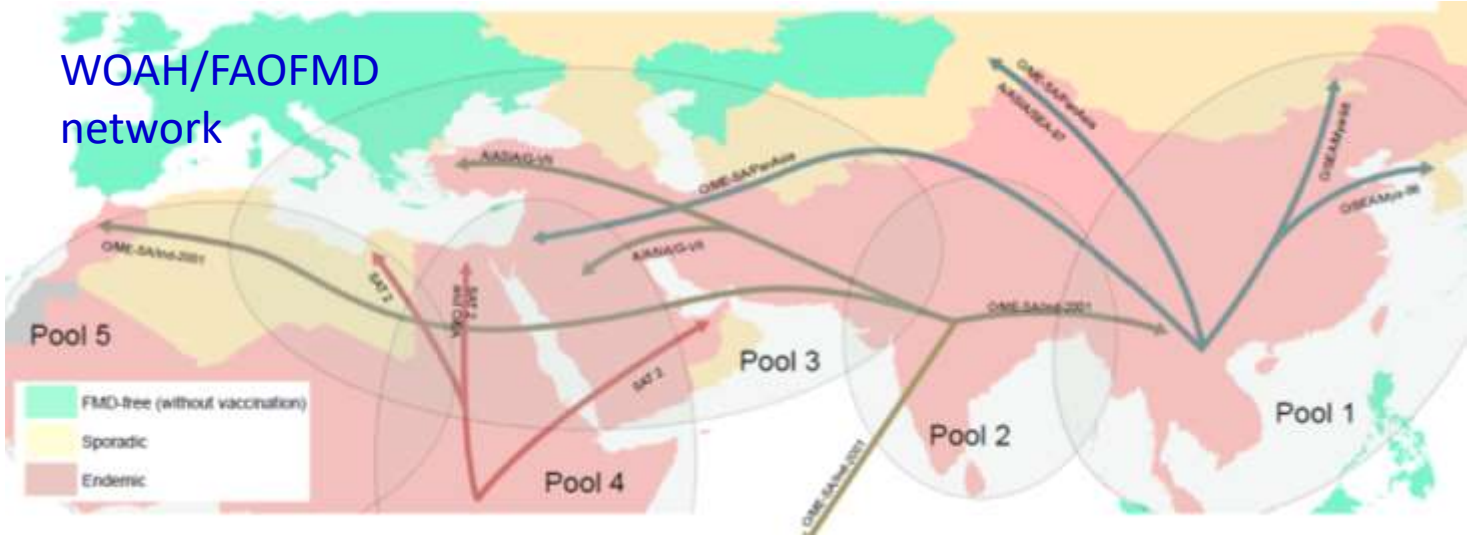
Field isolate	Animal	Vaccine strain	Vaccine strain
		O/BY/2010	Re-O
2021-008	pig	N	M
2021-A011	cattle	M	M
2021-A052	pig	M	M
2021-021	pig	N	nd
2020-A136	cattle	M	M
2022-031	pig	N	N
2023007-013	pig	M	M
2023039-28	pig	N	M(re-O/17002)
2023015	cattle	M	No data
2023025	cattle	M	No data

Vaccine matching and animal challenge test

Name of Vaccine strain	Name of Challenge strain	Result
Re-O (vaccine strain)	O/Mya-98 (O/2021008)	10/10 protective
Re-O/17002 (alternative vaccine strain)		9/(10-1) protective
Re-O (vaccine strain)	O/CATHAY 2021-A052株 (SID50≥6.0)	10/10

3. Alert of the threatened strains

- A-Iran-05
- A /India (A/G-VII)
- O-PanAsia-2
- Asia1 Sindh-08
- **SAT2**



4. International exchange and cooperation

Information and technology exchange

Acknowledgment

- MARA, China
- LVRI
  - China national FMDRL
  - FMD Diagnosis Group
- SEACFMD
- WRL

Thank you for your attention