猪消化道疾病国际研讨会
International Pig Digestive Diseases Symposium

猪病毒性腹泻的临床研究与防控技术开发

Clinical Research on Viral Diarrhea in Pigs and Development of Technology for Its Prevention and Control

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中国 • 武汉

Wuhan, China

汇报内容
Report Content

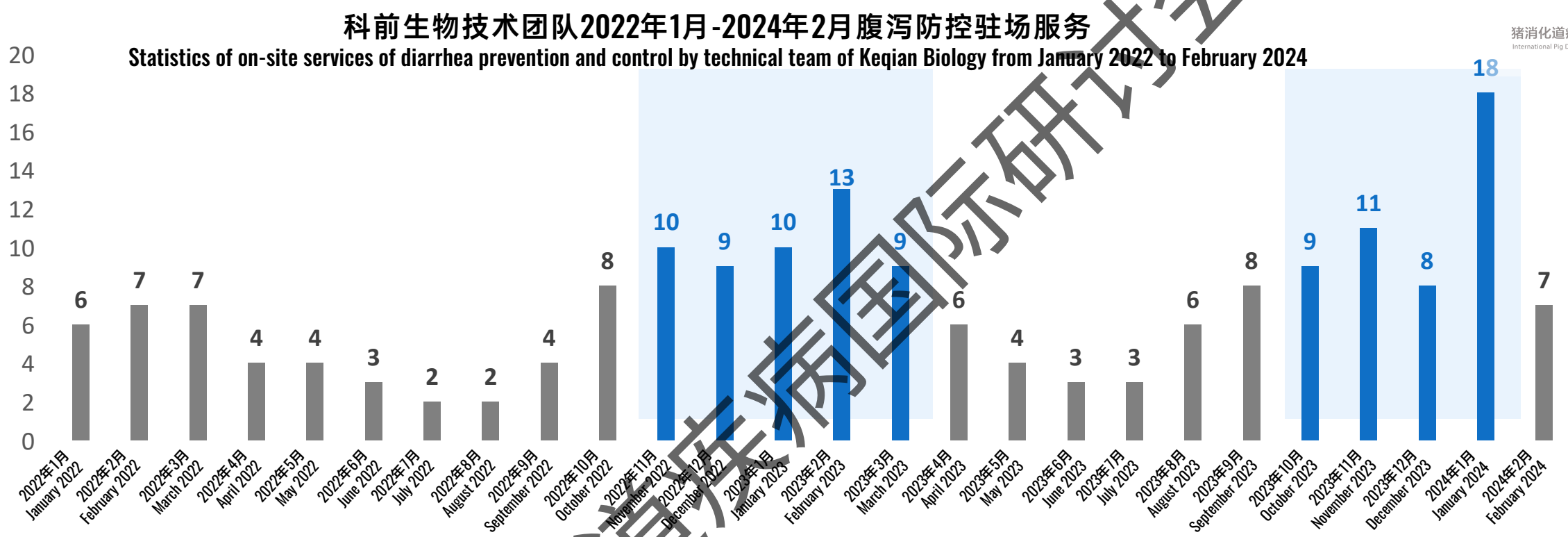
PART 01

临床病毒性腹泻的研究与防控技术开发

Clinical Research on Viral Diarrhea in Pigs and Development of Technology for Its Prevention and Control

1. 近两年规模化猪场病毒性腹泻防控分析

Analysis of Experiences with the Prevention and Control of Viral Diarrhea in Large-scale Pig Farms in the Past Two Years



- **2022年-24年2月科前技术团队共服务规模化猪场1650场次，驻场处理腹泻181次，占服务猪场总数的11%。**

  From 2022 to February 2024, the technical team from Keqian served large-scale swine farms a total of 1650 times, including 181 times (11%) for on-site treatment of diarrhea.

- **驻场服务主要集中在22年10月-23年3月、2023年10月-2024年2月，提示该时间段为腹泻高发期。**

  On-site services were provided mainly from October 2022 to March 2023 and from October 2023 to February 2024, suggesting a high prevalence of diarrhea during this period of time.

近两年全国范围腹泻发病特征

Epidemiological characteristics of diarrhea in the past two years

- 集中发病阶段为11月到次年4月中旬

  The disease occurred primarily in the period from November 2022 to mid-April 2023

- 与新建群、静默生产群密切相关，产房仔猪死亡率高（80%以上）

  They were closely associated with newly established herds and quietly isolated production herds, and resulted in a high mortality (more than 80%) of piglets in farrowing houses.

- 临床妊娠舍腹泻与流产，可检出PEDV S-indel和PDcoV的混合感染情况。

  In clinical gestation houses, diarrhea and abortions occurred with mixed infection with PEDV S-indel and PDcoV detected.

1. 猪场腹泻的损失
Losses Due to Diarrhea in Swine Farms

死淘率 Mortality-culling rate	场次 Service frequency	比例 Percentage
5%以下 Less than 5%	8	6.25%
5%-20%	17	13.28%
20%-50%	69	53.91%
50%以上 More than 50%	34	26.56%

正品率（7kg以上） Percentage of pigs meeting the requirement (more than 7 kg)	场次 Service frequency	比例 Percentage
70%以上 More than 70%	8	6.25%
50%-70%	32	25.00%
30%-50%	75	58.59%
30%以下 Less than 30%	13	10.16%

- **一旦猪场爆发腹泻，80%以上的猪场死淘会超过20%，一半以上集中在20%-50%。**
  Once outbreaks of diarrhea occurred, there would be a mortality-culling rate of more than 20% in more than 80% of swine farms, and the rate fell within a range of 20%-50% in more than half of the farms.
- **近70%的猪场断奶猪正品率会低于50%。**
  The percentage of weaned piglets meeting the requirement would be less than 50% in nearly 70% of swine farms.

4. 2022-2024年腹泻主要原因

Major etiologic factors for diarrhea from 2022 to 2024

其它疾病PRRSV或冷应激

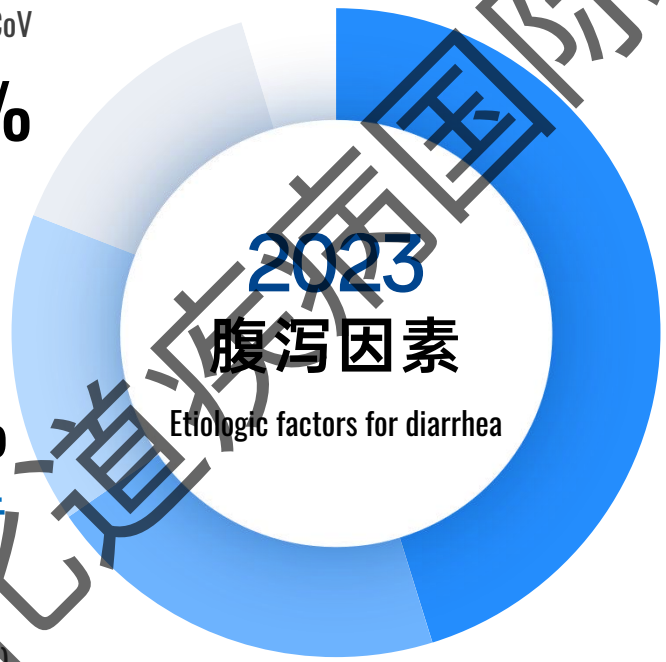
Porcine reproductive and respiratory syndrome virus (PRRSV) or cold stress

4.7%

PEDV S-indel/PRoV/PDCoV 感染

PEDV S-indel/PRoV/PDCoV

14.4%



45.2%

后备猪多源引种，入群前未检测

隔离驯化不足（少于30天）

Breeding stock pigs were introduced from multiple sources and not tested before entering the herd

Insufficient isolation and domestication (less than 30 days)

15.5%

舍内洗消不彻底，（部分洗消后CT值仍低于28）

Incomplete cleaning and disinfection of the house (cycle threshold (CT) value still below 28 after partial cleaning and disinfection)

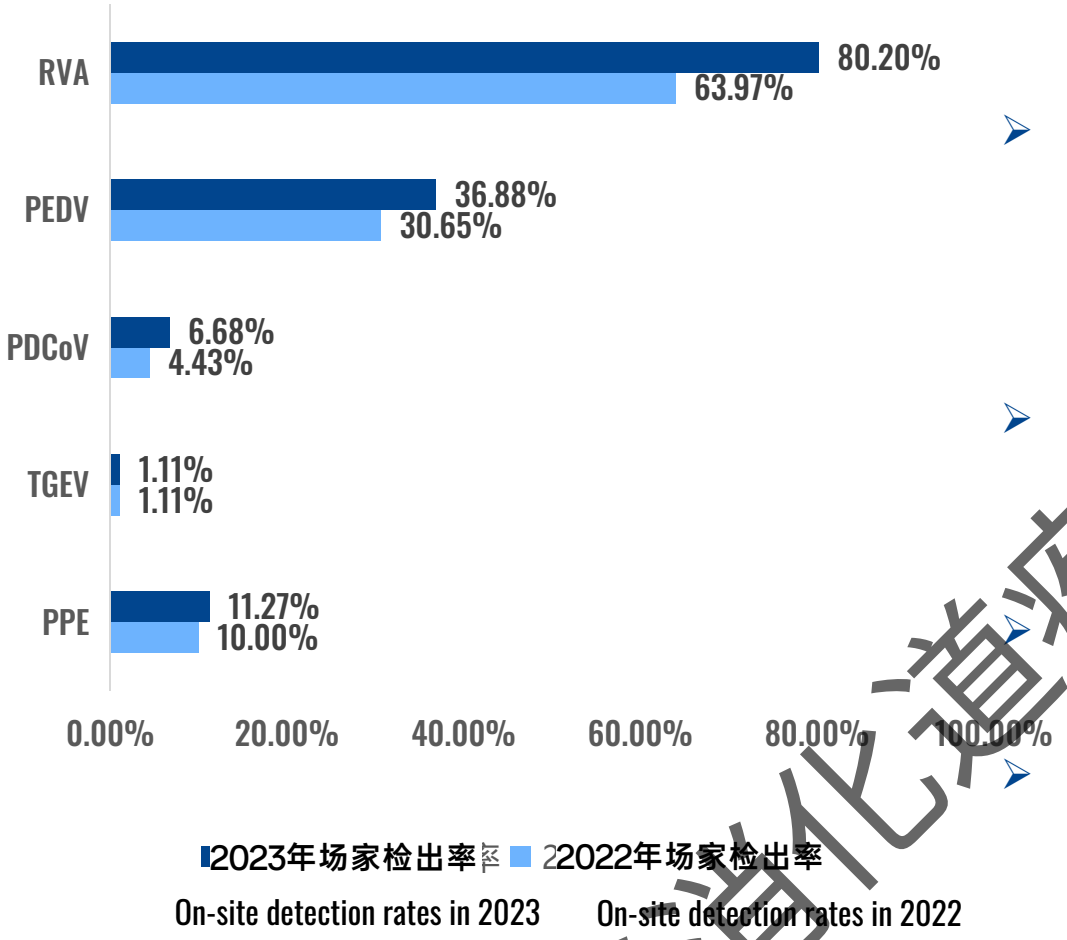
20.2%

引种车辆及售卖猪车辆引入病毒

Viruses were introduced into breeding vehicles and pig-selling vehicles

2. 2022—2023年主要病毒性腹泻检出率

Detection Rates for Major Pathogens of Viral Diarrhea from 2022 to 2023



- **猪流行性腹泻（PEDV）检出率依然处于高位，致病力较强，是猪场发生腹泻第一考虑因素。**

The detection rate for porcine epidemic diarrhea virus (PEDV) remained high. This virus was strongly pathogenic and considered the first etiologic factor for diarrhea in swine farms.

- **猪轮状病毒（PoRV）的检出率最高，阳性场普遍存在。**

The detection rate for porcine rotavirus (PoRV) was highest. This virus was prevalent in PoRV-positive farms.

- **猪δ冠状病毒（PDCoV）发病率在持续增加。**

The detection rate for porcine deltacoronavirus (PDCoV) continued to increase.

- **猪传染性胃肠炎（TGEV）成区域流行。**

Transmissible gastroenteritis virus (TGEV) spread regionally.

3. 猪流行性腹泻分子流行病学分析
Molecular Epidemiologic Analysis of PEDV

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2023全年共748份PEDV阳性样品进行S1基因测序分析

A total of 748 PEDV-positive samples were subjected to S1 genetic sequence analysis throughout 2023.

- **测序结果表明GII-a毒株为目前最主要的流行毒株，占比高达74.6%（558株），其次是GII-b毒株占比13.5%（101株）、S-INDEL毒株占比11.5%（86株）、经典毒株占比0.13%（1株）、其他毒株占比0.27%（2株）。**

The results showed that the GII-a strain was the most dominant strain at that time with a high percentage of 74.6% (558 samples), followed by the GII-b strain accounting for 13.5% (101 samples), the S-INDEL strain accounting for 11.5% (86 samples), the classical strain accounting for 0.13% (1 sample), and other strains accounting for 0.27% (2 samples).

	GIIa	GIIb	S-INDEL	经典 Classical samples	其他 Other samples
阳性数 Number of positive samples	558	101	86	1	2
阳性率 Positive rate	74.60%	13.50%	11.50%	0.13%	0.27%

5. 规模化猪场腹泻预警评估——打分百分表

100-Point Scale for Early Warning Assessment of Diarrhea in Large-scale Swine Farms

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规模化猪场腹泻风险评估百分表
100-Point Scale for Risk Assessment of Diarrhea in Large-scale Swine Farms

重点专项 Key item	分子项目 Sub-item	重要性 Importance	参考分值 Reference score	实际得分 Actual score	扣分说明 Explanation of the reason for score deduction	改进措施 Corrective action
1、生物安全 1. Biosafety （20）	1.运猪、转猪车辆转猪后PEDV病原检测阴性 1. Negative result for PEDV shown by pathogen testing after pig-transporting/transferring vehicles to pigs	*	3.0			
	2.人员、物资、饲料车辆定期监测PEDV 2. Regular monitoring of PEDV is conducted for personnel, materials and feed vehicles	*	3.0			
	3.有定期评估厂区周边5km以内PED发病情况 3. Regular assessment of PED onset is conducted within 5 km around the swine-production plant	*	3.0			
	4.有定期评估饲料、水源腹泻病原 4. Regular assessment of pathogens of diarrhea is conducted in feed and water sources		2.0			
	5.本厂参与转猪、售猪人员有进行严格洗消后进场 5. Personnel involved in the transfer and sale of pigs in the plant are strictly decontaminated before entering the farm.	*	3.0			
	6.本厂生活区、洗澡间、办公室每周有定期进行消毒 6. The living quarter, bathrooms and offices in the plant are regularly disinfected on a weekly basis.		2.5			
	7.本厂进出猪舍有手部、脚踏盆消毒措施 7. The factory is equipped with disinfectant hand/foot baths used before entering and leaving the piggery.	*	2.5			
	8.场内有定期进行杀灭蚊虫、苍蝇、蟑螂、老鼠等操作 8. There are regular operations to kill mosquitoes, flies, cockroaches, rats, etc. in the farm.		2.0			
2、猪群结构 2. Structure of the pig herd. （10）	9.现阶段场内2胎龄以内母猪占比小于30% 9. Currently sows in parity 1 to 2 account for less than 30% in the farm	*	2.5			
	10.全场妊娠母猪与后备母猪平均胎龄在3以内 All pregnant sows and breeding stock sows have an average parity of 1 to 3	*	3.0			
	11.后备猪年更新率30%以内 11. The annual replacement rate for breeding stock pigs is less than or equal to 30%	*	3.0			
	12.后备猪坚持自繁自育 12. Breeding stock pigs are persistently produced independently		1.5			
3、生产节律/管理 3. Production rhythm/management （7.5）	13.批次可以做到全进全出，无仔猪压栏等情况 13. Batch production can be performed in an all-in/all-out (AIAO) manner to avoid mixing earlier weaned piglets with piglets weaned at an older age	*	3.5			
	14.无超负荷生产，预期分娩母猪数小于等于空置产床数 14. There is no excess production: Number of sows expected to farrow is less than or equal to the number of vacant farrowing beds	*	3.5			
	15.母猪饲喂和仔猪保健按照公司标准流程进行 15. Sow feeding and piglet health care are carried out according to the company's SOP		0.5			
4、后备猪管理 4. Management of breeding stock pigs （12.5）	16.近3个月无后备母猪入群 16. No breeding stock sows have entered the herd in the last 3 months		2.0			
	17.后备猪引种进行蓝耳、伪狂犬、腹泻相关病原监测 17. Introduction of breeding stock pigs is monitored for pathogens related to blue ear disease, pseudorabies, and diarrhea	*	2.0			
	18.后备猪入群前有进行腹泻疫苗驯化 18. Breeding stock pigs have been domesticated with diarrhea vaccines before entering the herd.	*	2.5			
	19.后备猪隔离舍有专人转岗负责，且与种猪区无交叉 19. The isolation house for breeding stock pigs is managed by designated personnel at work shifts and does not cross over to the breeding area	*	3.0			
	20.后备猪隔离期内，并群前有群体腹泻病原采样评估 20. During the quarantine period, breeding stock pigs are subjected to pooled-sample testing as a herd-screening tool for detection of pathogen of diarrhea prior to mixing with a herd.	*	3.0			
5、疫苗免疫 5. Immunization with vaccines （12.5）	21.每周有明确的本周详细免疫计划 21. There is a clear detailed weekly immunization plan for the week		1.5			
	22.疫苗免疫采取商品弱毒活疫苗加商品灭活疫苗配合使用，且进行跟胎与普免 22. Immunization is conducted with commercially available live attenuated vaccines plus commercially available inactivated vaccines in conjunction with immunization of empty sows and immunization of the entire pig herd	*	3.0			
	23.种猪群进行秋冬季节腹泻疫苗普免 23. The entire breeding herd is immunized with vaccines against diarrhea in the fall and winter seasons	*	3.5			
	24.免疫操作规范（肌肉注射），不存在出血漏免或未及时补免等情况 24. Immunization is conducted routinely (intramuscular injection) without cases including missed immunization due to bleeding or failure to administer extra vaccine doses to make up for missed immunization in a timely manner		1.5			
	25.免疫程序记录完善（纸质版，电子档等记录详细，有专门负责人） 25. Well-documented immunization process (detailed paper/electronic records managed by designated personnel)	*	3.0			
6、栏舍洗消 6. Cleaning and disinfection of pens and houses （10）	26.每批次出猪后，都会进行粪沟彻底清理与消毒 26. After each batch of pigs leave pens for slaughter, manure ditches are thoroughly cleaned and disinfected	*	3.5			
	27.栏舍洗消严格按照本厂洗消SOP执行 27 Pens and houses are cleaned and disinfected strictly in accordance with the plant's SOP for cleaning and disinfection		2.0			
	28.有烘干与白化相关操作 28. There are operations related to drying and whitening		1.5			
	29.腹泻场发病后有进行精细洗消，验收合格后进猪 29. The farm is cleaned and disinfected occurrence of diarrhea, and pigs enter the farms after passing an acceptance test.	*	2.0			
7、产房管理 7. Management of farrowing houses （12.5）	30.母猪上产床前有严格的洗消程序，按照本厂产房消毒SOP执行 30. Farrowing houses are cleaned and disinfected strictly in accordance with the plant's SOP for cleaning and disinfection before sows are put onto farrowing beds		2.0			
	31.产房接产、消黄、消毒等物资有充分消毒后进入单元，且不存在不同单元混用 31. In farrowing houses, materials for delivery, feces removal and disinfection are sufficiently disinfected before entering units, without mixture of materials for use in different units		2.5			
	32.产房温度管理、湿度控制与通风管理达到公司标准要求 32. Temperature management, humidity control and ventilation management in arrowing houses meet the company's specified requirements		1.5			
	33.母猪哺乳期，产房可以做到单元专人负责管理，不存在交叉、串栏、串舍 33. During the lactation period for sows, farrowing houses can be managed by designated personnel in charge of units, without cross-over or mutual visits to pens/houses		3.0			
	34.腹泻发病时集体操作（疫苗免疫、阉割、断尾等）有充分防交叉措施 34. There are adequate measures to prevent cross-over during operations (vaccination, castration, weaning, tail docking, etc.) in the herd at the onset of diarrhea	*	3.5			
8、异常和常态化监测 8. Non-routine and routine monitoring （12.5）	35.近3个月未检出PED/PoRV等病毒性腹泻病原 35. No pathogens of viral diarrhea, such as PED/PoRV, have been detected in the last 3 months		3.0			
	36.近期腹泻发病时，母猪上产床前有进行病原监测 36. Pathogen monitoring is performed before sows are put onto farrowing beds during recent diarrhea episodes	*	2.5			
	37.产房洗消后，有定期抽查病毒性腹泻病原 37. After cleaning and disinfection of farrowing houses, there are regular spot checks for pathogens of viral diarrhea		1.0			
9、腹泻应急处理 Emergency treatment of diarrhea （7.5）	38.本场有明确的腹泻发病处理预案 38. 38 The farm has a clear plan for the treatment of diarrhea outbreaks	*	3.0			
	39.本场有定期进行腹泻防控常规操作流程培训与相关演练 39. The farm has conducted regular training and drills regarding the procedure for prevention and control of diarrhea.	*	3.0			
	40.本场储备有腹泻防控物资（如：一次性手套、干粉消毒剂、防交叉物资等） 40. The farm has stock supplies (e.g., disposable gloves, dry disinfectant powder, anti-crossing supplies, etc.)		1.5			
合计得分 Total score			100.0			

- **生物安全** Biosafety
- **猪群结构** Structure of the pig herd
- **生产节律/管理** Production rhythm/management
- **后备猪管理** Management of breeding stock pigs
- **疫苗免疫** Immunization with vaccines
- **栏舍洗消** Cleaning and disinfection of pens and houses
- **产房管理** Management of farrowing houses
- **异常和常态化监测** Non-routine and routine monitoring
- **腹泻应急处理** Emergency treatment of diarrhea

结果判定
Interpretation of results

得分（分） Score (points)	符合情况 Compliance	风险等级 Risk level	重要项满分（个） Number of key sub-items with a full score
≥80	同时满足得分和关键项满分数量要求 Complying with the requirement for a total score and the requirement for the number of key sub-items with a full score	低风险 Low risk	数量≥18 Number ≥18
60~80	同时满足得分和关键项满分数量要求 Complying with the requirement for a total score and the requirement for the number of key sub-items with a full score	中等风险 Intermediate risk	10≤数量＜18 10≤Number＜18
＜60	满足得分或满足关键项满分数量要求其中一项 Complying with either the requirement for a total score or the requirement for the number of key sub-items with a full score	高风险 High risk	数量＜10 Number＜10

5.1 2023年第4季度腹泻打分表评估分析

Assessment of Diarrhea in the 4th Quarter of 2023 Based on the 100-Point Scale

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- **2023年10月初对92个规模化猪场开展腹泻评分，80分以上占比69.5%（64/92）；**

  92 large-scale swine farms were scored for risk assessment of diarrhea in early October 2023. 69.5% (64/92) of them were scored 80 or higher.

- **对低于80分的猪场追踪，腹泻发病率：大客户29%（8/28）；**

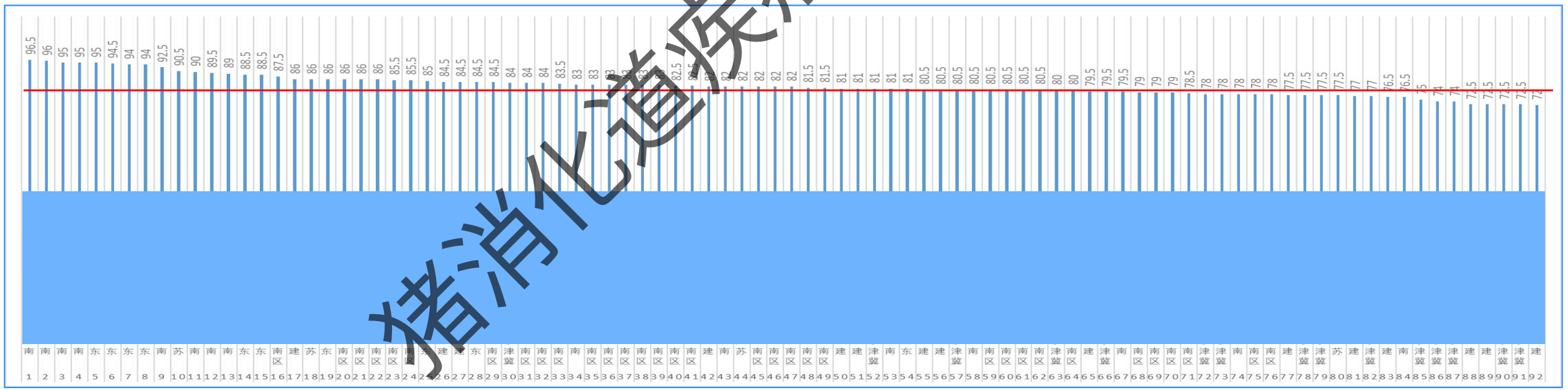
  Swine farms with a score of less than 80 were tracked. The results showed that large-scale farms where diarrhea occurred accounted for 29% (8/28).

- **对高于80分的猪场追踪，有4个场出现腹泻问题；**

  Swine farms with a score of more than 80 were tracked. The results showed that diarrhea occurred in 4 of them.

- **腹泻发病表现：产房大日龄仔猪腹泻，产房仔猪死亡率低于10%，怀孕母猪出现腹泻问题，个别场伴有流产。**

  Diarrhea onset manifestations: The mortality was less than 10% in piglets aged a large number of days with diarrhea in farrowing houses, and pregnant sows presented with diarrhea, accompanied by abortion in individual farms.



5.2 猪场腹泻的有效控制
Measures to control diarrhea in Swine Farms

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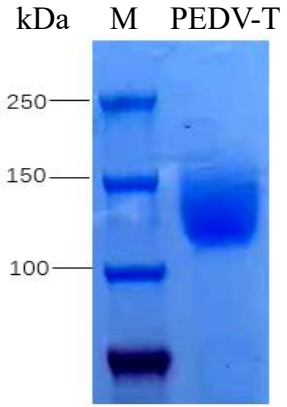
疫苗控制措施 Control measure	场次 Service frequency	控制时间（死淘率5%以下） Control duration (mortality-culling rate of less than 5%)
跟胎加一针灭活 Administration of a dose of an activated vaccine to empty sows	19	12-35天，平均22天 A mean of 22 days (range, 12-35 days)
普免活灭灭 Administration of a live vaccine + an activated vaccine + an activated vaccine to the entire pig population	69	7-16天，平均11天 A mean of 11 days (range, 7-16 days)
普免灭灭 Administration of an activated vaccine + an activated vaccine to the entire pig herd	28	6-20天，平均14天 A mean of 14 days (range, 6-20 days)
返饲加灭灭 Exposure of healthy pigs to feces or gastric contents from infected pigs plus an activated vaccine + an activated vaccine	12	9-25天，平均12天（有1个场3个月后再次波动） A mean of 12 days (range, 9-25 days) (recurrence in 1 farm after 3 months)

- **临床数据表明：在规模化猪场针对病毒性腹泻做到精准检测、精准免疫，是可以实现有效防控的，进而减少猪群的死淘率。**

  Clinical data showed that accurate testing and appropriate immunization were able to achieve effective prevention and control of viral diarrhea, and then reduce the mortality-culling rate in large-scale swine farms.

6. 腹泻防控新技术开发——PEDV亚单位疫苗

Development of new technologies for diarrhea prevention and control ——PEDV Subunit Vaccine

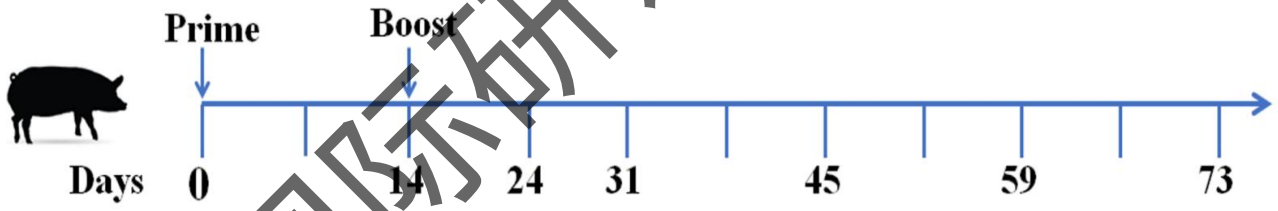


表达水平：4g/L

Expression level: 4 g/L

适合皮下无针免疫

Indicated forsubcutaneous needle-Free immunization



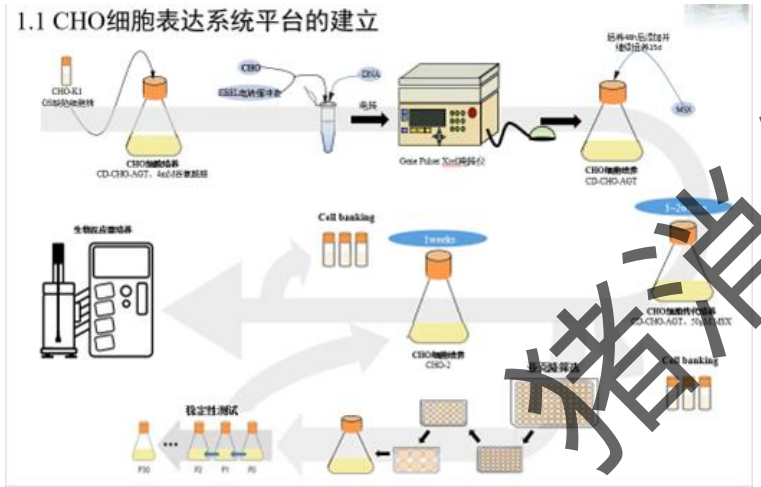
血清中和抗体效价检测

Serum neutralizing antibody (Nab) titer determination

仔猪编号 Piglet No.	AJ1102					
	14d	24d	31d	45d	59d	73d
1	<1:4	1:64	1:128	1:128	1:128	1:91
2	<1:4	1:109	1:128	1:161	1:141	1:128
3	<1:4	1:128	1:150	1:181	1:161	1:141
4	<1:4	1:51	1:128	1:181	1:128	1:109
5	<1:4	1:51	1:128	1:80	1:128	1:109

1.1 CHO细胞表达系统平台建立

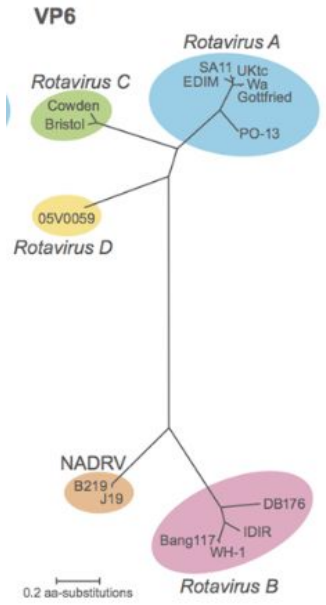
1.1 CHO cell expression system establishment



7.1 PoRV 病原学
Etiology of Diarrhea Caused by PoRV

➢ **血清群：依据VP6蛋白进行分群，已证实至少有5种血清群(A/B/C/E/H)可以感染猪**

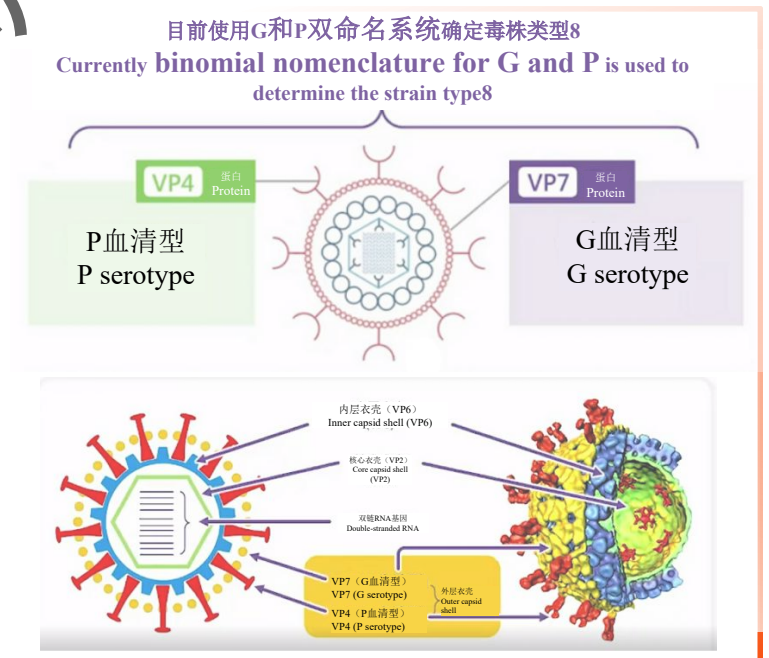
Serogroups: Grouping was carried out based on VP6 proteins. At least 5 serogroups (A/B/C/E/H) have been shown to infect pigs.



● **血清型：**
Serotypes:

➢ (Glycosylated)分成27种不同G型依据VP7蛋白；
Classified into into 27 different G types based on VP7 protein (Glycosylated);

➢ 依据VP4蛋白(Protease sensitive)分成37种不同P型
Classified into into 37 different P types based on VP4 protein (Protease sensitive);



➢ **基因型：依据VP7和VP4的核苷酸序列分成不同G基因型和P基因型**

Genotypes: Classified into different G and P genotypes based on nucleotide sequences of VP7 and VP4

7.2 PoRV理化特性
Physicochemical Properties of PoRV

- **对环境抵抗力强、存活长；**

  High environmental resistance and long survival;

- **常用消毒剂消毒效果不理想；**

  Not disinfected well by commonly used disinfectants;

- **1-8周龄仔猪易感；**

  Piglets aged 1-8 weeks were susceptible;

- **1-2周龄仔猪死亡率15%左右；**

  The mortality of piglets aged 1-2 weeks was about 15%;

- **3周龄以上症状较轻，死亡率也较低，但会导致猪跛行以及生长速度减缓；**

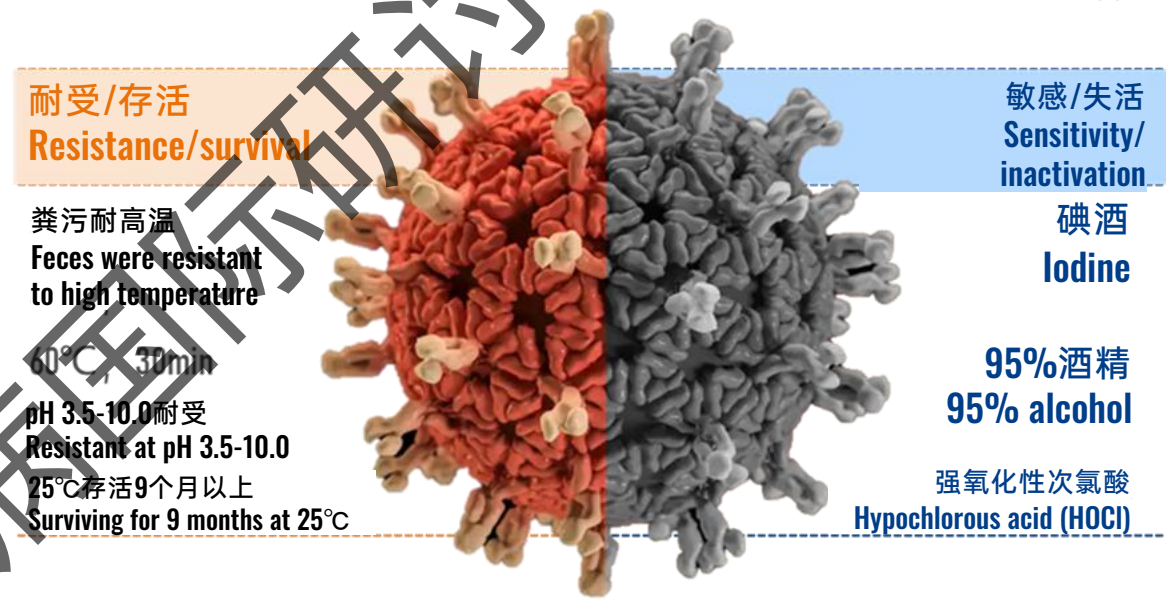
  In piglets aged 3 weeks, symptoms were less severe with a low mortality but would lead to lameness and slower growth;

- **初产母猪的仔猪比经产母猪的仔猪更易感；**

  Piglets from primiparous sows were more susceptible than piglets from parturient sows;

- **成年猪血清抗体检出率40%-100%，一旦感染以后每年发生，难以净化。**

  The serum antibody detection rate in adult pigs was 40%-100%. Once they were infected within this virus, infection occurred every year thereafter, indicating that this virus is difficult to remove.

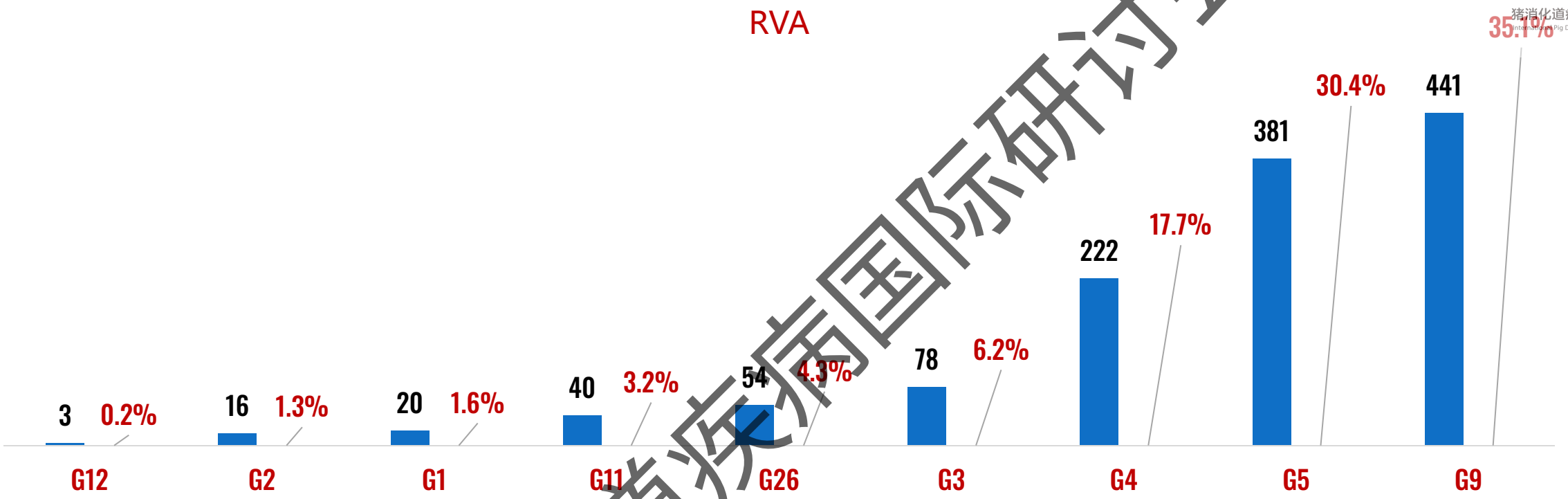


7.3 PoRV 感染临床表现
Clinical manifestations of PoRV infection



发病日龄 Days of age at which the disease occurred	临床症状 Clinical symptom	病死率 Mortality
1周龄内 Within 1 week of age	呕吐、水样或黄绿色或黄色糊状、脱水、消瘦 Vomiting, watery or yellow-green/yellow mucoid feces, dehydration, emaciation	最高可达100% Up to 100%
1-3周龄 1-3 weeks of age	呕吐、黄色粘稠或稀便，症状较轻，一般隔离1-3天可恢复 Vomiting, yellow mucoid or loose feces, mild symptoms, usually recovery in 1-3 days of isolation	10%-50%
3-8周龄 3-8 weeks of age	黄色或深绿色稀便，发病时间短，恢复快，死亡率相对较低 Yellow or dark green loose stools, short onset, quick recovery, a relatively low mortality	10%-30%
8周龄以上 More than weeks of age	黄色或灰绿色或水泥样粪便，一般不致死 Yellow/grayish green or cement-like feces, usually not lethal	<5%

7.4 PoRV分子流行病学
Molecular Epidemiologic Analysis of PoRV



2023全年共1255份RVA阳性样品进行VP7基因测序分析，其中G9亚型占比35.1%（441株）、G5亚型占比30.3%（381株）、G4亚型占比17.7%（222株）

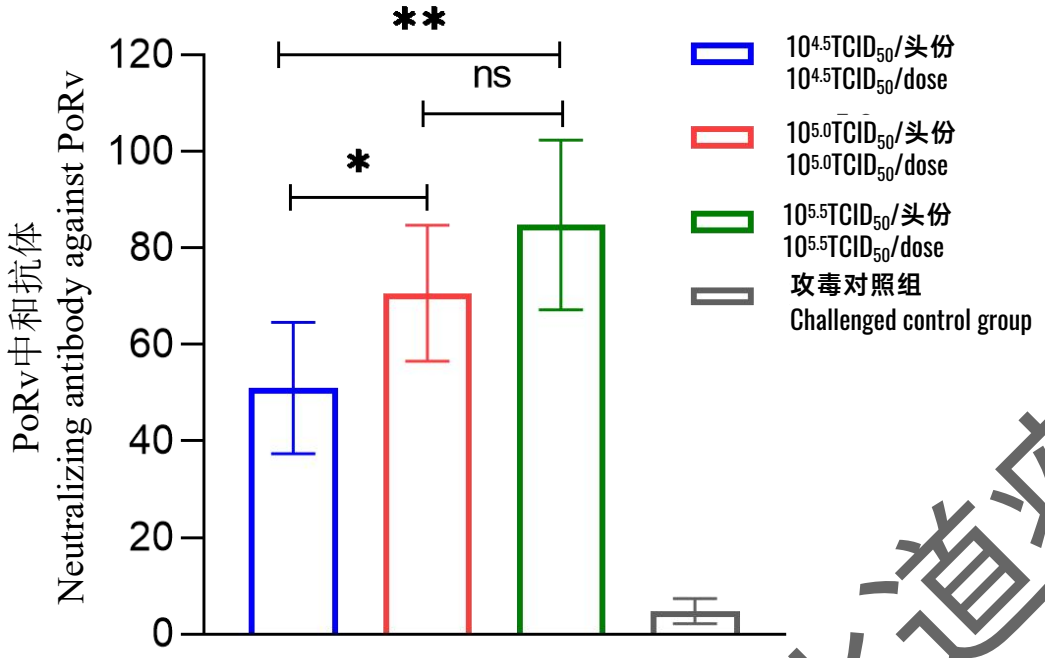
A total of 1255 RVA-positive samples were analyzed by VP7 gene sequencing throughout 2023. Of the subtypes detected, G9 subtype accounted for 35.1% (441 strains), G5 subtype accounted for 30.3% (381 strains), and G4 subtype accounted for 17.7% (222 strains).

8. PoRV 防控新技术开发——PoRV 活疫苗

Development of new technology for PoRV prevention and control —— PoRV live vaccine

➢ PEDV-PoRV二联活疫苗效力评估——中和抗体与攻毒保护

Evaluation of the efficacy of the PEDV-PoRV live vaccine--neutralizing antibodies and protection against challenge



A：$10^{4.5}TCID_{50}$/头疫苗免疫组；B：$10^{5.0}TCID_{50}$/头疫苗免疫组；

A: $10^{4.5}TCID_{50}$/dose vaccine group; B: $10^{5.0}TCID_{50}$/dose vaccine group;

C：$10^{5.5}TCID_{50}$/头疫苗免疫组；D：攻毒对照组

C: $10^{5.5}TCID_{50}$/dose vaccine group; D: Challenged control group

➢ 二联活疫苗以$10^{5.0}TCID_{50}$/头份的剂量免疫母猪所产仔猪中和抗体水平即可达到保护标准。

Neutralizing antibody levels in piglets from sows immunized with the vaccine at a dosage of $10^{5.0}TCID_{50}$/dose can achieve protection.

➢ 二联活疫苗以$10^{5.0}TCID_{50}$/头份的剂量免疫仔猪攻毒后均可提供80%及以上保护率。

The vaccine provided 80% or more protection in all piglets immunized at a dosage of $10^{5.0}TCID_{50}$/dose after challenge.

8. PoRV 防控新技术开发——PoRV 灭活疫苗

Development of new technology for PoRV prevention and control —— PoRV Inactivated vaccine

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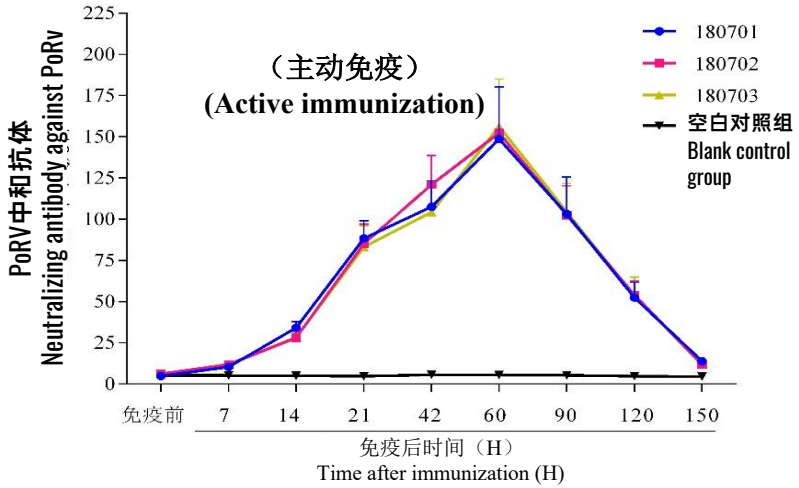
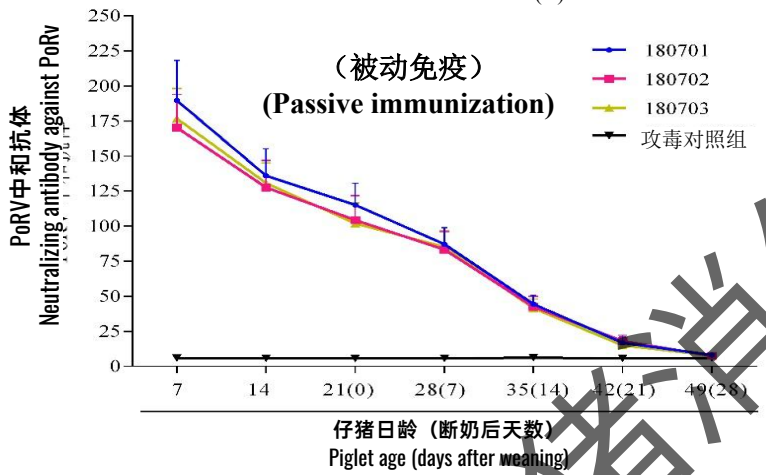
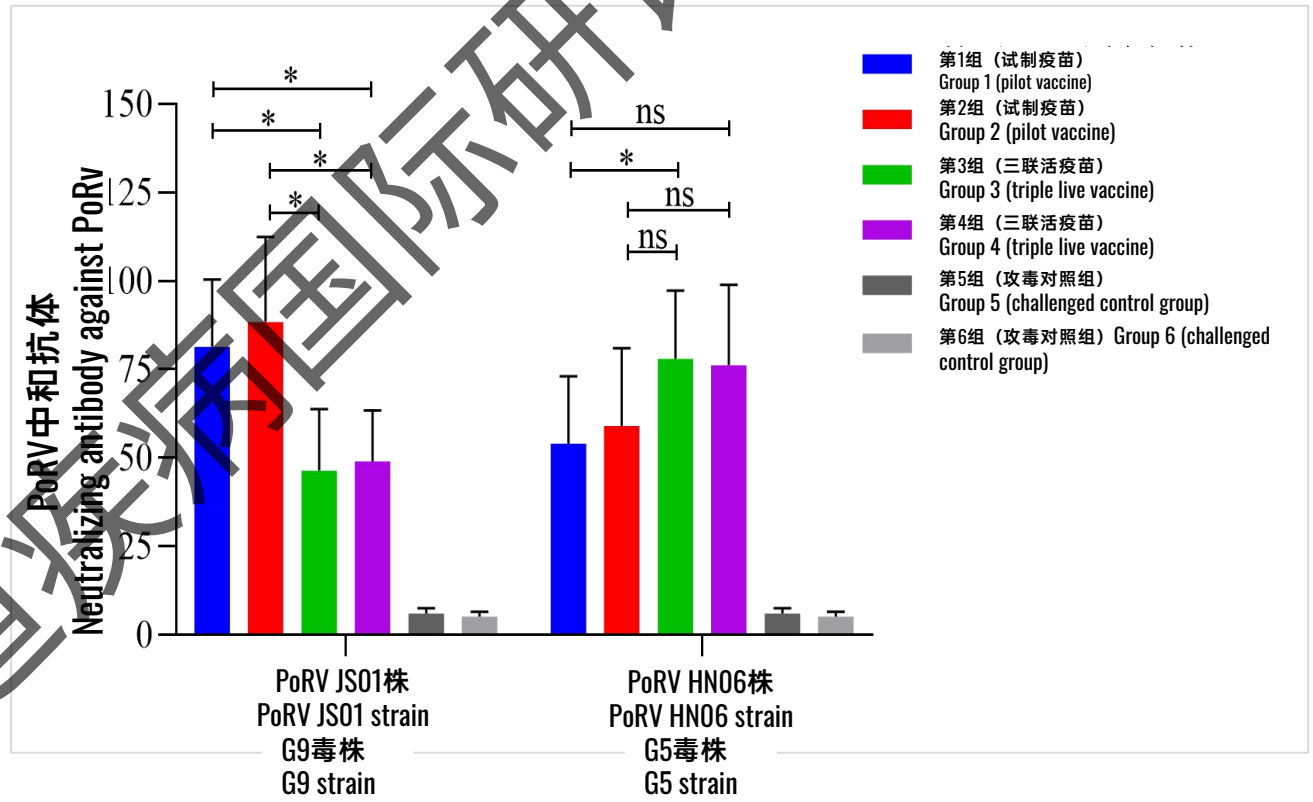
➢ PEDV-PoRV二联灭活疫苗免疫持续期与交叉保护

Immunization duration and cross-protection with the PEDV-PoRV inactivated vaccine





RV抗体消长规律
RV antibody change



➢ 中和抗体交叉保护结果显示：该疫苗对G9型有较高中和病毒能力，G5型有一般的中和病毒能力。

The results of cross-protection by neutralizing antibodies showed that the vaccine had high virus-neutralizing capacity against G9 and intermediate virus-neutralizing capacity against G5.

9. PDCoV首次在规模化猪场爆发

The First PDCoV Outbreak Occurred in Large-scale Swine Farms

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International Pig Digestive Diseases Symposium

- 2014年2月，美国俄亥俄州农业部门实验室在送检的腹泻样品中，发现有一个猪场并没有PEDV、TGEV和PoRV感染，但同样发生严重的腹泻，深入研究发现：腹泻样品中可以检测到PDCoV

  In February 2014, in the diarrhea samples sent for testing, the Ohio Department of Agriculture laboratory found a swine farm that was not infected with PEDV, TGEV and PoRV, but had the same severe diarrhea, and an in-depth study revealed that PDCoV was detectable in the diarrhea samples.

- 截止到2014年底，美国有20多个州发生PDCoV

  By the end of 2014, PDCoV was detected in more than 20 U.S. states.

Detection and Genetic Characterization of Deltacoronavirus in Pigs, Ohio, USA, 2014

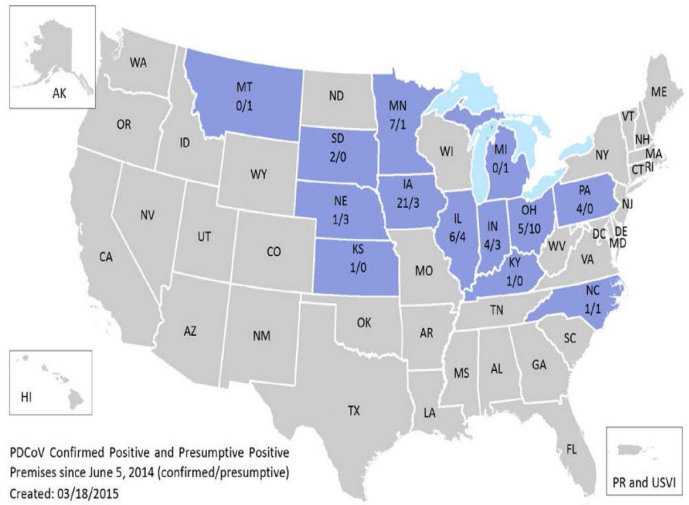
Leyi Wang,[1] Beverly Byrum, and Yan Zhang[1]

Table 1. Detection of porcine coronavirus HKU15 and porcine epidemic diarrhea virus in samples from pigs on 5 farms in Ohio, USA, 2014*

Farm no	No. samples positive/total samples tested for: Porcine coronavirus HKU15	Porcine epidemic diarrhea virus
1	12/12†	0/12
2	8/11‡	2/11
3	8/8	1/8
4	4/4	1/4
5	7/7	1/7

*Porcine coronavirus HKU15 was detected by reverse transcription PCR. Porcine epidemic diarrhea virus was detected by real-time reverse transcription PCR. The samples consisted of 42 feces and intestine samples from pigs with diarrheal disease.
†Of the positive samples, 3 were from piglets.
‡Of the positive samples, 2 were from piglets.

Map 2. PDCoV: Cumulative Confirmed and Presumptive PDCoV Positive Premises since June 5, 2014



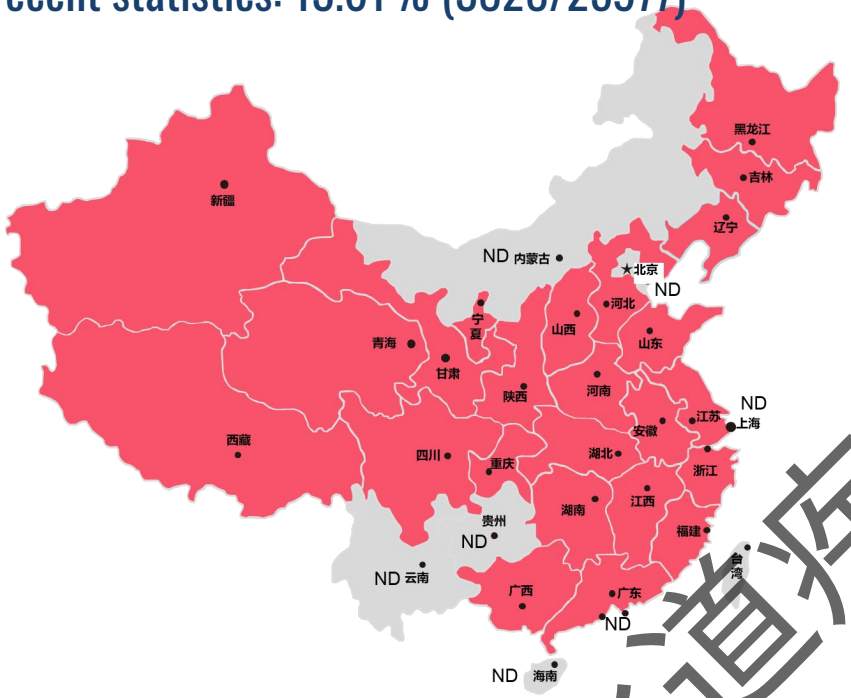
www. aasv.org

10. PDCoV在中国大陆广泛存在

PDCoV was Widespread in Mainland China

最近的统计数据：13.61% (3828/25977)

Most recent statistics: 13.61% (3828/25977)



Dong et al., Emerg Infect Dis, 2015

Song et al. Transbound Emerg Dis, 2015

Zhang et al., Prev Vet Med. 2019

PDCoV抗原阳性率介于10-33%，但抗体阳性率明显高于抗原阳性率

Positive rate for the PDCoV antigen fell within the range of 10-33%. However, the positive rate for the antibody was significantly higher than that for the antigen.

PDCoV与PEDV、PoRV的共感染比较普遍

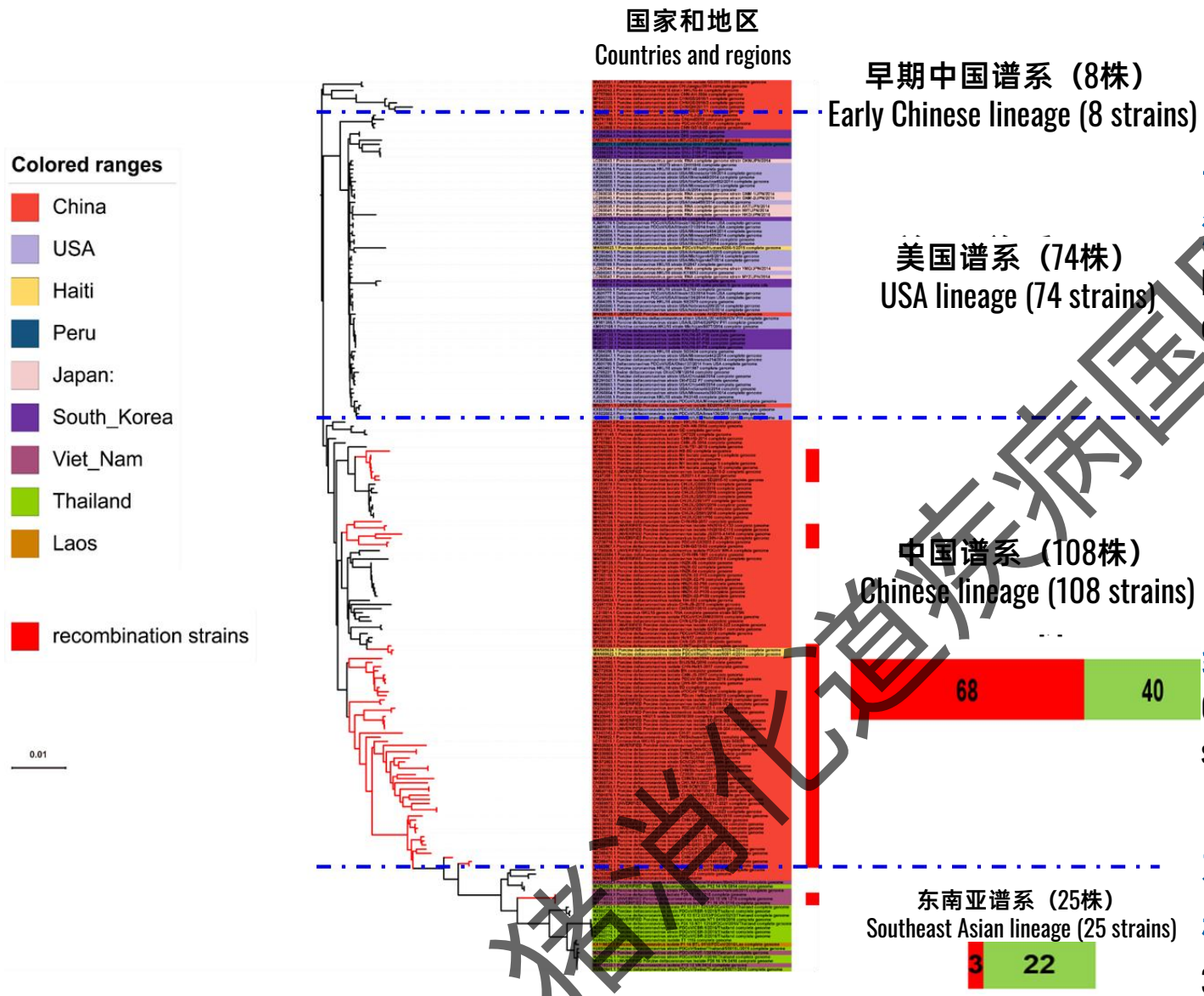
Co-infection of PDCoV with PEDV and PoRV was commonly found.

可以从2004年保存的腹泻样品中检测到PDCoV

PDCoV was detectable in diarrhea samples saved from 2004

11. 中国、东南亚PDCoV毒株重组频繁

Frequent Recombination of PDCoV Strains in China and Southeast Asia



早期中国谱系和美国谱系中没有检测到重组毒株

No recombinant strains were detected in the early Chinese lineage and USA lineage

中国谱系中重组毒株为68株，非重组毒株为40株

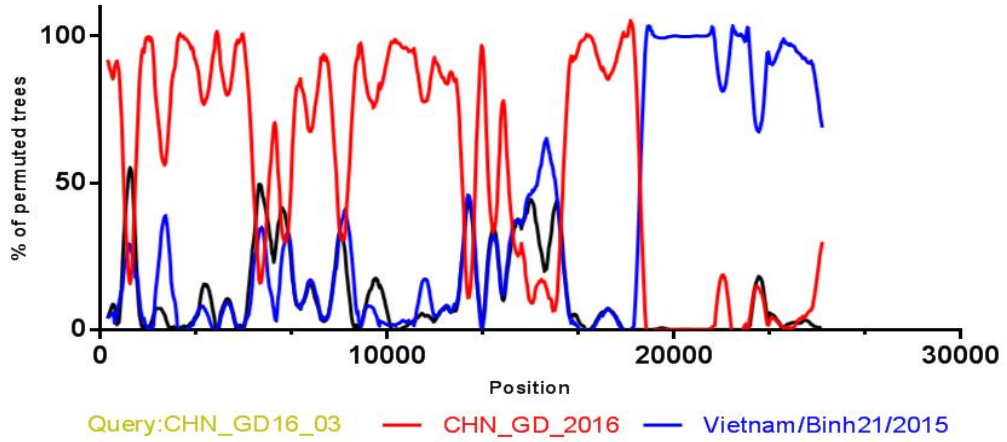
68 recombinant strains and 40 non-recombinant strains in the Chinese lineage.

东南亚谱系中重组毒株为3株，非重组毒株为22株

3 recombinant strains and 22 non-recombinant strains in the Southeast Asian lineage.

致病性更强的东南亚PDCoV可能已经传入我国

More strongly pathogenic Southeast Asian PDCoV may have spread to China.



CHN_GD16_03是由CHN_GD_2016和Vietnam/Binh21/2015重组而来，CHN_GD16_03在S之后的序列与越南毒株有很强的相似性，提示越南毒株很可能已经传播到广东

CHN_GD16_03 was recombined from CHN_GD_2016 and Vietnam/Binh21/2015, and the sequence of CHN_GD16_03 after S showed strong similarity with the Vietnamese strain, suggesting that the Vietnamese strain has probably spread to Guangdong

frontiers in Veterinary Science | July 2021 | Volume 8 | Article 7[illegible]

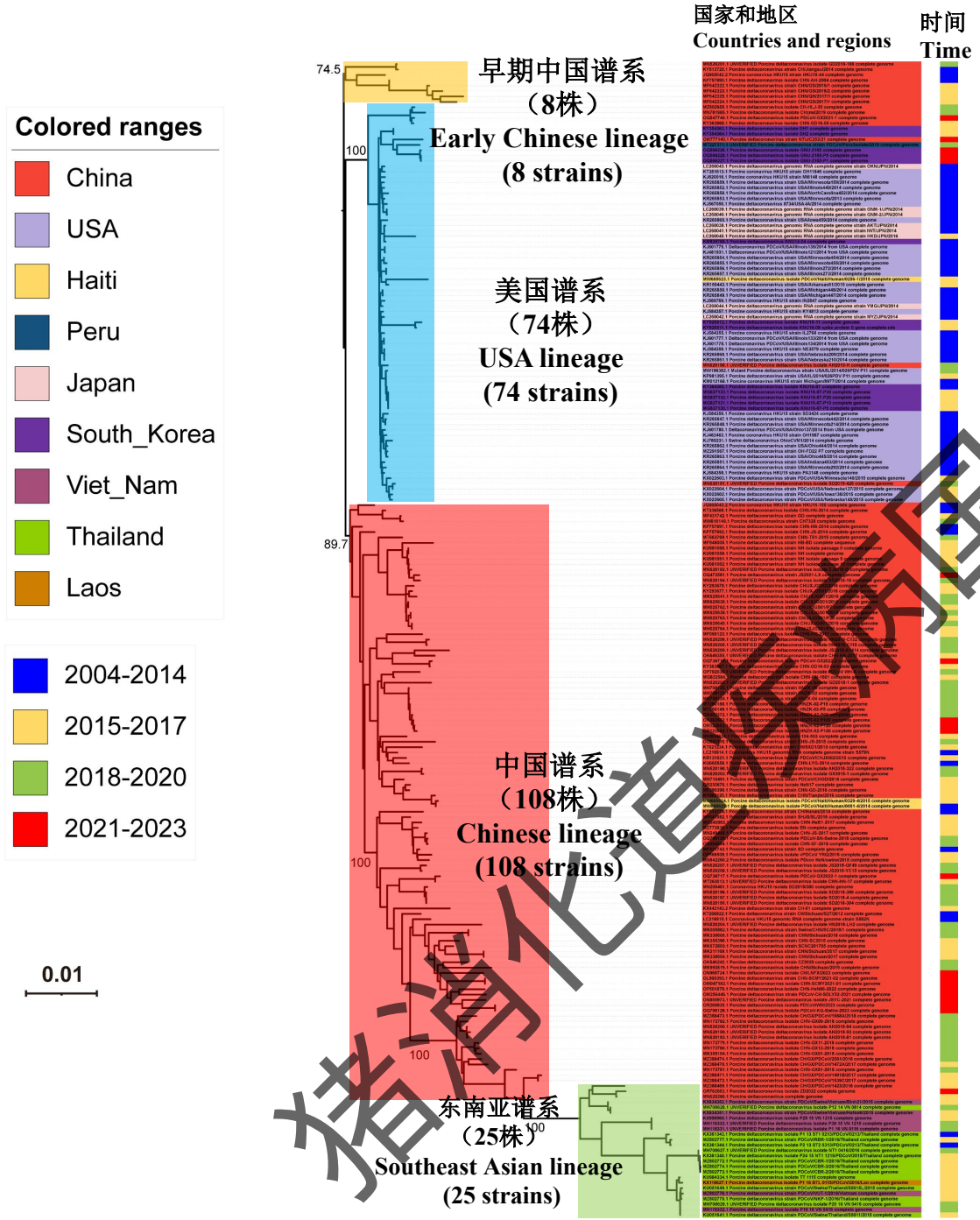
Genetic Characteristics and Pathogenicity of a Novel Porcine Deltacoronavirus Southeast Asia-Like Strain Found in China

Hejie Wang[1†], Yibin Qin[2†], Wu Zhao[2†], Tingting Yuan[1], Chunjie Yang[1], Xue Mi[1], Ping Zhao[1], Ying Lu[1], Bingxia Lu[2], Zhongwei Chen[2], Ying He[2], Cui Yang[3], Xianfeng Yi[3], Zhuyue Wu[3], Ying Chen[1], Zuzhang Wei[1], Weijian Huang[1] and Kang Ouyang[1]*

Vet Med Sci. 2020;6:854–859.

Emergence of Thailand-like strains of porcine deltacoronavirus in Guangxi Province, China

Haixin Huang[1,2] | Yanwen Yin[3] | Wei Wang[2,4] | Liang Cao[2] | Wenchao Sun[1,2] | Kaichuang Shi[3] | Huijun Lu[2] | Ningyi Jin[1,2]



截止到2024年1月，GenBank数据中总共公布215条PDCoV全基因组序列

As of January 2024, a total of 215 PDCoV whole genome sequences have been published in the GenBank data.

2021-2023年中国分离毒株逐步接近东南亚毒株

Chinese isolates gradually approached Southeast Asian strains in 2021-2023.

12. PDCoV感染引起腹泻、死亡的典型案例（国内案例）

Typical Cases of PDCoV Infection Causing Diarrhea and Death (domestic cases)

- **湖北某猪场，2015年底发生腹泻(PEDV/TGEV/PoRV均为阴性)，PDCoV阳性**

  In a swine farm in Hubei, diarrhea (negative for PEDV/TGEV/PoRV) occurred with a positive result for PDCoV in late 2015.

- **育肥猪、后备母猪先发病，随后传播到产房**

  The disease occurred first in fattening pigs and breeding stock sows, and then spread to the farrowing house.

- **2016年1-4月产房仔猪死亡率13.1%(1714/13098)**

  The mortality of piglets in the farrowing house was 13.1% (1714/13098) in January-April 2016.

- **后备母猪PDCoV阳性率高达86.7%(26/30)**

  The positive rate for PDCoV in breeding stock sows was up to 86.7% (26/30).

小结
Summary

- **从近几年全球PDCoV监测数据看，PDCoV的致病性有增强的趋势**

  The global PDCoV surveillance data in recent years shows that the pathogenicity of PDCoV tends to increase

- **致病性更强的东南亚PDCoV已经传入我国，尤其是南方地区，要加强监测**

  More strongly pathogenic Southeast Asian PDCoV has spread to China, especially in the south, and surveillance should be strengthened.

- **尽管东南亚高致病性PDCoV传入、国内毒株重组频繁，但主要免疫原性蛋白S的变异相对较小，不同谱系间具有很好的交叉免疫保护**

  Despite the spread of highly pathogenic PDCoV from Southeast Asia and the frequent recombination of domestic strains, the variation of the main immunogenic protein S is relatively small, and there is good cross-immunoprotection between different lineages.

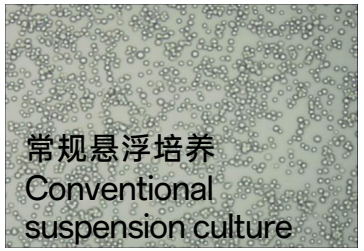
- **当前是控制PDCoV的最佳时机!**

  Now is the best time to take control of PDCoV!

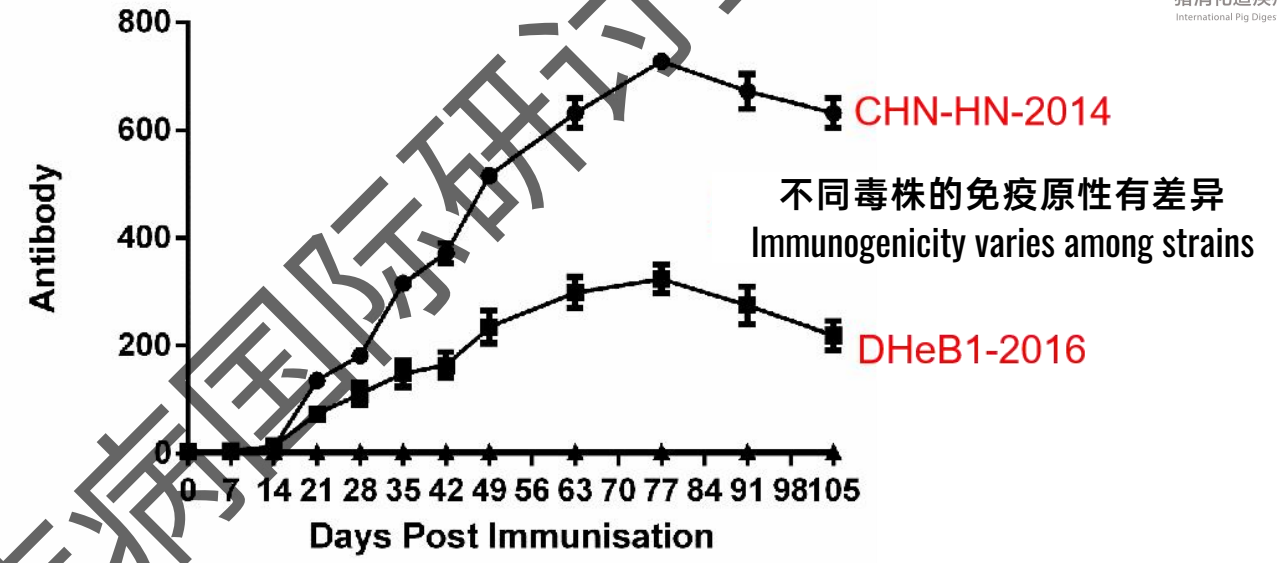
13. PDCoV CHN-HN-2014灭活疫苗产品特点

Product features of an Inactivated PDCoV CHN-HN-2014 Vaccine

片状载体悬浮培养
Suspension culture with a flake carrier



常规悬浮培养
Conventional suspension culture



- **悬浮培养，抗原含量高 ($10^{8.0}TCID_{50}$/ml)**

  Suspension culture with a high antigen content ($10^{8.0}TCID_{50}$/ml)

- **采用片状载体，细胞成份少，抗原纯净度高**

  Few cellular components with high antigen purity in the presence of the flake carrier

- **无血清培养、无细胞碎片，应激小**

  Serum-free culture, no cell debris, low stress

- **PDCoV CHN-HN-2014具有良好的免疫原性**

  PDCoV CHN-HN-2014 has good immunogenicity.

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PART 02

临床猪病毒性腹泻的防控案例分析

Clinical Analysis of Prevention and Control Cases of Viral Diarrhea in Pigs

1. 猪流行性腹泻防控案例——猪场背景信息

Prevention and Control Cases of PEDV - Background information on swine farms

- **西北某猪场设计规模6000头，场内实际存栏5200头左右。**

  A swine farm in Northwestern China designed a scale of production of 6,000 pigs, and had an actual stock of about 5,200 pigs.

- **场内结构包含：后备舍、公猪舍、配怀舍和分娩舍，为多点式生产。**

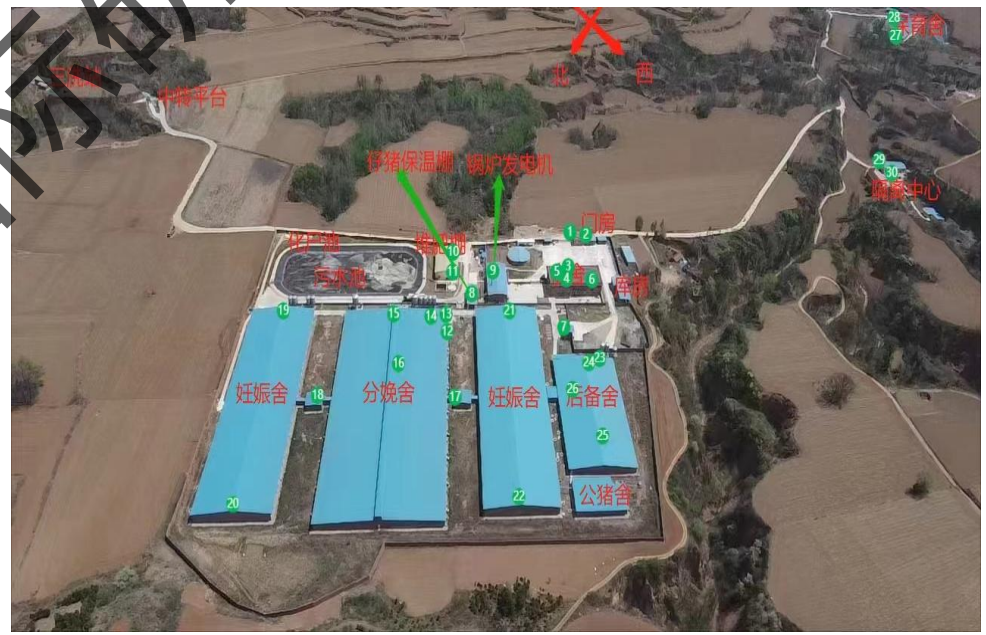
  The farm was structurally composed of a house for breeding stock pigs, a boar house, a mating house and a farrowing house for multi-point production.

- **全场猪群为一个整体大循环，周生产模式。**

  The whole herd represented an entire big cycle of production.

- **腹泻苗免疫程序一直采用（灭活苗+灭活苗）跟胎免疫方式，且未按照集团规定免疫程序执行。**

  The program for immunization with diarrhea vaccines always used an inactivated vaccine + inactivated vaccine for empty sows, and immunization was not carried out in accordance with the Group's prescribed immunization program.



2. 流行性腹泻防控案例——发病损失情况

Prevention and Control Cases of PEDV - Losses from the disease

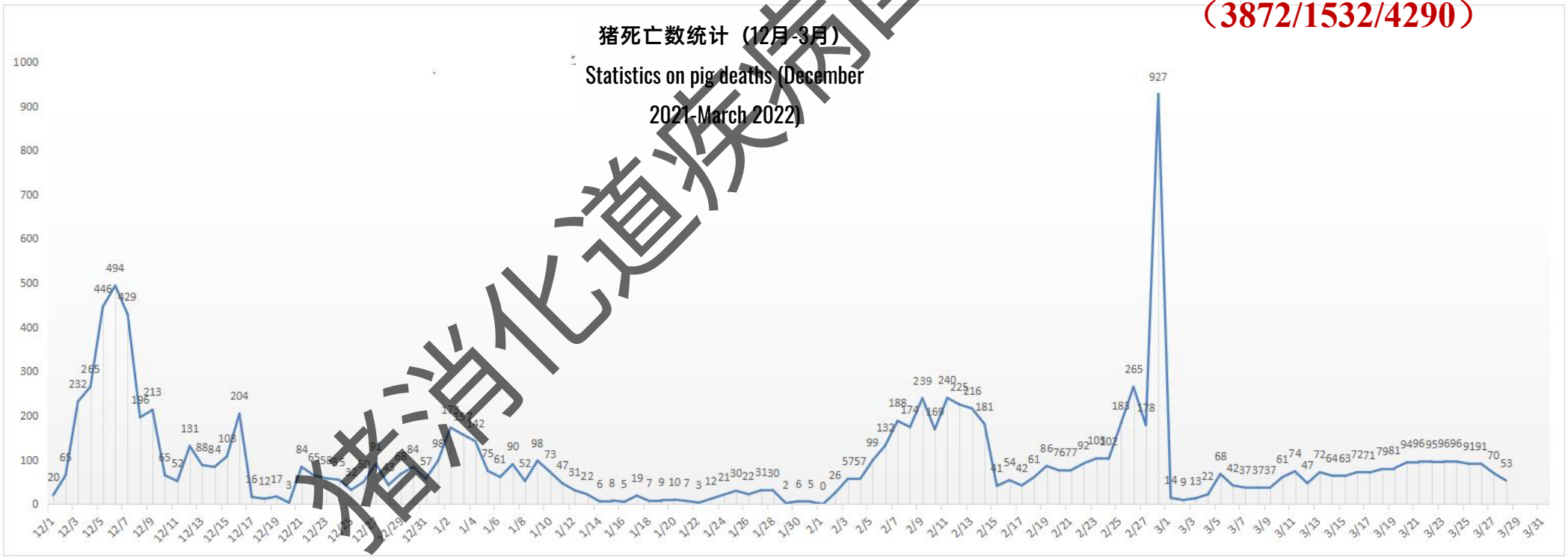
- 2021年11月底场内妊娠舍母猪发生腹泻，接着产房仔猪出现，期间一直持续不断，2022年1月份有好转。

Diarrhea occurred in sows in the farm's gestation house at the end of November 2021, followed by occurrence of diarrhea in piglets in the farrowing house, and persistent diarrhea throughout the period, with an improvement in January 2022.

- 2022年2月初再次爆发，仔猪临床表现呕吐,胃内含有未消化的乳凝块，腥臭味水样腹泻，脱水严重死亡，单栋猪舍死亡率达40%-90%。

In early February 2022, there was another outbreak. Piglets clinically manifested as vomiting, undigested milk clots in the stomach, fishy-smelling watery diarrhea, serious dehydration and death. The mortality in a single house reached 40%-90%.

（3872/1532/4290）



3. 猪流行性腹泻防控案例——临床表现

Prevention and Control Cases of PEDV - Clinical manifestations

仔猪拉稀脱水死亡

Piglets died of diarrhea and dehydration.

仔猪肠壁变薄、透明、胃内含有未消化的乳凝块

Piglets had thin, transparent intestinal walls and stomachs containing undigested milk clots.

- 基础母猪群（包括后备母猪）水样腹泻，比例10%左右，传播迅速，3-4即可自行恢复，无死亡；

  Watery diarrhea occurred in the basic sow herd (including breeding stock sows) with an incidence of about 10%, spread rapidly, resolve spontaneously after 3-4 days. No death occurred.

- 仔猪严重水样腹泻、呕吐，死亡率达90%以上。

  Serious watery diarrhea and vomiting occurred in piglets, with a resulting mortality of over 90%.

4. 猪流行性腹泻防控案例——实验室病原检测

Prevention and Control Cases of PEDV - Laboratory testing for pathogen detection

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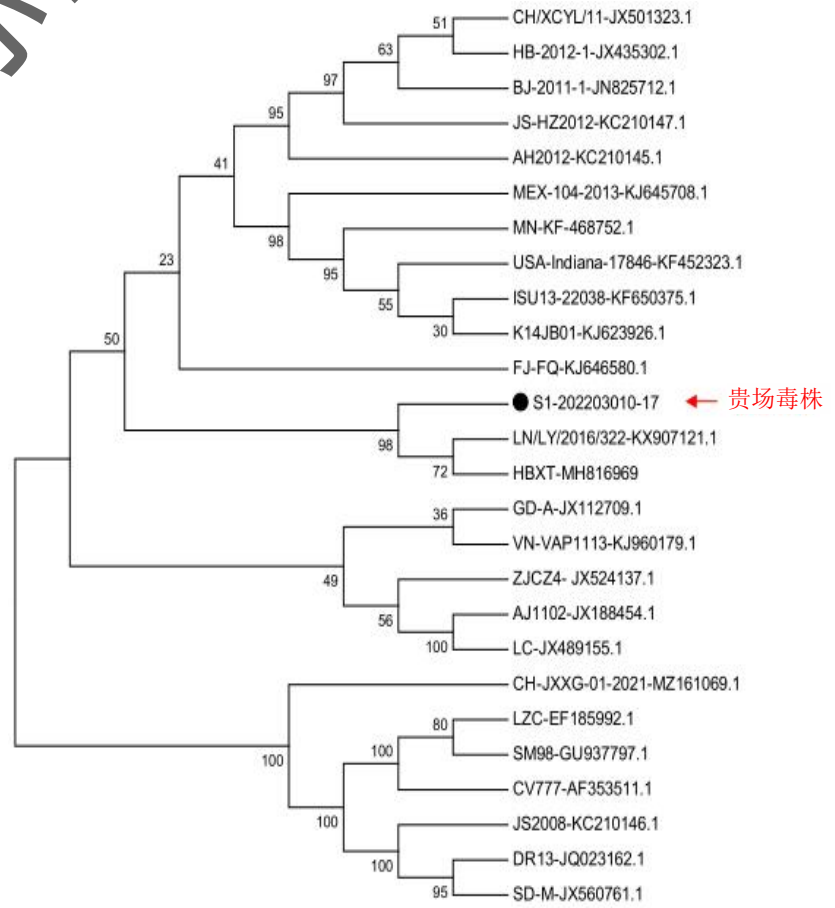
病原检测结果 Results from pathogen testing

病毒病原四项检测结果为：猪流行性腹泻病毒阳性率66.7%+猪德尔塔冠状病毒阳性率66.7%+轮状病毒阳性率100%；PEDV毒株为GIIa型变异毒株，RV为G9 型毒株。

Results form viral pathogen testing for four items: a positive rate of 66.7% for PEDV + a positive rate of 66.7% for porcine deltacoronavirus (PDCoV) + a positive rate of 100% for rotavirus; PEDV was a GIIa-type mutant strain, and RV was a G9 strain.

动物类别 Animal type	样品名称 Sample name	样品数量 Sample quantity
猪 Swine	肠道 Gastrointestinal tract	5合3份 3 aliquots from 5 boxes
检测项目 Test item	依据标准 Test rationale	检测结果 Result
猪流行性腹泻病毒核酸荧光RT-PCR检测 Fluorescence-based RT-PCR for the detection of PEDV	/	检测3份样品，其中2份阳性，1份阴性，详见附表。 3 sample aliquots were tested. Of them, 2 tested positive and 1 tested negative, as detailed in the attached table.
猪传染性胃肠炎病毒核酸荧光RT-PCR检测 Fluorescence-based RT-PCR for the detection of TGEV	DB33/T 2254-2020	检测3份样品，其中0份阳性，3份阴性，详见附表。 3 sample aliquots were tested. Of them, 0 tested positive and 3 tested negative, as detailed in the attached table.
猪轮状病毒核酸RT-PCR检测 RT-PCR for the detection of PoRV	GB/T 36871-2018	检测3份样品，其中2份阳性，1份阴性，详见附表。 3 sample aliquots were tested. Of them, 0 tested positive and 3 tested negative, as detailed in the attached table.
猪Delta冠状病毒核酸荧光RT-PCR检测 Fluorescence-based RT-PCR for the detection of PDCoV	/	检测3份样品，其中2份阳性，1份阴性，详见附表。 3 sample aliquots were tested. Of them, 2 tested positive and 1 tested negative, as detailed in the attached table.
备注：无 Remark: None		

动物类别 Animal type	样品名称 Sample name	样品数量 Sample quantity
猪 Swine	拭子 Swab	合4份 4 aliquots
检测项目 Test item	依据标准 Test rationale	检测结果 Result
猪流行性腹泻病毒核酸荧光RT-PCR检测 Fluorescence-based RT-PCR for the detection of PEDV	/	检测4份样品，其中3份阳性，1份阴性，详见附表。 4 sample aliquots were tested. Of them, 3 tested positive and 1 tested negative, as detailed in the attached table.
猪传染性胃肠炎病毒核酸荧光RT-PCR检测 Fluorescence-based RT-PCR for the detection of TGEV	DB33/T 2254-2020	检测4份样品，其中0份阳性，4份阴性，详见附表。 4 sample aliquots were tested. Of them, 0 tested positive and 4 tested negative, as detailed in the attached table.
猪轮状病毒核酸RT-PCR检测 RT-PCR for the detection of PoRV	GB/T 36871-2018	检测4份样品，其中4份阳性，0份阴性，详见附表。 4 sample aliquots were tested. Of them, 4 tested positive and 0 tested negative, as detailed in the attached table.
猪Delta冠状病毒核酸荧光RT-PCR检测 RT-PCR for the detection of PDCoV	SN/T 5124-2019	检测4份样品，其中0份阳性，4份阴性，详见附表。 4 sample aliquots were tested. Of them, 0 tested positive and 4 tested negative, as detailed in the attached table.
备注：无 Remark: None		



5. 猪流行性腹泻防控案例——发病原因分析

Prevention and Control Cases of PEDV - Cause analysis of disease onset

- **本次疫情直接原因：PEDV+RV+PDCoV三重混合感染，没有免疫相应的疫苗**

  Direct cause of this outbreak: triple mixed infection of PEDV+RV+PDCoV without immunization with appropriate vaccine

- **本场疫苗免疫程序与整个集团公司规定程序不相符**

  The vaccine immunization program in this farm did not correspond to the Group's prescribed immunization program.

- **距离2公里处集团内另一猪场爆发PED疫情**

  PED outbreak occurred in another swine farm in the group 2 kilometers away

检测编号 Test No.	原始编号 Original No.	猪轮状病毒 Rotavirus
KQZD-202203010-B016	C01-C03	+弱 Weakly positive (+)
KQZD-202203010-B017	C04-C06	+弱 Weakly positive (+)
KQZD-202203010-B018	C07-C10	+弱 Weakly positive (+)
KQZD-202203010-B019	产房环境 Farrowing hous	+弱 Weakly positive (+)

说明：“+”表示阳性；“-”表示阴性。
Note: “+” denotes positive; “-” denotes negative

检测编号 Test No.	原始编号 Original No.	猪Delta冠状病毒核酸荧光RT-PCR检测 Fluorescence-based RT-PCR for detection of PDCoV	
		Ct值 Ct value	判定 Interpretation
KQ-202202119-B073	1、2	31.44	+
KQ-202202119-B074	3、4	无Ct值 No Ct value	–
KQ-202202119-B075	5	29.55	+
阴性对照 Negative control (NC)		无Ct值 No Ct value	–
阳性对照 Positive control (PC)		14.13	+

说明：“+”表示阳性；“-”表示阴性。Note: “+” denotes positive; “-” denotes negative

检测编号 Test No.	原始编号 Original No.	猪流行性腹泻病毒核酸荧光RT-PCR检测 Fluorescence-based RT-PCR for detection of PEDV	
		Ct值 Ct value	判定 Interpretation
KQZD-202203010-B016	C01-C03	26.93	+
KQZD-202203010-B017	C04-C06	28.02	+
KQZD-202203010-B018	C07-C10	19.28	+
KQZD-202203010-B019	产房环境 Farrowing house	无Ct值 No Ct value	–
阴性对照 Negative control (NC)		无Ct值 No Ct value	–
阳性对照 Positive control (PC)		20.78	+

说明：“+”表示阳性；“-”表示阴性。Note: “+” denotes positive; “-” denotes negative.

生产猪 Production pigs	2、8月 Feb., Aug.	伪狂犬（活苗） Pseudorabies (live vaccine)	科前 Keqian	1头份 Keqian	肌注 Intramuscular injection
	5、11月 May, Nov.	伪狂犬（死苗） Pseudorabies (inactivated vaccine	科前 Keqian	1头份 Keqian	肌注 Intramuscular injection
	妊娠70天 70 days pregnant	腹泻（活苗） Diarrhea (live vaccine	科前 Keqian	1头份 Keqian	肌注 Intramuscular injection
	妊娠90天 90 days pregnant	腹泻（死苗） Diarrhea (inactivated vaccine)	科前 Keqian	1头份 Keqian	肌注 Intramuscular injection
	妊娠100天 100 days pregnant	腹泻（死苗） Diarrhea (inactivated vaccine)	科前 Keqian	4ml	肌注 Intramuscular injection

6. 猪流行性腹泻防控案例——内部生物安全漏洞大

Prevention and Control Cases of PEDV - Large internal biosecurity vulnerability

- **产房洗消不到位；**

Cleaning and disinfection of farrowing houses were not put in place.

- **存在人员、工具的交叉；**

There was a crossover of people and tools.

- **粪便不清理、发病仔猪与母猪未隔离。**

Feces were not cleaned up, and sick piglets were not isolated from sows.

2天洗消、上猪，空栏洗消时间短，湿度大，洗消不彻底
A short interval of 2 days between decontamination and transfer of sows onto farrowing beds caused a high humidity and incomplete decontamination

7. 猪流行性腹泻防控案例——猪群健康问题

Prevention and Control Cases of PEDV - Herd health problems

- **饲喂管理不到位，母猪群体况差，20%以上母猪膘情差**

  Inadequate feeding management, poor sow herd condition, more than 20% of sows being poorly fattened

- **猪群疫苗免疫操作不到位，母猪颈部脓肿严重比例较高（70%），免疫效果差**

  Inadequate herd immunization practices, a high percentage (70%) of sows with serious neck abscesses, poor immunological efficacy

- **猪群结构严重老龄化，7胎以上母猪占比68%**

  Serious aging of herd structure, 68% of sows with more than 7 litters

8.1 猪流行性腹泻防控案例——防控措施1（疫苗紧急免疫）

Prevention and Control Cases of PEDV - Prevention and control measure 1 (emergency immunization)

类别 Category	特征 Characteristics	推荐免疫程序 Recommended immunization program
GGP/GP场 GGP/GP farm	持续无PEDV野毒检出 Sustained absence ofwild-type PEDV detected	配种前：140日龄和180日龄免疫“科泻宁”两次 Pre-vaccination: two doses against “Kexiening” at 140 and 180 days of age. 经产母猪：产前6周-4周-2周，分别免疫“科泻宁” Parturient sows: immunized with“Kexiening”at 6-4-2 weeks before farrowing
阳性稳定场 Positive stable farm	偶有PEDV病原检出，但CT值高于33，且CT无降低趋势，无腹泻临床症状 Occasionally PEDV pathogen was detected, but the CT value was higher than 33 and there was no tendency for the CT to decrease. Absence of clinical symptoms of diarrhea	后备母猪 120-140日龄：弱毒活疫苗（口服或肌注或皮下）1头份 180-200日龄：弱毒活疫苗+灭活疫苗（肌注或皮下）1头份+2ml/头 经产母猪（跟胎） 每胎次产前4-5周：弱毒活疫苗 1头份+灭活疫苗 2ml/头 产前2-3周：灭活疫苗 2ml/头 季节普免 9-10月份：弱毒活疫苗（产前1月内母猪除外）1头份+灭活疫苗 2ml/头 10-11月份：灭活疫苗 2ml/头 Breeding stock sows 120-140 days of age: 1 dose of the live attenuated vaccine (oral or intramuscular or subcutaneous) 180-200 days of age: 1 dose of the live attenuated vaccine+ inactivated vaccines （ intramuscular or subcutaneous) +2 ml/pig Parturient sows (empty sows) 4 -5 weeks before each parity : 1 dose of the live attenuated vaccine+ inactivated vaccines 2 ml/pig 2-3 weeks before delivery: inactivated vaccine 2 ml/pig Immunization of the entire herd in seasons September-October : 1 dose of the live attenuated vaccine+ inactivated vaccine (except sows within 1 month before delivery) + inactivated vaccine 2 ml/pig October-November: inactivated vaccine 2 ml/pig
暴发场 Farms where an outbreak occurs	场内正在发生PED，产房仔猪腹泻，死亡率高 PED is occurring in the farm. Piglets in the farrowing house suffer from diarrhea with a high mortality.	全群母猪紧急免疫 普免弱毒活疫苗 1头份+灭活疫苗2ml/头，间隔10天，再次普免灭活疫苗2ml/头； Emergency immunization of the whole herd of sows Immunization of the entire herd with 1 dose of the live attenuated vaccine + inactivated vaccine 2 ml/pig, 10 days apart, re-immunization of the entire herd with inactivated vaccine 2 ml/pig;

8.2 猪流行性腹泻防控案例——防控措施2（生产物资采购）

Prevention and Control Cases of PEDV - Prevention and control measure 2 (procurement of production materials)

猪消化道疾病国际研讨会
International Pig Digestive Diseases Symposium

生产所需物资采购

Procurement of materials required for production

- 高压冲洗枪头及枪管
  High-pressure pipette tip and pipette
- 柴油消毒机4台
  4 diesel sterilizers
- 脚踏盆及洗手盆
  Disinfectant hand/foot baths
- 背负式喷雾器
  Backpack sprayer
- 花洒
  Shower head
- 饲料推车
  Feed trolley
- 保温灯及配套产品
  Heat preservation lamp and matching products
- 漂白粉
  Bleaching powder
- 防护服
  Protective clothing
- 鞋套及手套
  Shoe covers and gloves
- 其他生产所需物资
  Other materials required for production

8.3 猪流行性腹泻防控案例——防控措施3（生产管理加强）

Prevention and Control Cases of PEDV - Prevention and control measure 3 (strengthening of production management)

产房洗消、白化、烘干、空栏
Cleaning and disinfection of farrowing houses, with whitening, drying and empty

产房过道白化、人员工具防交叉
Whitening of the passageway in the farrowing house, and prevention of crossover of personnel and tools

清粪、撒干燥粉、人员禁止上产房
Cleaning feces, spreading drying powder, prohibiting personnel from reaching the farrowing house

产房升温、仔猪断水补液、隔离清群
Warming the farrowing house, fluid replacement for piglets weaned from water, isolation and decontamination of the herd

传染源隔离：低日龄发病猪只无害化处理，7日龄以上提前断奶护理；

Isolation of sources of infection: Harmless disposal of sick pigs aged a small number of days, and early weaning care for those aged more than 7 days;

- **产房静默生产：停止10日龄以内仔猪所有操作，停止接产；**

Quietly isolated production in the farrowing house: Stop all operations for piglets aged less than or equal to 10 days and stop picking up piglets;

温湿度的控制和仔猪断水；

Temperature and humidity control and water weaning of piglets;

- **粪便清理与内外环境消毒；**

Feces clean up and disinfection of internal and external environments;

- **人员隔离和防交叉管控；**

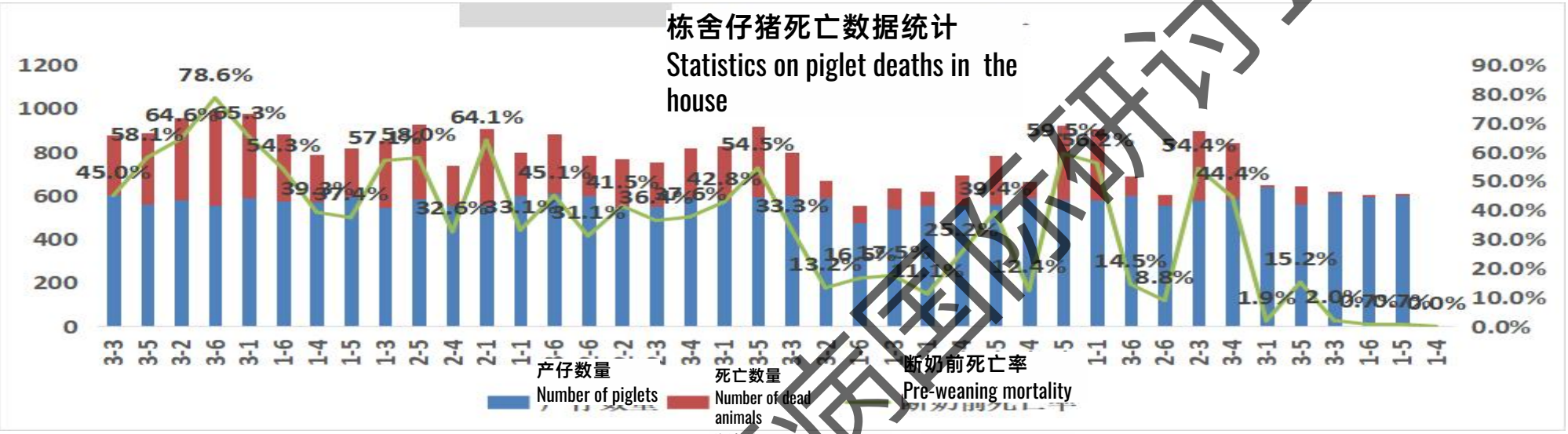
Personnel isolation and anti-crossover-control;

- **全进全出：栏舍的彻底洗消和母猪体表消毒**

AIAO: Thorough decontamination of pens and disinfection of the sow's body surface.

8.4 猪流行性腹泻防控案例——防控结果

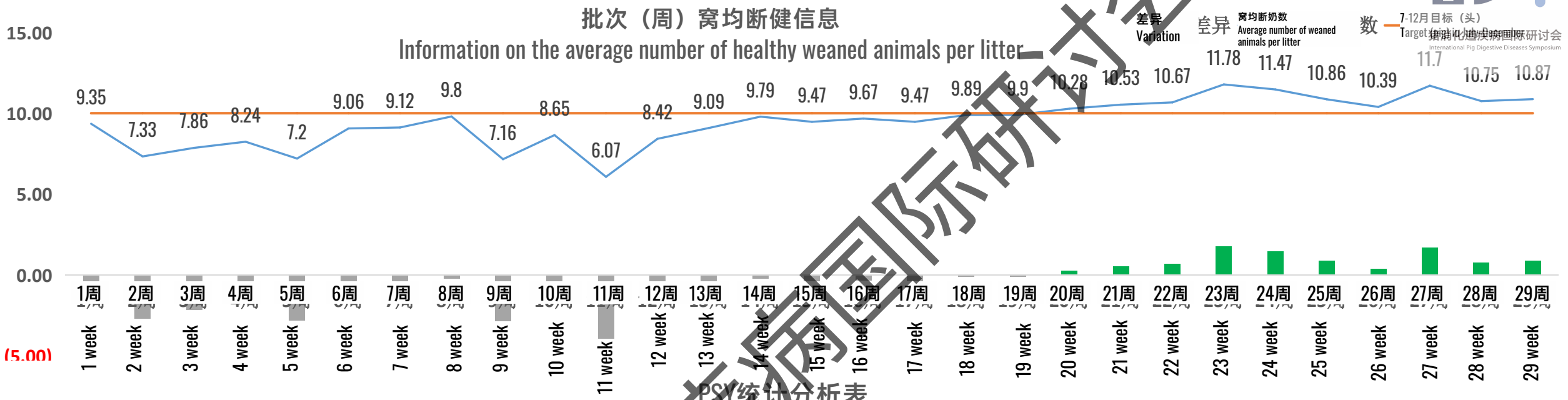
Prevention and Control Cases of PEDV - Results of prevention and control

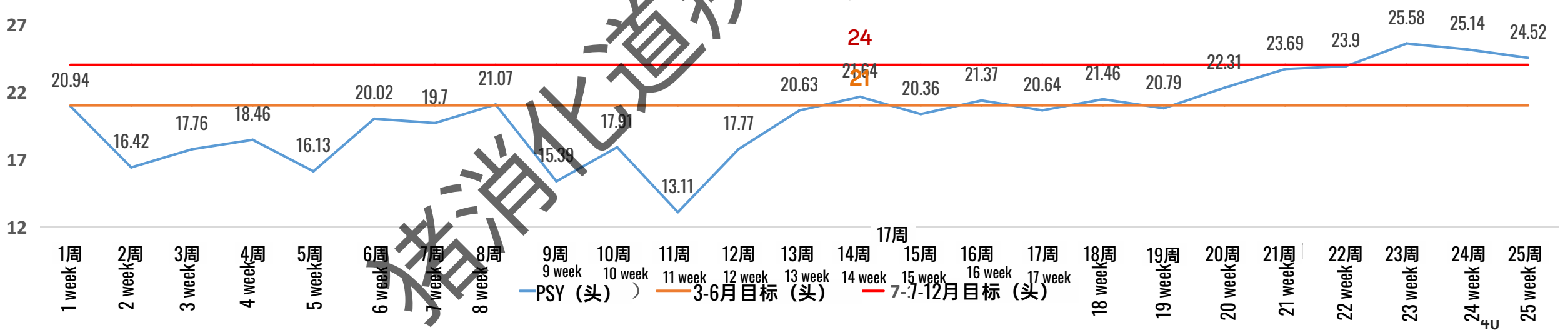


单元Unit	分娩日期Date of delivery	日龄Days of age	分娩数量Number of animals delivered	死亡数Number of dead animals	当前存栏Current stock	成活率Survival rate
2-4	2022年4月2日April 2, 2022	34	591	73	518	87.65%
1-1	2022年4月6日April 6, 2022	30	580	326	254	43.79%
3-6	2022年4月6日April 6, 2022	30	602	87	515	85.55%
2-6	2022年4月9日April 9, 2022	27	553	49	504	91.14%
2-3	2022年4月11日	25	581	316	265	45.61%
3-4	2022年4月14日April 14, 2022	22	585	266	319	54.53%
3-1	2022年4月15日April 15, 2022	21	638	15	623	97.65%
3-5	2022年4月17日April 17, 2022	19	560	98	462	82.50%
3-3	2022年4月20日April 20, 2022	16	609	59	550	90.31%
1-6	2022年4月22日April 22, 2022	14	595	7	588	98.82%
1-5	2022年4月26日April 26, 2022	10	599	36	563	93.99%
1-4	2022年4月28日April 28, 2022	8	611	11	600	98.20%
2-2	2022年5月1日May 1, 2022	5	624	4	620	99.36%
2-5	2022年5月4日May 4, 2022	2	671	10	661	98.51%
2-3						

猪流行性腹泻防控案例——防控结果

Prevention and Control Cases of PEDV - Results of prevention and control





谢　谢！ Thanks!

病毒性腹泻驻场专项防控，请联系技术服务部曾松林博士团队！

For on-site prevention and control of viral diarrhea, please contact the team led by Dr. Zeng Songlin of Technical Services Department.

- **曾松林 博士/科前生物全国技术总监**

  Zeng Songlin, Ph.D./National Technical Service Director, Keqian

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