Overview of research on prevention and control of animal diseases in China

Hanchun Yang, DVM, Ph.D
Key Lab of Animal Epidemiology and Zoonosis of Ministry of Agriculture
College of Veterinary Medicine
China Agricultural University (CAU)
Outline

- Current situation of animal infectious diseases in China
- Basic research on animal infectious diseases in China
- Research on prevention and control techniques animal infectious diseases in China
- Control and eradication of animal infectious diseases in China
1. Current situation of animal infectious diseases in China

- In recent decade, major animal diseases had outbreak frequently, which affected the poultry and livestock industry and caused great economic losses in China.

  - Foot and mouth disease (FMD)
    - Type Asia 1 (2005)
    - Type A (2009)
    - Type O (2010)
- Porcine circovirus associated diseases (PCVAD) (2002)
- postweaning multisystemic wasting syndrome (PWMS)
- porcine dermatitis and nephropathy syndrome (PDNS)
• Outbreak of highly pathogenic avian influenza (H5N1) (2004)
• Swine streptococcus (Sichuan, China, 2005).

214 cases, 39 death in human.
Emergence and prevalence of highly pathogenic PRRSV (2006)

- High fever
- High morbidity
- High mortality
A great variety of animal diseases (virus diseases, bacteria diseases, zoonoses) result in complicated situation of animal diseases in China.
Genetic variation and diversity of pathogens in China.

- H5N1 virus
- PRRSV
- PCV2
Diversity of H5N1

(Li et al., J. Virol. 2010, 84, 8389.)
Diversity of PRRSV of genotype 2

Emergence of PRRSV of genotype 1

(Chen et al., J Gen Virol 2011, 92:880-892.)
Diversity of genotype of PCV2
Review

Porcine circovirus type 2 and its associated diseases in China

Xinna Ge, Fang Wang, Xin Guo, Hanchun Yang

1 Key Laboratory of Animal Epidemiology and Zoonosis of Ministry of Agriculture, College of Veterinary Medicine and State Key Laboratory of Agrobiootechnology, China Agricultural University, No. 2 Yuanmingyuan West Road, Haidian District, Beijing 100193, PR China
2 China Institute of Veterinary Drug Control, No. 8 Nandajie, Zhongguancun, Haidian District, Beijing 100081, PR China

Table 1
Distribution of PCV2 genotypes in different geographic regions of mainland China.

<table>
<thead>
<tr>
<th>Region</th>
<th>Genotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beijing</td>
<td>PCV-2a, PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Tianjin</td>
<td>PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Hebei</td>
<td>PCV-2a, PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Shanxi</td>
<td>PCV-2b</td>
</tr>
<tr>
<td>Inner Mongolia</td>
<td>PCV-2b</td>
</tr>
<tr>
<td>Liaoning</td>
<td>PCV-2a, PCV-2b</td>
</tr>
<tr>
<td>Jilin</td>
<td>PCV-2a, PCV-2b</td>
</tr>
<tr>
<td>Heilongjiang</td>
<td>PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Shandong</td>
<td>PCV-2a, PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>PCV-2a, PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Anhui</td>
<td>PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Fujian</td>
<td>PCV-2a, PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Shanghai</td>
<td>PCV-2a, PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Guangdong</td>
<td>PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Guangxi</td>
<td>PCV-2a, PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Hainan</td>
<td>PCV-2b</td>
</tr>
<tr>
<td>Hubei</td>
<td>PCV-2a, PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Hunan</td>
<td>PCV-2a, PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Henan</td>
<td>PCV-2a, PCV-2b</td>
</tr>
<tr>
<td>Jiangxi</td>
<td>PCV-2a, PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Xinjiang</td>
<td>PCV-2a</td>
</tr>
<tr>
<td>Gansu</td>
<td>PCV-2a, PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Sichuan</td>
<td>PCV-2b, PCV-2d</td>
</tr>
<tr>
<td>Chongqing</td>
<td>PCV2b</td>
</tr>
</tbody>
</table>
Multi-infection of different pathogens affects the diagnosis and increases the difficulties of the prevention and control.

- H5N1+NDV, MDV+ALV, MDV+REV….(Chicken)
- PRRSV+PCV2, CSFV+PRRSV (Pig)
Some zoonoses are of severe situation.

- Rabies
- Tuberculosis
- Brucellosis
2. Basic research on animal infectious diseases in China

- Increasing attention has been paid to the prevention and control of animal diseases following the emergence and prevalence of high pathogenic avian influenza (HPAI) in Asia in 2004.

- With gradually increasing outlays for scientific research on animal diseases from Chinese government, the research of animal diseases is reinforced and goes further continually.
Involved research areas

- Etiological molecular biology of animal diseases
- Ecology and molecular epidemiology of pathogens
- Rules and molecular mechanisms of genetic variation
- Molecular mechanisms of pathogenesis and immunity
- Interaction mechanisms between pathogens and the hosts (cells)
Achievements

- Revealed the prevalence rule of some major animal diseases
- Revealed the genomic information and molecular characteristics of pathogens in China
- A great number of genomic sequences of China’s strains in GenBank database
- Revealed the characteristics of variation and molecular epidemiology of pathogens
- Revealed the molecular pathogenesis and immunity mechanisms
Applications of modern molecular biology techniques in basic research

- Reverse genetic manipulation for virus
- Proteomics technology
Established important theoretical bases for the study of techniques (diagnosis and vaccines) for the prevention and control of animal diseases in China

Provided scientific bases for the development of prevention and control strategy by Chinese authorities

The level of basic research on animal diseases in China upgrades constantly, making notable contributions to the international academia
Chinese scholars in veterinary medicine published papers on major international academic journals.
3. Research on prevention and control techniques

- Diagnostic techniques for animal diseases in China
  - Molecular diagnostic techniques and their commercial kits
  - Immunological techniques and their commercial kits
Molecular diagnostic techniques

- PCR, RT-PCR, Multiple PCR
Real-time quantitative PCR
Gene chips
Serological techniques

- **ELISA**: Antibody and antigen detection
Colloidal gold test strips
Applications of diagnostic techniques

- Etiological detection of animal diseases
- Diagnosis of animal diseases
- Epidemiology monitoring
- Evaluation of the clinical effectiveness of vaccination
- Vaccine
  - Inactivated vaccine
  - Live vaccine
  - Combined vaccine
  - Polyvalent vaccine
  - Novel vaccines

Local companies-producing animal vaccine in China
4. Control and eradication of animal diseases in China

- Vaccination is a major strategy to prevent and control animal diseases in China
- To implement national compulsory vaccination against major animal diseases (such as FMD and H5N1 AI)
- “Stamping out”, a supplemental measure for major animal diseases, is undertaken when clinical outbreaks occur.
Eradication strategy of some animal diseases has commenced

- PR, CSF

Established medium- and long-term control program for major animal diseases in China
Controlling and Eliminating the major animal diseases will be a long way to go in China.
Thank you for your attention!