

CANINE INFECTIOUS DISEASE COMPLEX: EVIDENCE OF EMERGING VIRUSES IN THAILAND

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CONTRIBUTORS

2



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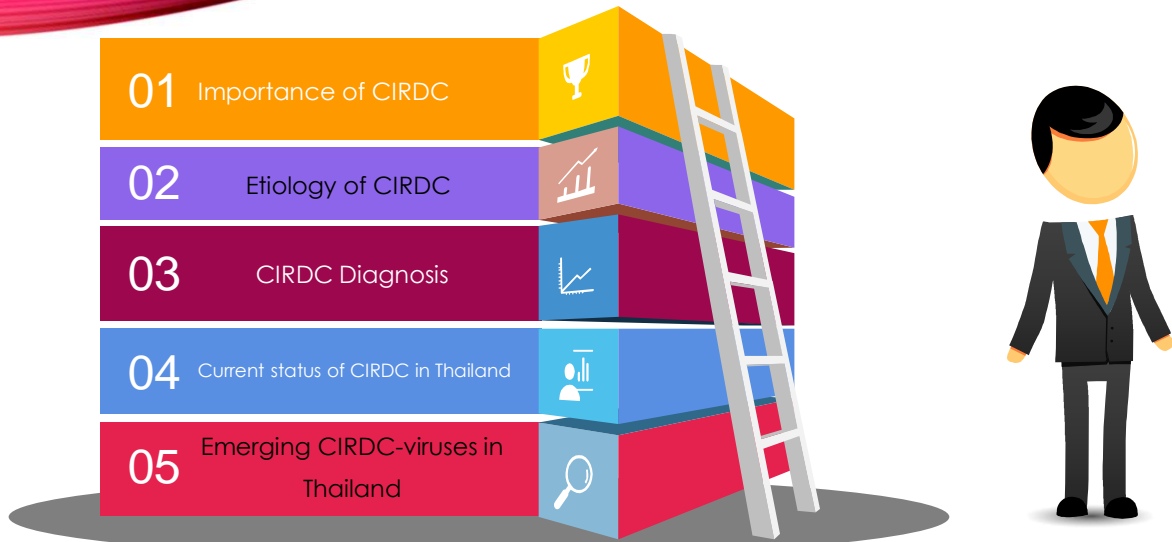


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OUTLINES

3



CANINE INFECTIOUS RESPIRATORY DISEASE COMPLEX “CIRDC”

4



Infectious Tracheobronchitis (Kennel Cough)



Common Limited Disease Syndrome



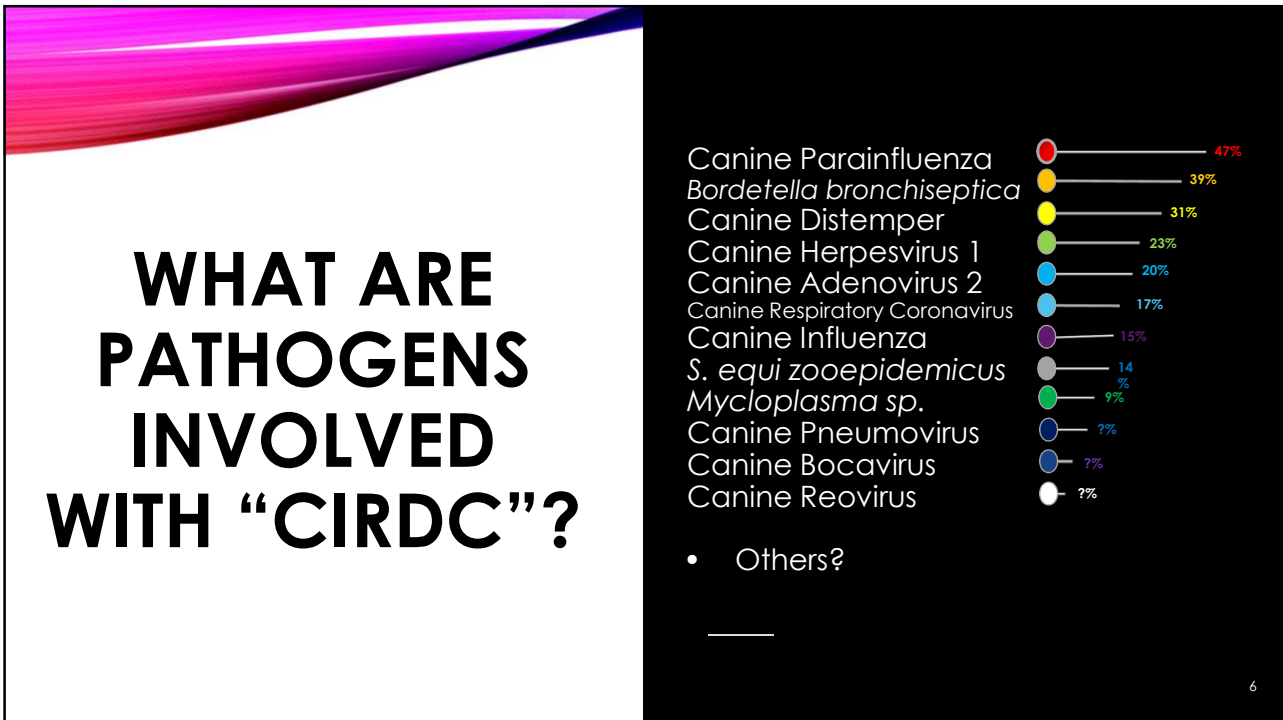
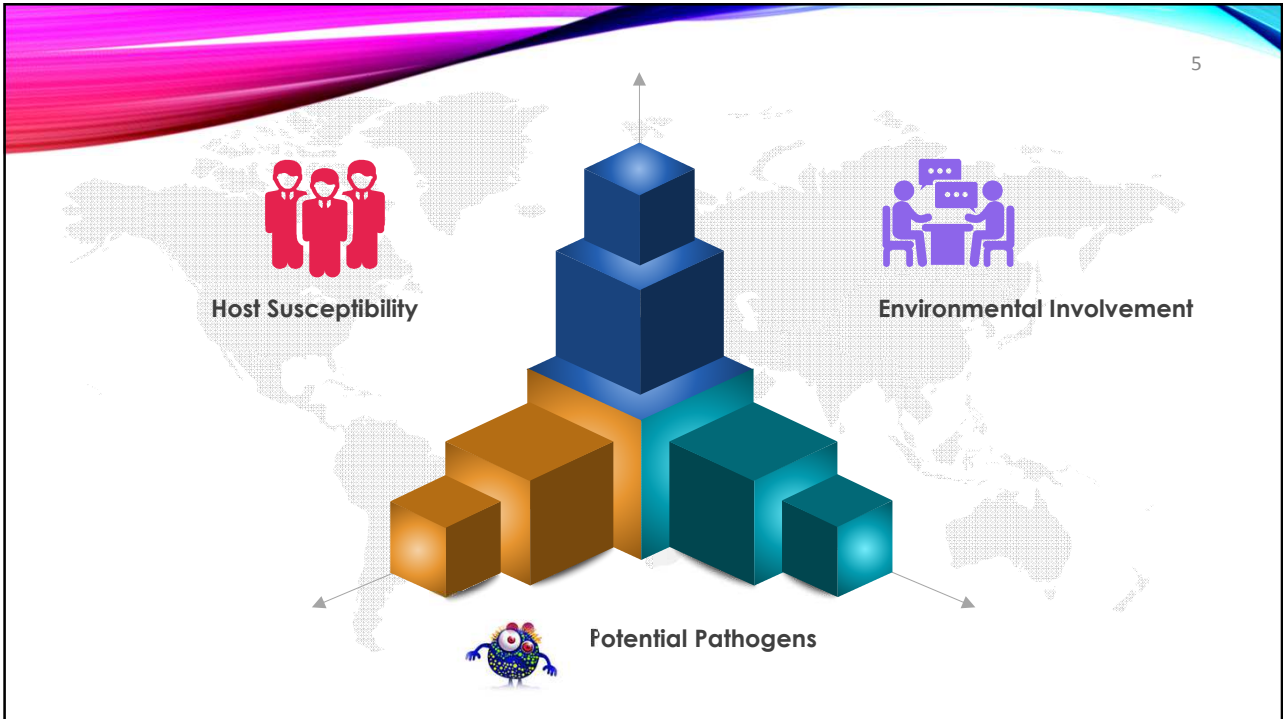
Endemic or Epidemic Disease?



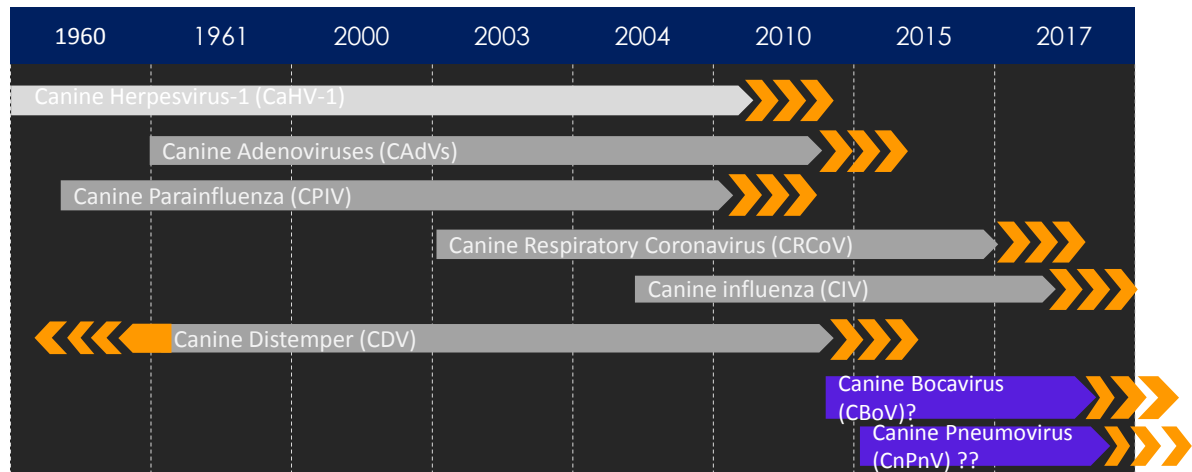
Factors involved with Disease Occurrence



Resurgence of Respiratory Pathogens in Last Decade



CIRDC-VIRUSES DISCOVERY IN LAST DECADE



COMMON CIRDC VITA

Canine Influenza; CIV

ssRNA, Influenza A, *Orthomyxoviridae*

Genetic Implications:

Equine: H3N8 (USA, 2004)

Avian: H3N2 (South Korea, 2007)

Canine Parainfluenza; CPIV

ssRNA, *Paramyxoviridae*

Genetic Implications:

Simian virus 5

Canine Distemper; CDV

ssRNA, *Paramyxoviridae*

Genetic Implications:

Measles, CDV wide-range hosts

Canine Respiratory Coronavirus; CRCoV

ssRNA, *Coronaviridae*

Genetic Implications:

Human Coronavirus OC43

Bovine Coronavirus

Canine Adenovirus-2 (CAAdV-2)

dsDNA, *Adenoviridae*

Genetic Implications:

CAAdV-1, wild mammals

Canine Herpesvirus-1 (CaHV-1)

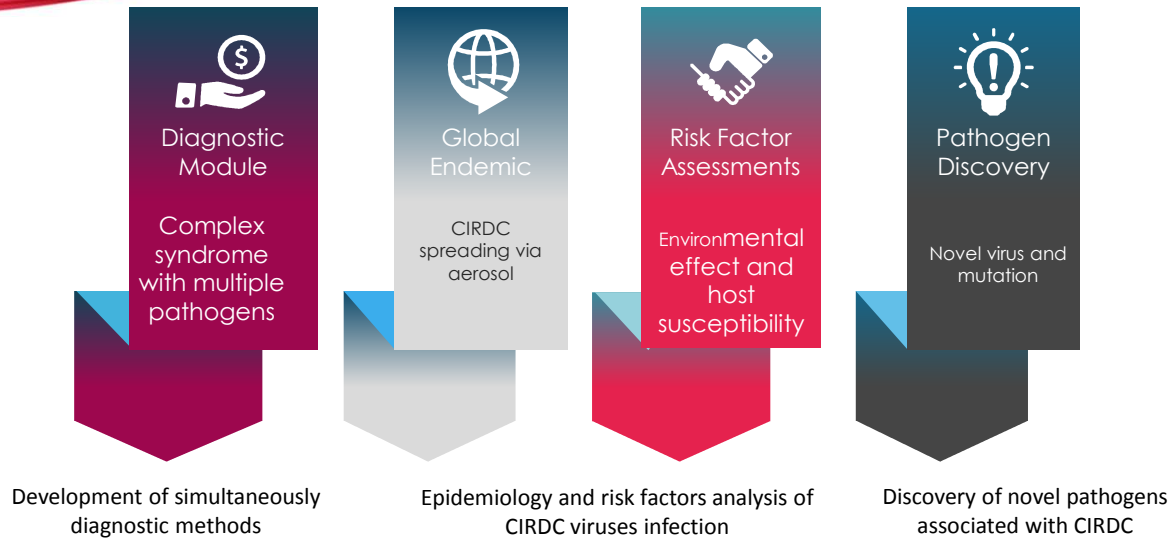
dsDNA, *Alphaherpesviridae*

Genetic Implications

Feline herpesvirus-1 (FHV-1)

Equine herpesvirus-1/-4 (EHV-1/4)

CIRDC viruses become more convincing!⁹



CIRDC DIAGNOSIS

Fast, Precise and Accurate

- Clinical signs
- Antigen detection
 - ELISA antigen detection
 - PCRs
 - Virus Isolation
- Antibody detection
 - ELISA antibody detection
 - SN test

Simultaneous detection is needed!

MULTIPLEX-PCR FOR CIRDC-VIRUS DETECTION

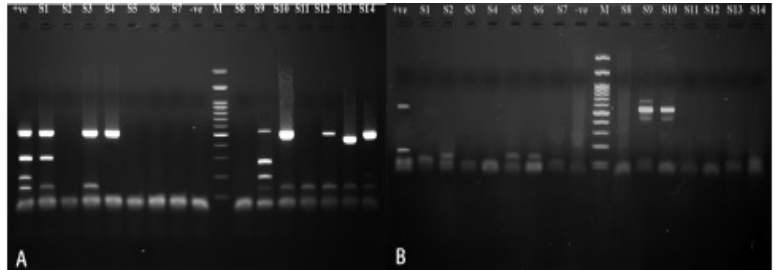
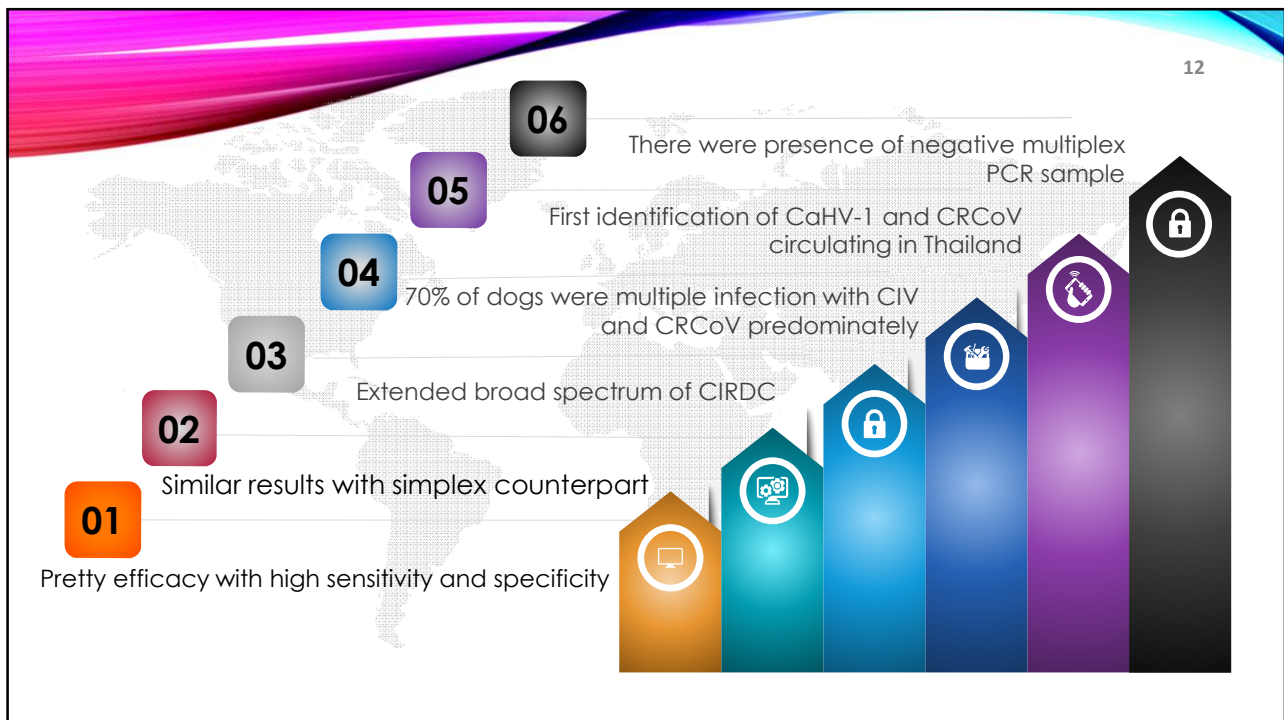
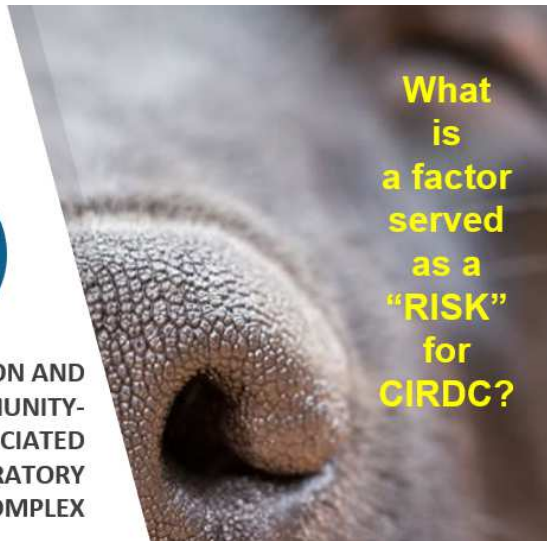


Figure. (A) multiplex RT-PCR and (B) multiplex PCR tested on clinical samples (S1–S14). (Piewbang et al., 2016)





CROSS-SECTIONAL INVESTIGATION AND
RISK FACTOR ANALYSIS OF COMMUNITY-
ACQUIRED AND HOSPITAL-ASSOCIATED
CANINE INFECTIOUS RESPIRATORY
DISEASE COMPLEX



CIRDC INVESTIGATION IN THAILAND

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Healthy dogs

Respiratory
illness



Respiratory
illness



Respiratory
illness

2008- 2009

2008- 2009

2012

2013

2014

CIV: 2.94%

CDV: 2.94%

CPIV: 0.98%

CAdV-2: 0%

(Posuwan et al., 2010)

CIV: 1.83%

CDV: 2.75%

Cin lacus. Class: CPIV: 11.93%

Vestibulum fermentum

CAdV-2: 9.71%

(Posuwan et al., 2010)

CIV (H3N2)

(Bunpapong et al.,
2014)

31.2% CRIDC

illness dogs

7.8% CIRDC

healthy dogs

(Thepmanee et al., 2014)

Multiple infections
of CRCoV, CIV, CPIV,
CDV

(Piewbang et al., 2014)

STUDY DESIGN AND SAMPLE POPULATION

2013-2015 Prospective cross-sectional study

418 Nasal and Oropharyngeal swabs

209 respiratory illness dogs*

Hospital, Pet grooming center, Shelters

Central: 127 dogs
Eastern: 21 dogs
Southern: 49 dogs
Western: 12 dogs

THAILAND



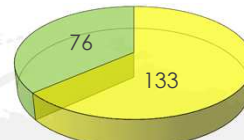
population : 67 million
 capital : bangkok
 official languages : thai
 religion : buddhism



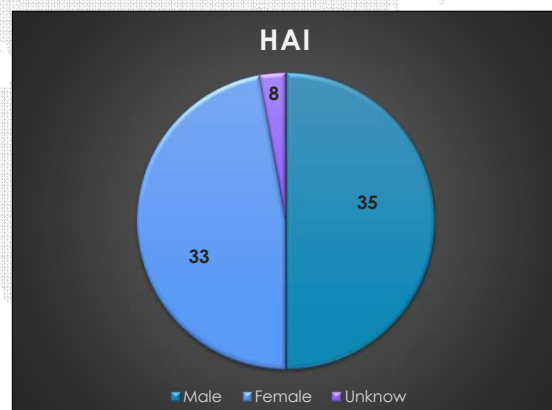
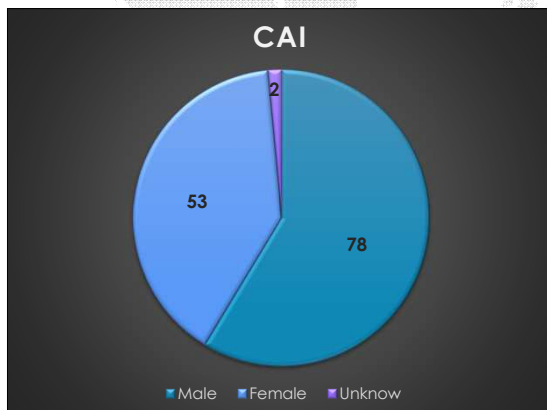
Piewbang et al., 2019 (under reviewed)

Sample Population (Dogs)

16

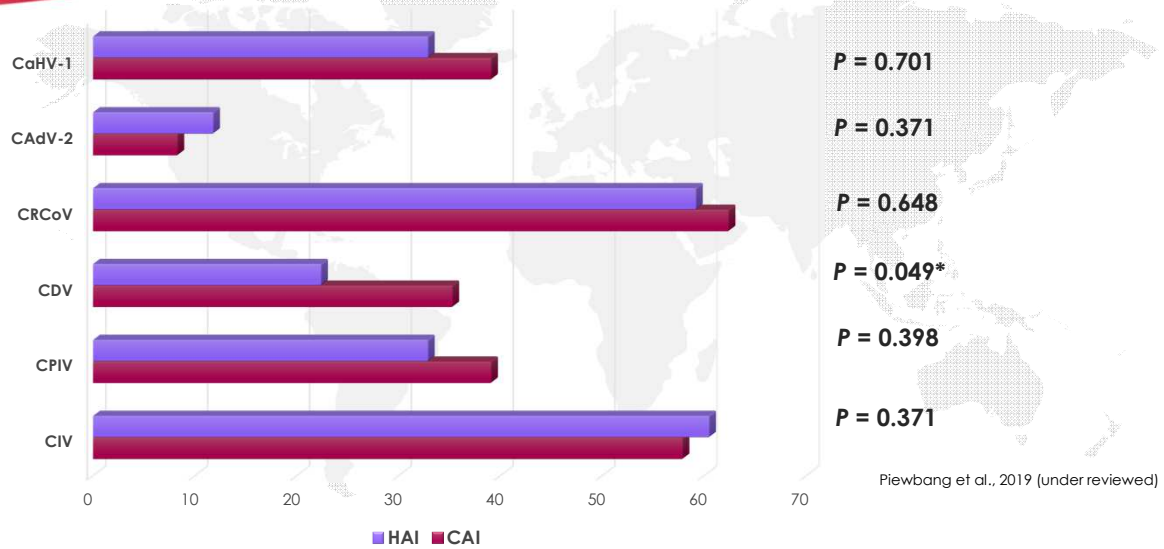


■ CAI ■ HAI

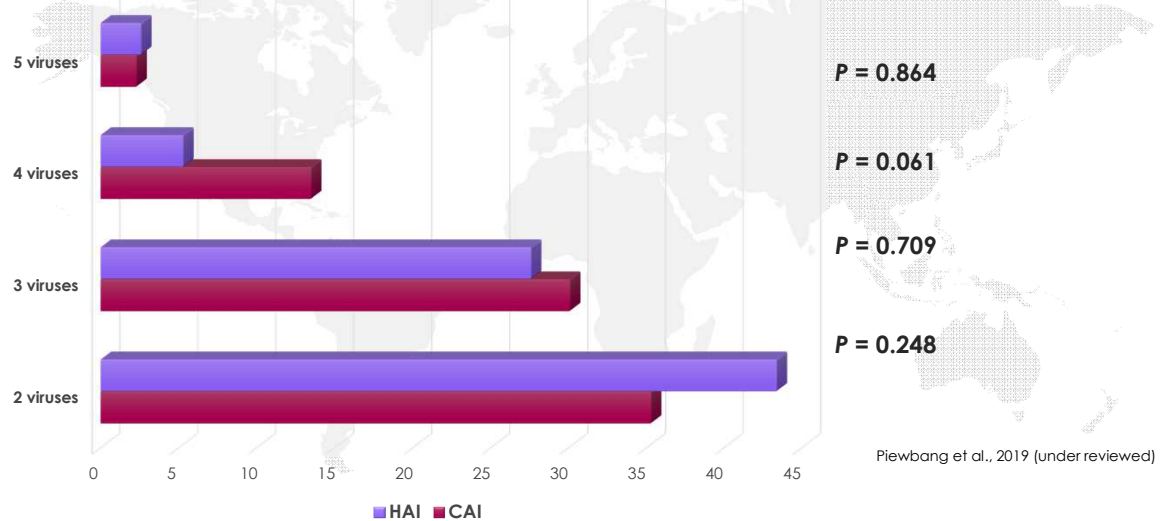


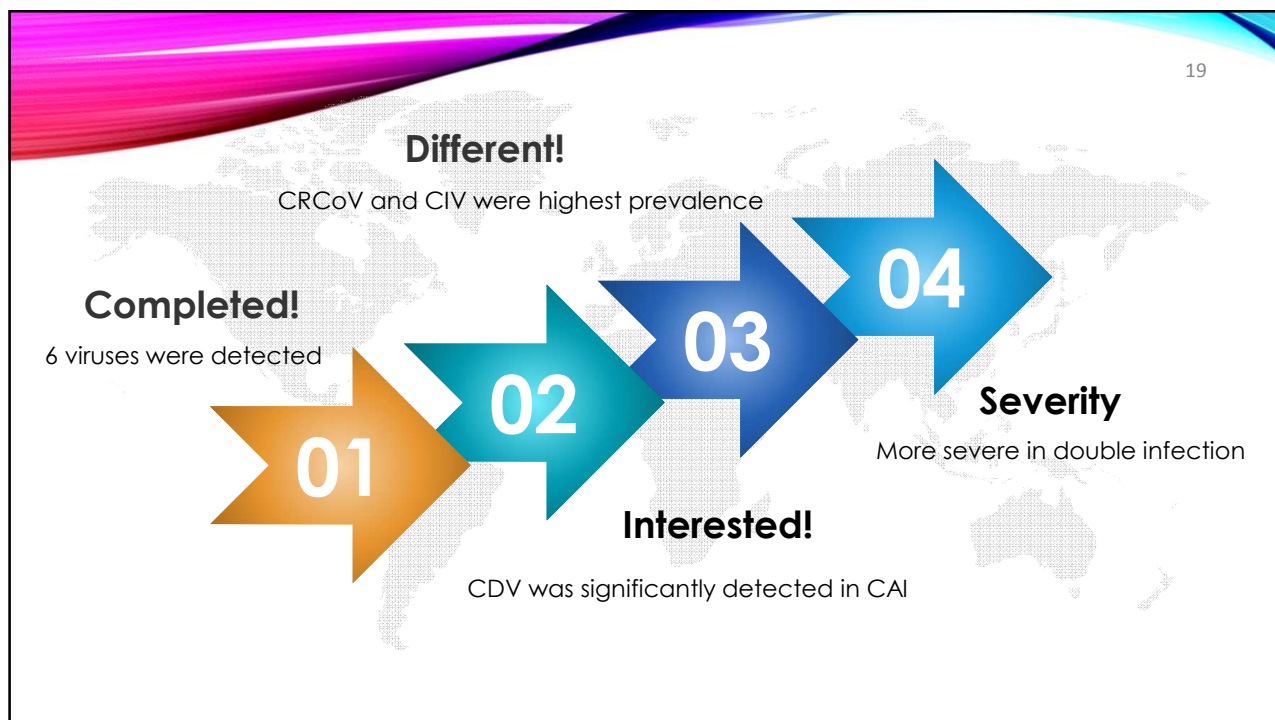
Piewbang et al., 2019 (under reviewed)

DETECTION OF CIRDC VIRUSES IN CAI- AND HAI GROUPS



DETECTION OF MULTIPLE CIRDC VIRUSES BETWEEN CAI AND HAI GROUPS





EMERGING VIRUSES ASSOCIATED WITH CIRDC IN THAILAND



Acta Veterinaria-Beograd 2017, 67 (1), 11-24
UDK: 636.7.09-[616.98:578.825
DOI: 10.1515/acev-2017-0002

Research article

VIRAL MOLECULAR AND PATHOLOGICAL INVESTIGATIONS OF CANID HERPESVIRUS 1 INFECTION ASSOCIATED RESPIRATORY DISEASE AND ACUTE DEATH IN DOGS

PIEWBANG Chutchai^{1,2}, RUNGSIPIPAT Anudep¹, POOVORAWAN Yong³,
TECHANGAMSUWAN Somporn^{1,2*}

Infectious Disease-Original Article

Canine Bocavirus Type 2 Infection Associated With Intestinal Lesions

Chutchai Piewbang^{1,2}, Wendy K. Jo³, Christina Puff³, Martin Ludlow²,
Erhard van der Vries², Wijit Banlunara¹, Anudep Rungsiipat¹,
Jochen Kruppa⁴, Klaus Jung⁴, Somporn Techangamsuwan^{1,5},
Wolfgang Baumgärtner³, and Albert D. M. E. Osterhaus²

Veterinary Pathology
2018, Vol. 55(3): 434-441
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DOI: 10.1177/0300985818755253
journals.sagepub.com/home/vet

SCIENTIFIC REPORTS

OPEN

Genetic and evolutionary analysis of a new Asia-4 lineage and naturally recombinant canine distemper virus strains from Thailand

Chutchai Piewbang^{1,2}, Araya Radtanakattikanon¹, Jiratchaya Puenpa¹, Yong Poovorawan² &
Somporn Techangamsuwan^{1,2*}

SCIENTIFIC REPORTS

OPEN

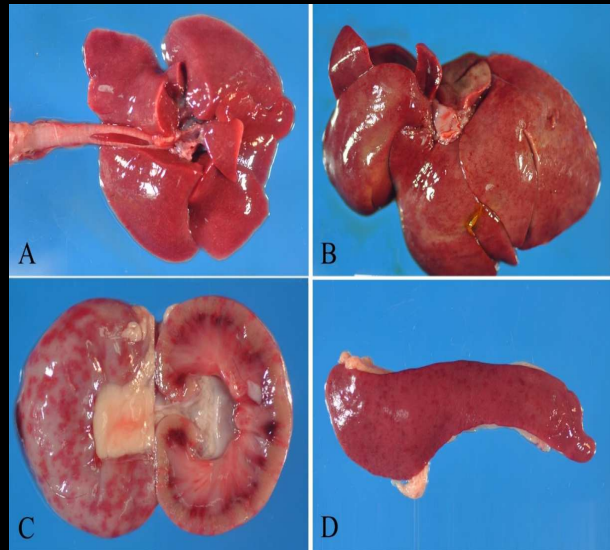
Novel canine circovirus strains from Thailand: Evidence for genetic recombination

Received: 19 January 2018
Accepted: 27 April 2018
Published online: 14 May 2018

Chutchai Piewbang^{1,2}, Wendy K. Jo³, Christina Puff³, Erhard van der Vries², Sawang Kesdangakonwut², Anudep Rungsiipat¹, Jochen Kruppa⁴, Klaus Jung⁴, Wolfgang Baumgärtner³, Somporn Techangamsuwan^{1,5}, Martin Ludlow² & Albert D. M. E. Osterhaus²

CANINE HERPESVIRUS-1

Fatal systemic infection in
puppies

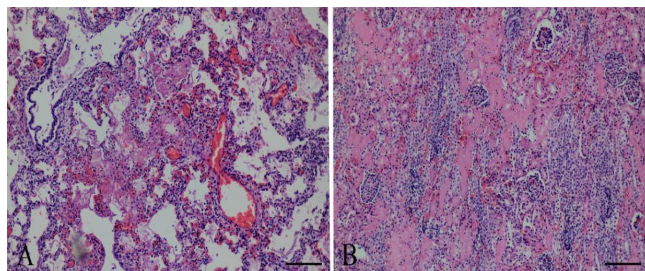


Piewbang et al., 2017

Histopathology of CaHV-1 infected
puppies.

(A) Severe acute multifocal
pyogranulomatous necrotizing
hemorrhagic pneumonia.

(B) severe acute tubular
necrosis with massive
congestion. Bar = 200 μ m.



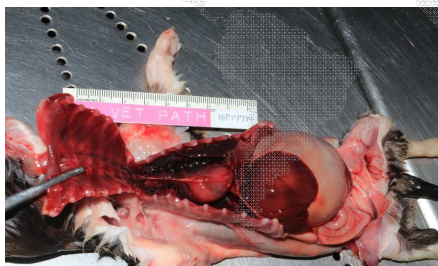
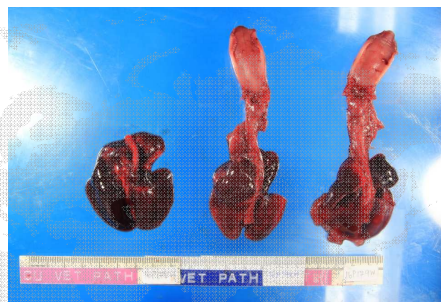
Piewbang et al., 2017

Respiratory –
Intestinal
associated
disease

CANINE BOCAVIRUS-2

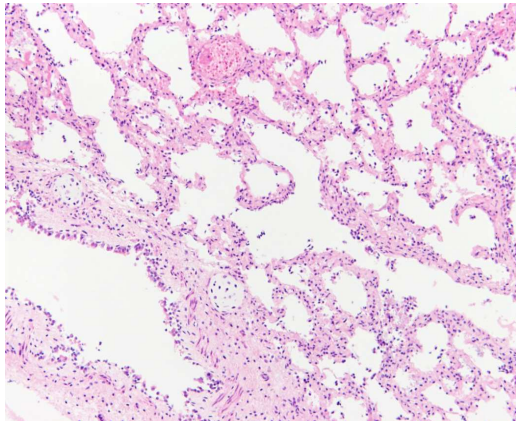
What is your differential diagnosis?

24

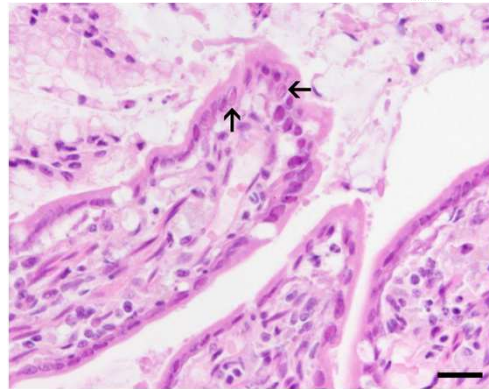


- Acute respiratory distress pups
- Massive death within 7 days after parturition from vaccinated dam
- Massive respiratory hemorrhage

Piewbang et al., 2018



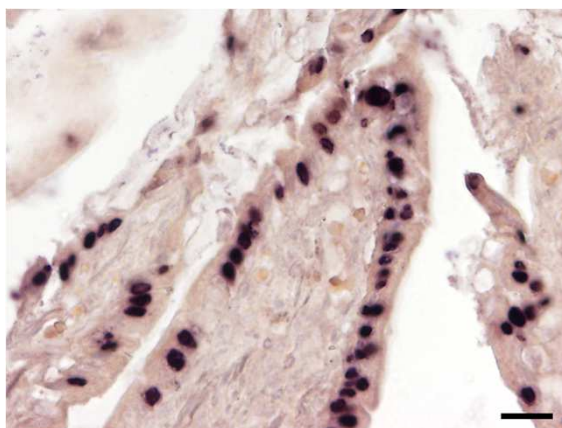
Lung, dog. Moderate interstitial pneumonia without inflammatory cells are presented. Hematoxylin and eosin (HE).
Negative CIRDC multiplex PCR



Small intestine, dog. Multiple intranuclear inclusion bodies (INIB) are presented within enterocytes (arrows), Hematoxylin and eosin (HE).

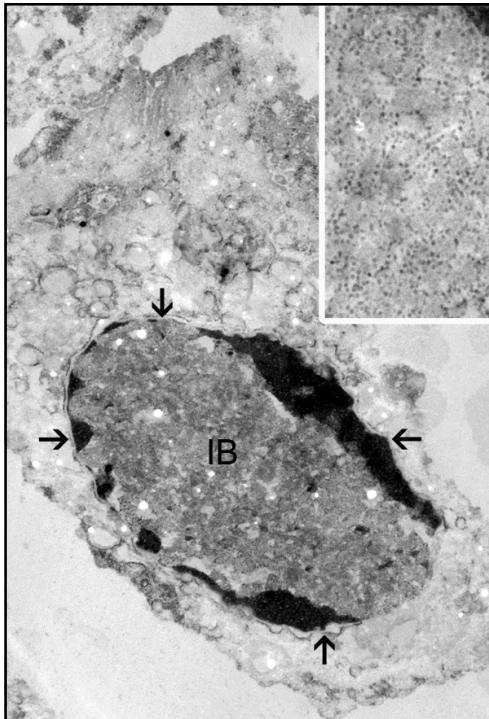
Negative Canine Parvovirus-2 PCR and IHC

Piewbang et al., 2018



SMALL INTESTINE. DOG.
STRONG POSITIVE CBOV-2
SIGNALS (BROWN COLOR)
WITHIN THE NUCLEI OF
ENTEROCYTES

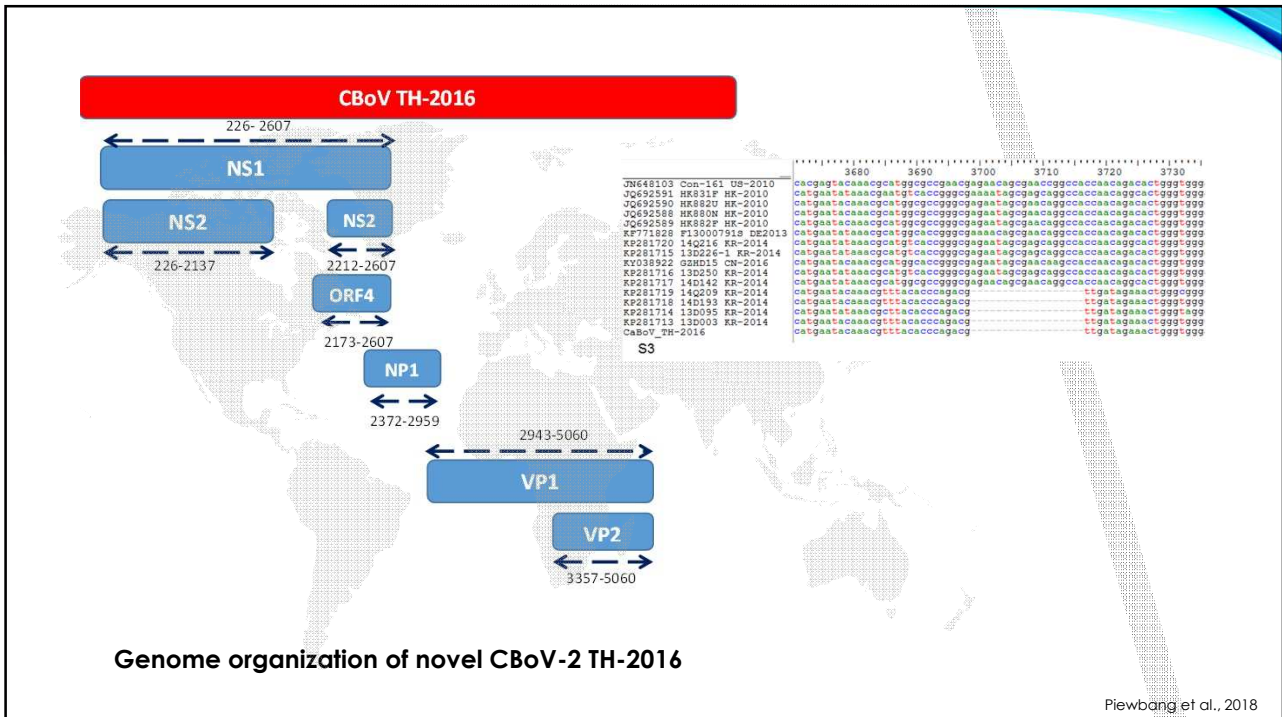
Piewbang et al., 2018



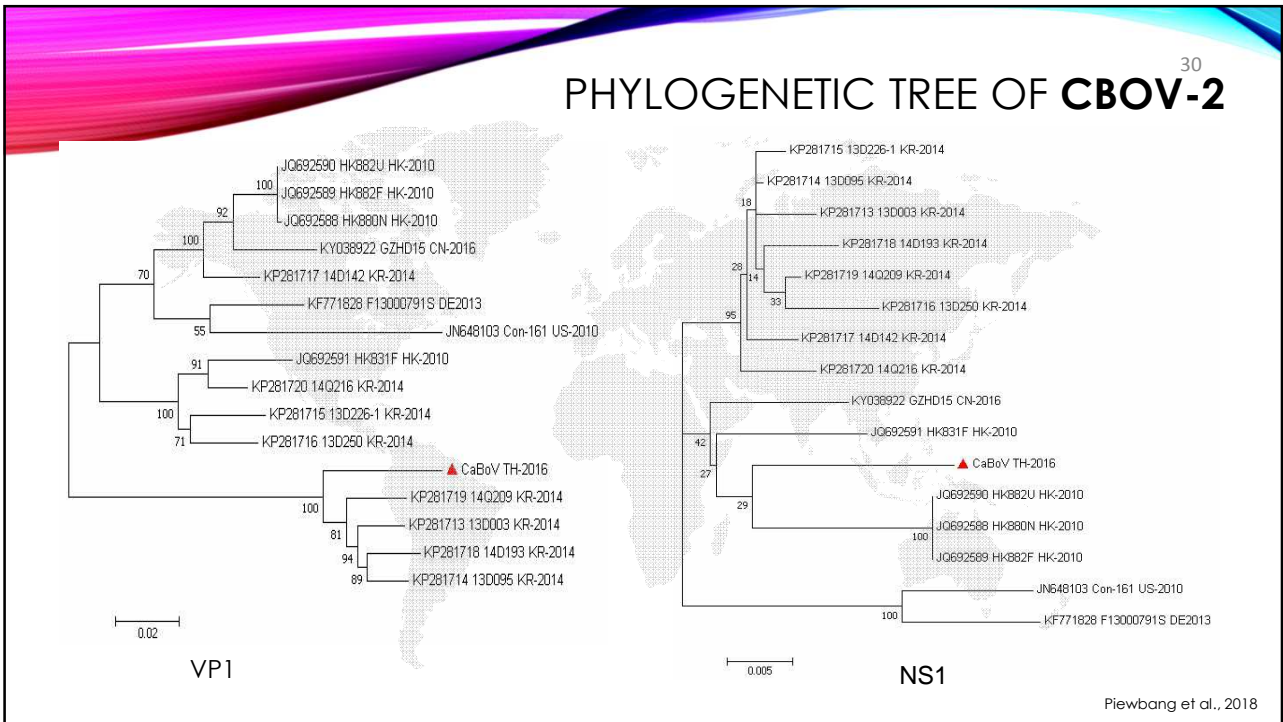
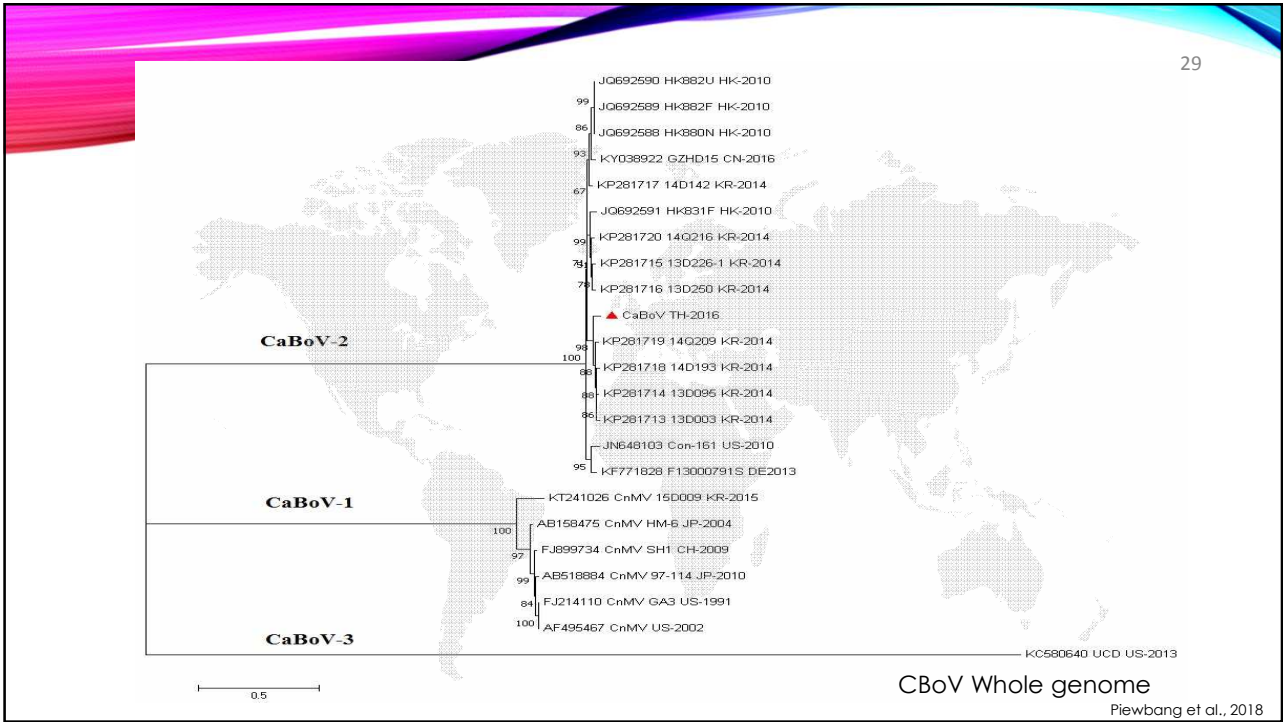
SMALL INTESTINE, DOG.

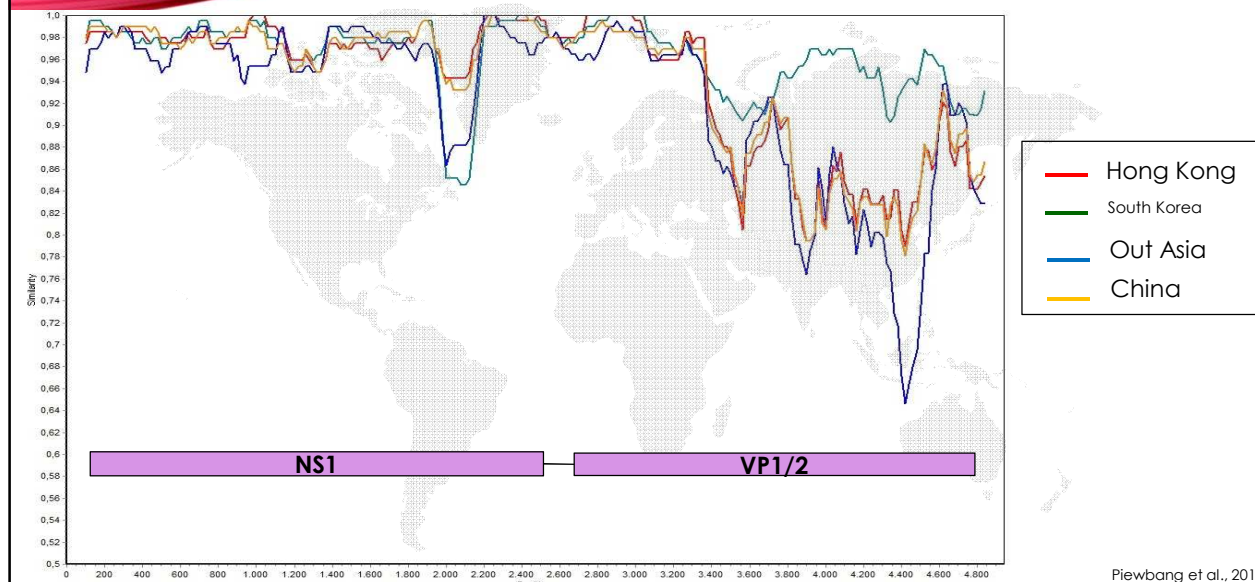
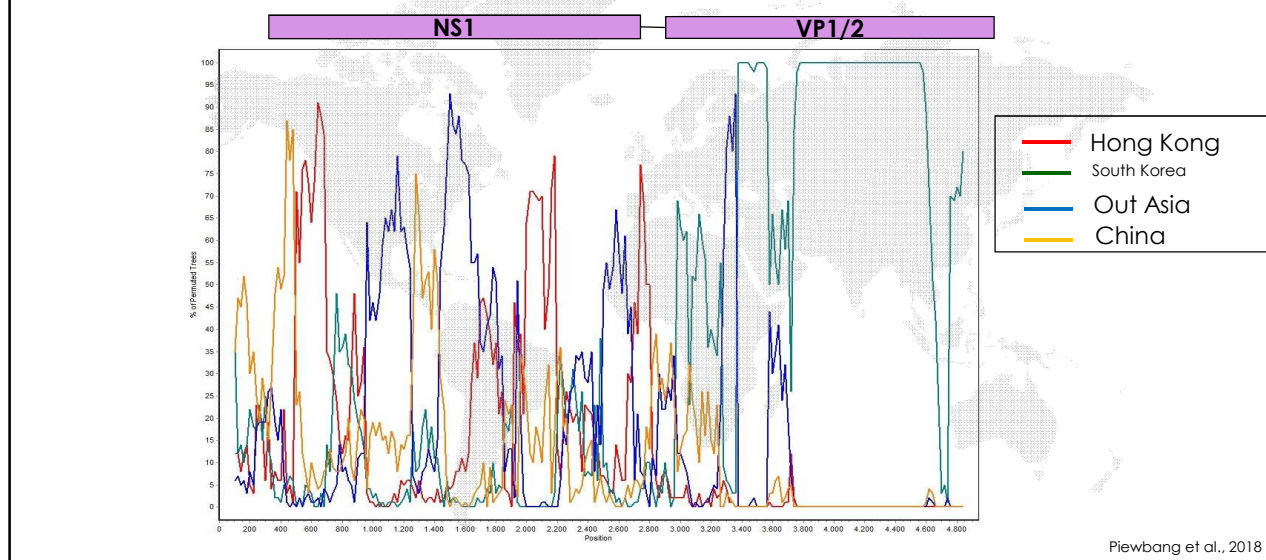
AN INTRANUCLEAR INCLUSION BODY (IB) IS PRESENT WITHIN THE NUCLEUS (ARROWS) OF A SMALL INTESTINAL ENTEROCYTE CHARACTERIZED BY AGGREGATES OF NUMEROUS VIRIONS (INSET)

Piewbang et al., 2018

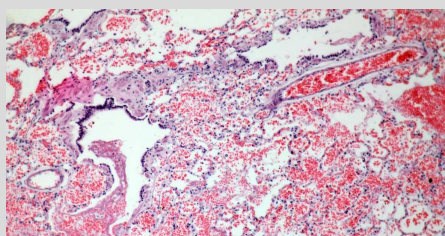
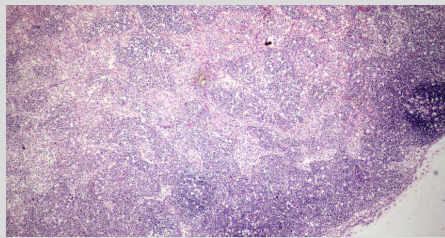
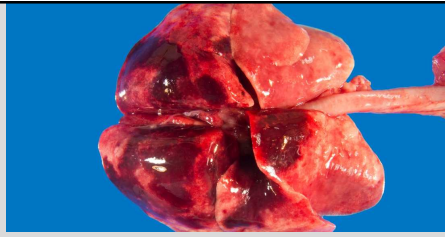


Piewbang et al., 2018



SIMILARITY PLOT OF **CBOV-2**BOOTSCAN ANALYSIS OF **CBOV-2**

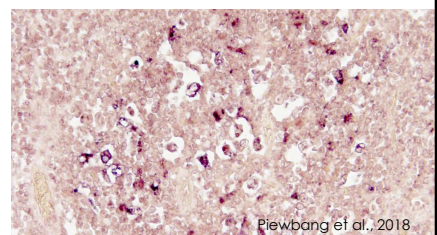
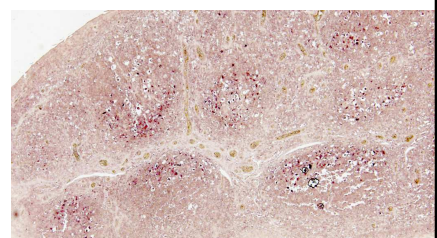
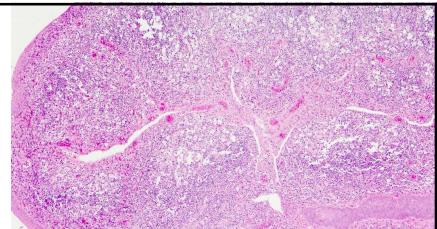
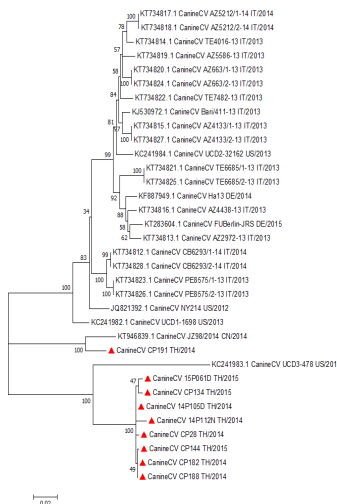
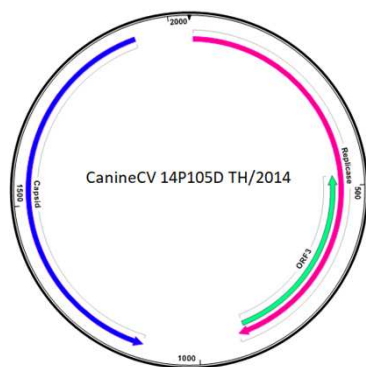
CANINE CIRCOVIRUS



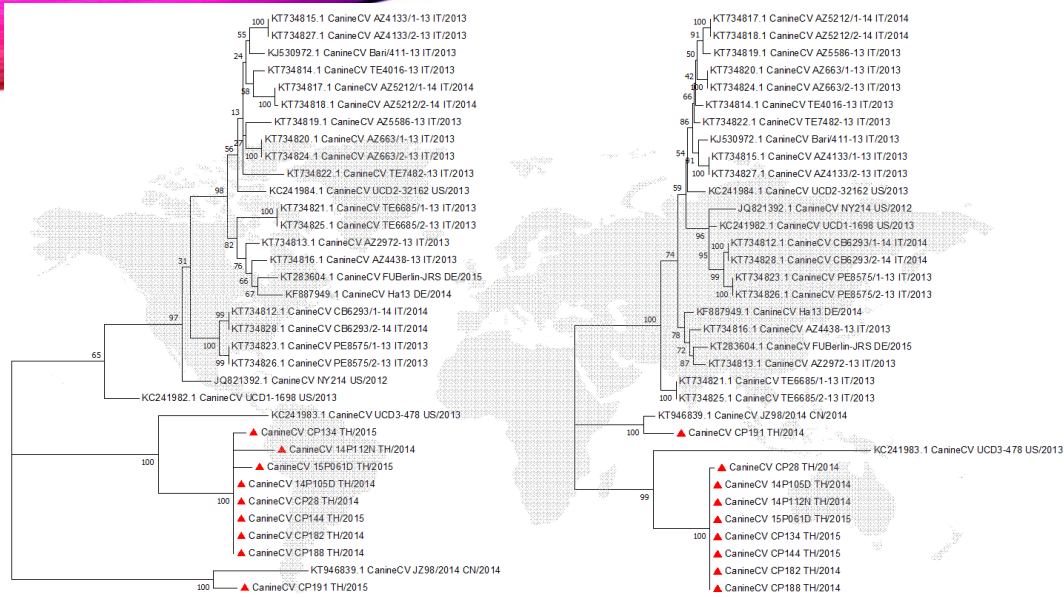
- 5 months Pomeranian and 8 months Poodle
- Hospital associated history.
- One day-presented clinical signs by panting and mild diarrheal, follow by acute dead with hemoptysis.
- CIV and CRCoV were detected in nasal swabs.

Piewbang et al., 2018

CANINE CIRCOVIRUS



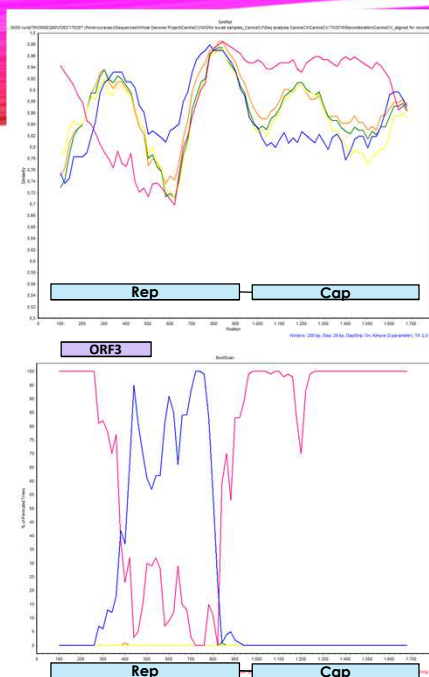
Piewbang et al., 2018



Cap gene

Rep gene

Piewbang et al., 2018



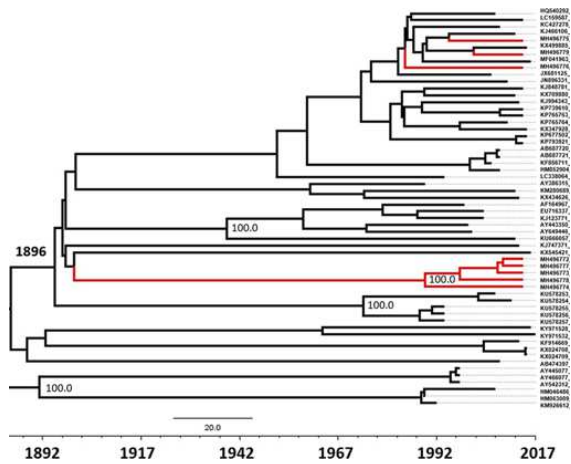
- USA
- Italy
- China
- Germany
- UCD-3

Genome Position	UCD3-478	JZ98/2014	14P105D TH/2014	CP191TH/2014
Rep gene				
327	A	G	A	G
333	C	G	C	T*
339	T	A	T	A
345	A	G	A	A
383	C	A	A	A
384	T	A	A	A
390	G	A	A	A
408	T	C	C	C
414	G	C	C	C
426	C	T	T	T
456	A	C	C	C
525	C	G	G	G
540	G	C	C	C
543	C	T	T	T
692	G	T	T	T
762	A	C	C	T
805	A	G	G	G
807	T	G	G	G
825	T	C	T	T
837	T	C	T	C
1095	G	T	G	T
1096	T	G	T	G
Cap gene				
1125	T	G	T	T
1182	G	C	C	C
1305	T	C	T	C
1329	A	T	A	T

* Specific nucleotide mutation detected in CanineCV CP191 TH/2016 strain.

The genetic markers were identified in the CanineCV 14P105D TH/2014 by nucleotide marker position starting from nt383 through nt807, which was incorporated by nucleotide derived from CanineCV JZ98/2014 isolate.

Piewbang et al., 2018

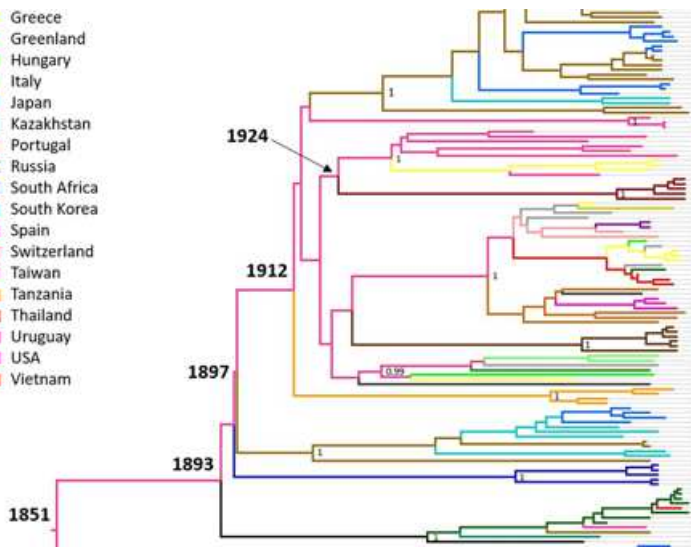


CANINE DISTEMPER ASIA-4



Piewbang et al., 2019

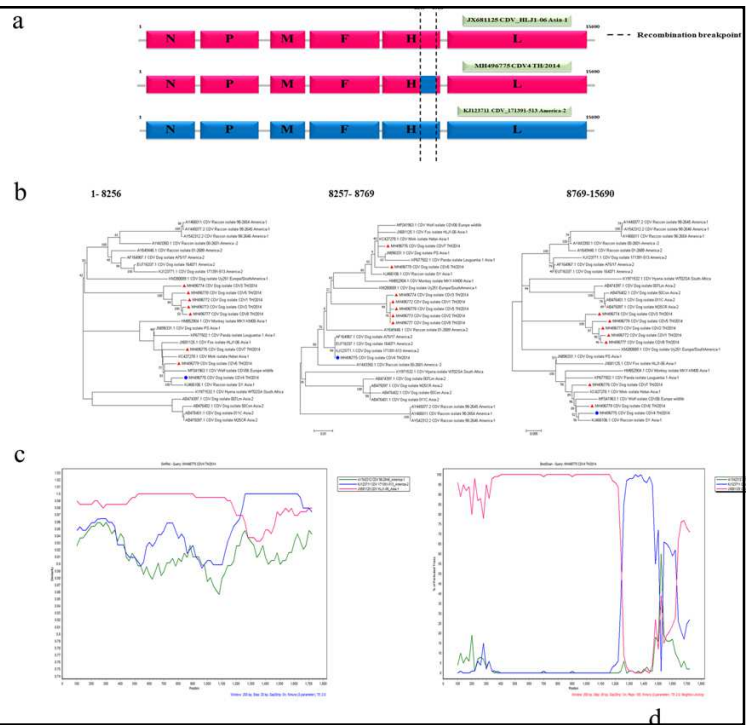
- Greece
- Greenland
- Hungary
- Italy
- Japan
- Kazakhstan
- Portugal
- Russia
- South Africa
- South Korea
- Spain
- Switzerland
- Taiwan
- Tanzania
- Thailand
- Uruguay
- USA
- Vietnam



- America-3
- America-2
- Asia-4 (Thailand)
- Europe-1/South America-1
- South America-3
- European Wildlife
- South America-2
- Africa-2
- Asia-2/Asia-3
- Africa-1
- Arctic-like

GENETIC RECOMBINATION

- One CDV Asia-1 strain isolated in Thailand, has evident of genomic recombination
- Occurred in H gene
- Asia-1 and America-II as parents



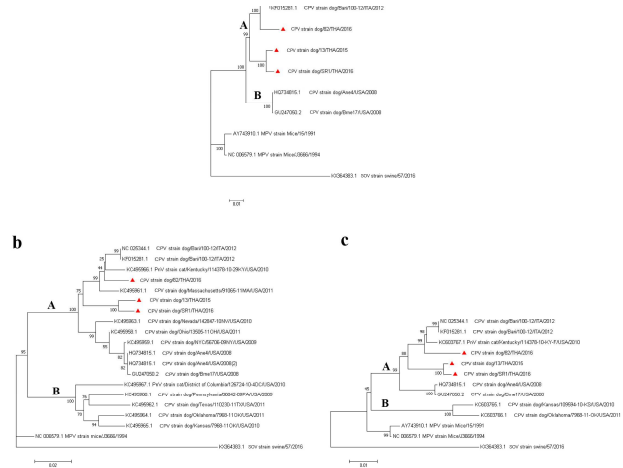
CANINE PNEUMOVIRUS

- Among 209 dogs, 8 dogs positive CnPNV
- The CnPNV isolating in Thailand belongs to CnPNV gr. A
- First identification of CnPNV in Asia
- Genetic recombination firstly identified in CnPNV-Thai strain

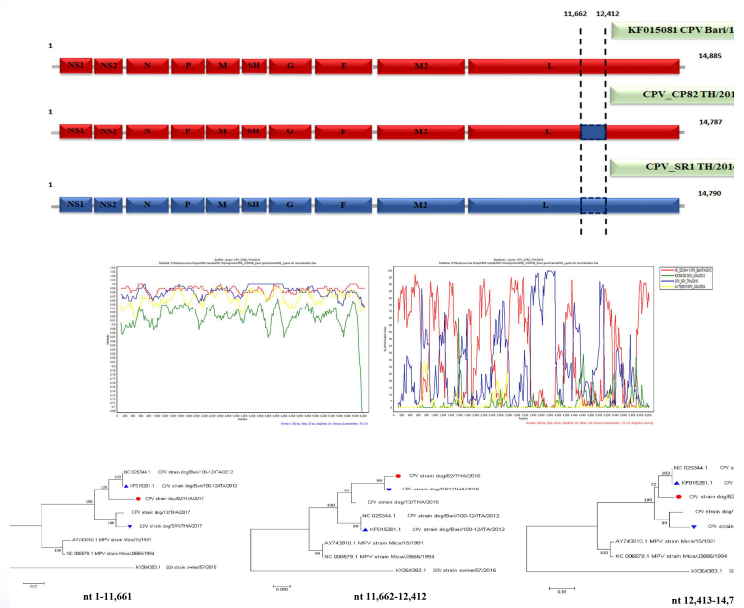
Piewbang et al., unpublished

CANINE PNEUMOVIRUS

- Among 209 dogs, 8 dogs positive CnPnV
- The CnPnV isolating in Thailand belongs to CnPnV gr. A
- First identification of CnPnV in Asia
- Genetic recombination firstly identified in CnPnV-Thai strain



GENETIC RECOMBINATION OF CANINE PNEUMOVIRUS-A



EXECUTIVE SUMMARY

- Developed multiplex PCRs yielded effective dynamic ranges for CIRDC virus detection.
- Many common respiratory viruses including CaHV-1, CIV and CRCoV were established in this study.
- CaHV-1 is one pathogens that should be considered in acute dead pups
- Most of infected dogs were multiple infection; however, no correlation of possible source of infections.
- CDV is still present and high prevalent in Community acquired dogs.
- Severity of respiratory clinical signs is depended on age of infected dogs.
- Novel naturally recombinant CBoV-2, CanineCV, CDV-Asia I and CnPnV were reported.
- Establishment of CBOV-2 could be represent pathognomonic lesion mimic to CBoV-1 infection.
- Novel CDV-Asia4 was addressed.
- Recent Respiratory associated pathogens were determined.

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ACKNOWLEDGEMENTS



Chulalongkorn University
จุฬาลงกรณ์มหาวิทยาลัย



สำนักงาน
คณะกรรมการวิจัยแห่งชาติ
**National Research
Council of Thailand**



Funded by the Horizon 2020
Framework Programme of the
European Union



Niedersachsen

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THANK YOU