UNIVERSIDADE FEDERAL DE MINAS GERAIS
ESCOLA DE VETERINÁRIA
COLEGIADO DO CURSO DE PÓS-GRADUAÇÃO EM CIÊNCIA ANIMAL

GENETIC VARIABILITY OF NEW BRAZILIAN PCV2D STRAINS AND THEIR RELATION TO COMMERCIAL VACCINES

Heloiza Irtes de Jesus Nascimento

Belo Horizonte
2021

Heloiza Irtes de Jesus Nascimento

GENETIC VARIABILITY OF NEW BRAZILIAN PCV2D STRAINS AND THEIR RELATION TO COMMERCIAL VACCINES

Dissertation submitted to the Graduate Program from Escola de Veterinária, Universidade Federal de Minas Gerais, in partial fulfillment of requirement of Master's degree in Veterinary Science.

Major: Preventive Veterinary Medicine
Advisor: Prof. Dra. Érica Azevedo Costa
Co-advisers: Prof. Dra. Maria Isabel Maldonado Coelho Guedes
Prof. Dra. Zélia Inês Portela Lobato

Belo Horizonte
2021

Nascimento, Heloiza Irtes de Jesus, 1984-

N244g Genetic Variability of new Brazilian PCV2D strains and their relation to commercial vaccines/ Heloiza Irtes de Jesus Nascimento. -2021.

149 f: il.

Orientadora: Érica Azevedo Costa

Dissertação (Mestrado) apresentado à Escola de Veterinária da Universidade Federal de Minas Gerais.
Área de concentração: Medicina Veterinária Preventiva.

Bibliografia: f:55 a 67.

1. Suínos – Teses – 2. Vacinas – Doenças – Teses – 3. Circovirose suína – Teses – I. Costa, Érica Azevedo - II. Universidade Federal de Minas Gerais, Escola de Veterinária – III. Título.

CDD – 636.089

Bibliotecário responsável Marcio Alves dos Santos CRB 3589/0
Escola de Veterinária – UFMG.

UNIVERSIDADE FEDERAL DE MINAS GERAIS
ESCOLA DE VETERINÁRIA
COLEGIADO DO PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIA ANIMAL

FOLHA DE APROVAÇÃO

HELOIZA IRTES DE JESUS NASCIMENTO

Dissertação submetida à banca examinadora designada pelo Colegiado do Programa de Pós-Graduação em CIÊNCIA ANIMAL, como requisito para obtenção do grau de MESTRE em CIÊNCIA ANIMAL, área de concentração Medicina Veterinária Preventiva.

Aprovado(a) em 23 de setembro de 2021, pela banca constituída pelos membros:

Dr.(a). Érica Azevedo Costa - Presidente - Orientador(a)

Dr.(a). Roberto Mauricio Carvalho Guedes

Dr.(a). Daniel Lima Correia Linhares

Dr.(a). Amanda Gabrielle de Souza Daniel

Dr.(a). Israel Jose da Silva

Documento assinado eletronicamente por Erica Azevedo Costa, Professora do Magistério Superior, em 07/10/2021, às 16:40, conforme horário oficial de Brasília, com fundamento no art. 5º do Decreto nº 10.543, de 13 de novembro de 2020.

Documento assinado eletronicamente por Roberto Mauricio Carvalho Guedes, Professor do Magistério Superior, em 13/10/2021, às 10:19, conforme horário oficial de Brasília, com fundamento no art. 5º do Decreto nº 10.543, de 13 de novembro de 2020.

Documento assinado eletronicamente por Israel Jose da Silva, Professor do Magistério Superior, em 13/10/2021, às 11:01, conforme horário oficial de Brasília, com fundamento no art. 5º do Decreto nº 10.543, de 13 de novembro de 2020.

Documento assinado eletronicamente por Daniel Correia Lima Linhares, Usuário Externo, em 15/10/2021, às 16:03, conforme horário oficial de Brasília, com fundamento no art. 5º do Decreto nº 10.543, de 13 de novembro de 2020.

Documento assinado eletronicamente por amanda gabrielle de souza daniel, Usuário Externo, em 19/10/2021, às 06:28, conforme horário oficial de Brasília, com fundamento no art. 5º do Decreto nº 10.543, de 13 de novembro de 2020.

A autenticidade deste documento pode ser conferida no site https://sei.ufmg.br/sei/controlador_externo.php?acao=documento_conferir&id_orgao_acesso_externo=0, informando o código verificador **0997881** e o código CRC **2CDCCCCA**.

ACKNOWLEGMENT

Here I express my deepest gratitude to the people who make it possible! Another dream to come true.

I was very lucky to meet good people who inspired me on my path and made me go beyond my horizons. Jussara, Helida and Wilson, I dedicate all my intellectual development to you. Without you I wouldn't have started.

I thank my parents and family for their support in my decisions, I know how difficult it was for them many times and I thank you for believing in me.

I thank Dalvan Veit for supporting me in this trajectory. Studying and working requires a good deal of support and understanding. In the same way I thank Marcos Lopes.

I would like to thank my husband and love of my life, Rafael Panonko, for understanding my hard moments and always support me to move forward.

Erica, my advisor, without you this master's degree would not have been possible. Thank you for trusting that we could accomplish the task together. With you I learned not only science, but also many lessons of humanity and love.

Professor João Luis, thank you for introducing me to a new world called bioinformatics. Having you this time made all the difference.

Also, many thanks to my colleagues at the lab for all the support.

“Once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return.”

— Leonardo da Vinci

RESUMO

No presente estudo 246 amostras clínicas oriundas de granjas de suínos comerciais nas regiões sul, sudeste e centr-oeste do Brasil, previamente vacinadas contra PCV2 e que apresentavam sinais clínicos compatíveis com PCVD foram submetidas para genotipagem de PCV2. O tipo de material enviado para diagnóstico foram amostras de fluido oral, soro e pool de órgãos linfoides. Das amostras analisadas, 106 (43.09% - 106/246) foram genotipadas, sendo 75.47% (80/106) identificadas como PCV2d e 22.64% (24/106) identificadas como PCV2b. Em 2/106 (1.89%) amostras foram verificadas co-infecção de PCV2b e PCV2d. Não houve detecção do genótipo PCV2a nas amostras analisadas. Dentre as amostras clínicas analisadas, o fluido oral obteve um maior número de amostras genotipadas (40/106-37.74%), seguido de pool de órgãos linfóides e soro, com o mesmo número de amostras genotipadas (33/106-31.13%). Adicionalmente, 51 amostras clínicas brasileiras coletadas em 2019 foram enviadas para sequenciamento genético do gene ORF2, que codifica a proteína do capsídeo viral (Cap). Destas, 25 apresentaram boa qualidade para análise, sendo 8 genotipadas como PCV2b e 17 como PCV2d, confirmando que no Brasil, como descrito mundialmente, houve o aumento do genótipo PCV2d. Para analisar a distribuição temporal dos genótipos e flutuação mundial dos genótipos desde 1993 à 2019, 3,544 sequencias disponíveis no GenBank foram analisadas, demonstrando um considerável aumento do genótipo PCV2d a partir de 2006, sendo hoje, o genótipo mais prevalente no mundo. Para estimar a variabilidade da Cap protein de nossas sequencias de PCV2d, comparamos nossas amostras com outras 1,300 sequencias de PCV2d disponíveis no GenBank. Com o objetivo de avaliar a possível pressão vacinal sobre o o genótipo PCV2d, separamos as sequencias em 4 grupos: (1) Pre vacinação (PreVacD) - sequencias de amostras coletadas antes de 2006; (2) Pós vacinação (PosVacD) - sequencias de amostras coletadas entre 2007 e 2020; (3) sequencias de suínos selvagens ou de vida livre(WboarD) que não sofreram pressão vacinal; e (4) nossas sequencias de PCV2d (TestD), analisadas no presente estudo.. Devido às possíveis falhas vacinais observadas nas granjas de suínos comerciais no Brasil, as amostras de PCV2d sequenciadas no presente estudo foram comparadas com as sequencias da ORF2 disponíveis de três vacinas comercias utilizadas no Brasil, uma contendo o genótipo PCV2b e duas contendo o genótipo PCV2a. Grande parte dos resíduos de aminoácidos que se encontram dentro de regiões de epítopo são conservadas, sugerindo uma boa reação cruzada entre as amostras vacinais e as amostras de PCV2d analisadas. Contudo, em alguns resíduos de aminoácidos em sítios antigênicos, essencias para ligação de anticorpos e, consequentemente, neutralização viral, foram detectadas mutações entre as sequencias de PCV2d e as sequencias vacinais. Este resultado sugere que estas mutações possam ter importancia em relação à resposta. Porém, mais estudos devem ser realizados para elucidar essas questões, principalmente a implementação de processos de vigilância de genótipos de Circovirus suínos tipo 2 circulantes no Brasil.

Palavras cahves: PCV2, PCV2d, Circovírus Suino tipo 2, Circovirose, Brasil

ABSTRACT

In the present study, 246 clinical samples from commercial pig farms located in the south, southeast and central-west regions of Brazil previously vaccinated against PCV2 and showing clinical signs compatible with PCVD were submitted for PCV2 genotyping. The type of material sent for diagnosis were samples of oral fluid, serum and lymphoid organs pool. Of the analyzed samples, 106 (43.09% - 106/246) were genotyped, with 75.47% (80/106) identified as PCV2d and 22.64% (24/106) as PCV2b. In 2/106 (1.89%) samples, coinfection of PCV2b and PCV2d was observed. There was no detection of the PCV2a genotype in the analyzed samples. Among the analyzed clinical samples, oral fluid obtained the greater number of genotyped samples (40/106-37.74%), followed by pool of lymphoid organs and serum, with the same number of genotyped samples (33/106-31.13%) . Additionally, 51 Brazilian clinical samples collected in 2019 were sent for genetic sequencing of the ORF2 gene, widely used for genomic/protein analysis, which encodes for the viral capsid protein (Cap). Of these, 25 had good quality for analysis, and 8 were genotyped as PCV2b and 17 as PCV2d, corroborating many other publications around the world that demonstrated the increase of the PCV2d genotype. To analyze the temporal distribution of genotypes and fluctuation of genotypes from 1993 to 2019 worldwide, 3,544 sequences available in GenBank were analyzed, demonstrating a considerable increase in the PCV2d genotype since 2006, today the most prevalent genotype in the world. To estimate the Cap protein variability of our PCV2d sequences, our results were compared to other 1,300 PCV2d sequences available in GenBank. In order to assess the possible pressure of the vaccine against the PCV2d genotype population infection, four groups of samples were defined: (1) Prevaccination (PreVacD) - sequences from samples collected before 2006; (2) Post-vaccination (PosVacD) - sequences of samples collected between 2007 and 2020; (3) sequences from wild or feral pigs (WboarD) that were not vaccinated, and (4) our PCV2d sequences (TestD) analyzed in the present study. Due to possible vaccine failures observed in commercial pig farms in Brazil, the PCV2d sequenced samples in the present study were compared to the ORF2 amino acid sequences available from three commercial vaccines used in Brazil, one containing the PCV2b genotype and 2 containing the PCV2a genotype. Most of the amino acid residues found within epitope regions were conserved, suggesting a good cross-reaction between vaccines and the analyzed PCV2d samples. However, in some amino acid residues in antigenic sites essential for antibody binding and consequently viral neutralization, mutations were detected in PCV2d sequences and in vaccine sequences. This result may suggest that these mutations might be involved in the vaccine immune response. However, further studies must be carried out to elucidate these aspects, especially the implementation of surveillance processes of Porcine Circovirus type 2 genotypes circulating in Brazil.

Key words: PCV2, PV2d, Porcine Circovirus type 2, Circovirosis, Brazil

LIST OF FIGURES

LIST OF TABLES

LIST OF ABREVIATIONS

3D - three-dimensional

A - Alanine

aa – Amino acid

Amino acid 3-letter abbreviation1-letter abbreviation

B-cell - B lymphocytes

C - Cysteine

Cap - Capsid protein

Cryo-EM - Cryo electron microscopy

D - Aspartic acid

DNA – Deoxyribonucleic acid

E - Glutamic acid

ELISA - enzyme-linked immunosorbent assays

EMBRAPA - Empresa Brasileira de Pesquisa Agropecuária

F - Phenylalanine

G - Glycine

H - Histidine

I - Isoleucine

ICTV - International Committee on Taxonomy of Viruses

IFN-gamma - Interferon-gama

IL10 - Interleukin 10

K - Lysine

L - Leucine

LPVA - Department of Preventive Veterinary Medicine

M - Methionine

mAb - monoclonal antibodies

MAFFT - multiple alignment using fast Fourier transform

mPCV2b - mutant PCV2b

N - Asparagine

NA - neutralizing antibodies

NCBI - National Center for Biotechnology
NJ - Neighbor-Joining
nt – Nucleotide
ORF – Open Reading Frame
P - Proline
PCR - polymerase chain reaction
PCV2 - Porcine Circovirus Type 2
PCV2- AD Associated Disease
PCV2- SD - PCV2 systemic disease
PCV2 -SI - PCV2 subclinical infection
PCV2-ED- PCV2 enteric disease
PCV2-LD – PCV2 lung disease
PCV2-RD – PCV2 reproductive disorder
PCVAD - Porcine Circovirus Associated Disease
PCVD - Porcine Circovirus Diseases
PDNS - Porcine dermatitis and nephropathy syndrome
PMWS - Postweaning multisystemic wasting syndrome
PosVacD - Pos-Vaccination genotype PCV2d
PreVacD - Pre-Vaccination genotype PCV2d
PRRSV- reproductive and respiratory syndrome virus
Q - Glutamine
R - Arginine
S - Serine
ssDNA - single-stranded DNA
T - Threonine
T-cell - T lymphocytes
TestD – Test genotype PCV2d
TNF-alfa - Tumor necrosis factor alfa
UV – Ultra Violet
V - Valine

W - Tryptophan

WboarD - Wild boar genotype PCV2d

Y - Tyrosine

SUMÁRIO

1. INTRODUCTION

Pork is still the most consumed animal protein in the world (OECD 2021) and Brazil is the fourth biggest pork producer, responsible for 3.88% of the world's production. The first three largest pork producer (China, European Union and United States) together are responsible for 78.49% of global production (USDA 2021).

Brazil has 2.019,356 housed sows and produced 4,436 million tons of pork in 2020 (ABPA 2021). There are 1,024 thousand tons of exported meat (4th place in the world) and an average consumption of 16 kg of pork per capita (ABPA 2021).

The entire relevance of Brazilian swine production justifies the swine herd heath concern and the importance of controlling diseases of economic impact such as porcine circovirus diseases (PCVD) caused by Porcine Circovirus type 2 (PCV2).

PCV2 genome is 1766–1777 nucleotides (nt) in length (WEI et al., 2019a), belongs to Circovirus genus of the family Circoviridae and is a single strained DNA (ssDNA) virus. It contains eleven open reading frames (ORFs) (HAMEL; LIN; NAYAR, 1998) and at least four ORFs were identified as important. ORF1 encodes a protein responsible for genome replication (MANKERTZ, 2001). ORF3 is associated with apoptosis during infection (LIN, 2011). ORF4 encodes a protein capable of blocking PCV2-induced apoptosis (GAO et al., 2014). The protein encoded by ORF2 is the capsid protein (Cap), the only viral structural protein, and it was found to be responsible for its antigenicity and virulence (HAMEL; LIN; NAYAR, 1998; NAWAGITGUL et al., 2000). ORF 2 is also used for analyzing PCV2 genetic diversity (OLVERA; CORTEY; SEGALÉS, 2007)

The first PCV2 diagnosis in Brazil was made in 1999 by Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA) swine and poultry team, but the first clinical signs such as postweaning multisystemic wasting syndrome (PMWS), pneumonia and other secondary diseases associated and aggravated by the virus appeared in 2005 (MIELE et al., 2011).Since the emergence of commercial vaccines against circovirus in 2006, Brazilian swine herd has been systematically vaccinated to ensure better production rates, reduction of viremia and excretion of PCV2.

Based on serological studies for PCV2, it is assumed that PCV2 infection is ubiquitous worldwide and is accepted as a multifactorial swine disease, in which PCV2 is the essential infective agent (SEGALÉS; ALLAN; DOMINGO, 2005). It is one of the most important pathogens in Brazilian and worldwide swine production, as it causes important economic losses due to high mortality, high cull rate and delayed performance. PCV2 is an immunosuppressive agent, making pigs more vulnerable to other pathogens of respiratory and enteric tracts (CIACCI-ZANELLA, 2017).

PCV2 has been suggested to play a role in reproductive disorders (reproductive failures, abortion and mummified), is part of the Porcine Respiratory Complex, causes enteritis, porcine nephropathy and dermatitis syndrome, and proliferative and necrotizing pneumonia (OPRIESSNIG; MENG; HALBUR, 2007). However, the subclinical manifestation of the disease is more common than the clinical form of circovirus diseases.

In PCV2 subclinical infection (PCV2-SI) there is decreased average daily gain without any evident clinical sign, or macroscopic lesions. In lymphoid tissues there is no lesion or mild lymphocyte depletion with granulomatous inflammation. There is a low amount of PCV2 found in lymphoid tissues, but it can be detected by the standard PCR technique (SEGALÉS, 2012). All these clinical conditions were referred as PCVD (Porcine Circovirus Diseases) in Europe and PCVAD (Porcine Circovirus “Associated” Diseases) in North América. In 2012, (SEGALÉS, 2012) proposed the unified terminology of porcine circovirus diseases – PCVD, to designate all the aforementioned diseases, including subclinical PCV2 infection and this is the term used in this work.

Interestingly the emergence of PCVD in Europe and North America occurred almost at the same time. This phenome can be explained by the independent emergence of the virus in several regions or by the unique emergence and global spread by the swine trade (FIRTH et al., 2009). This second theory seems more plausible and might explain the rapid spread of PCV2 virus around the word, including new genotypes.

The rate of swine herds vaccinated for PCV2 in Brazil varies between 80-98% (CIACCI-ZANELLA, 2017) and the most used protocol is the vaccination of three-week-old piglets, a time that usually coincides with weaning. Since the massive introduction of vaccination, the health status of farms has changed and there are currently self-limited subclinical problems, with occasional outbreaks. However, practices inherent to the application of the vaccine (half dose, change of manufacturers' brands, inadequate storage temperature, application in part of the batch) possibly caused the virus (of all genotypes) to continue circulating and causing disease (CIACCI-ZANELLA, 2017).

2. OBJECTIVES

- To determine which PCV2 genotypes are circulating in Brazilian vaccinated swine herds.

- Determine which PCV2 strains are more often present in Brazilian vaccinated pig herds from diagnostic samples and determine its genetic diversity

- Analyze samples of PCV2d from NCBI from the periods pre and pos launch of vaccines, checking for significant changes on amino acid level.

- To compare the amino acid sequence at antigenic sites among Brazilian PCV2d samples and three currently registered vaccines.

3. Literature Review

3.1. Etiology

PCV is thought to have originally evolved from a plant nanovirus through host-switch followed by a recombination event with a picorna-like virus in a mammalian host (GIBBS; WEILLER, 1999). FIRTH *et al*. (FIRTH et al., 2009) showed that PCV2 originated within approximately the last 100 years and that PCV2a and PCV2b shared a common ancestor (not that PCV2b evolved from PCV2a) and these two genotypes have been independently circulating since then.

The First report of an outbreak of what came to be called postweaning multisystemic wasting syndrome (PMWS) was reported in West Canada (ALLAN et al., 1998; ELLIS, 2014; HARDING et al., 1998) but the first identification of the virus as a pathogen and its isolation was performed by Dr. Gordon Allan and Brian Meehan in 1997 (ALLAN et al., 1998; MEEHAN et al., 1998)

PCV2 at the time of discovery was challenging because experiments failed while trying to reproduce koch's postulate (ELLIS, 2014), concluding that PCV2 is the necessary but not sufficient cause of PCVD but could be more severe or even fatal when pigs were coinfected with another pathogen (KRAKOWKA et al., 2000; OPRIESSNIG; HALBUR, 2012). Nowadays, it is clear that PCV2 is ubiquitous and was present many years prior to the onset of clinical PCVD (PATTERSON; OPRIESSNIG, 2010).

PCV2 genome is 1766–1777 nucleotides (nt) in length (WEI et al., 2019a) making them the smallest autonomously replicating pathogen. It belongs to *Circovirus* genus of the family *Circoviridae*, is a single-stranded DNA (ssDNA) and is a nonenveloped icosahedral virus. It contains eleven open reading frames (ORFs) (HAMEL; LIN; NAYAR, 1998) and at least four ORFs were identified as important. ORF1 encodes a protein responsible for genome replication (Rep) (MANKERTZ; HILLENBRAND, 2001)), ORF3 is associated with apoptosis during infection (Wei-Li Lin, 2011) and ORF4 protein is capable of blocking PCV2-induced apoptosis (GAO et al., 2014) . The protein encoded by ORF2 is the capsid protein (Cap) and the only viral structural protein and was found to be responsible for its antigenicity and virulence (HAMEL; LIN; NAYAR, 1998; NAWAGITGUL et al., 2000). ORF 2 is also used for analyzing PCV2 genetic diversity (OLVERA; CORTEY; SEGALÉS, 2007) and the virion is a structure containing 60 copies of the capsid protein (CROWTHER et al., 2003).

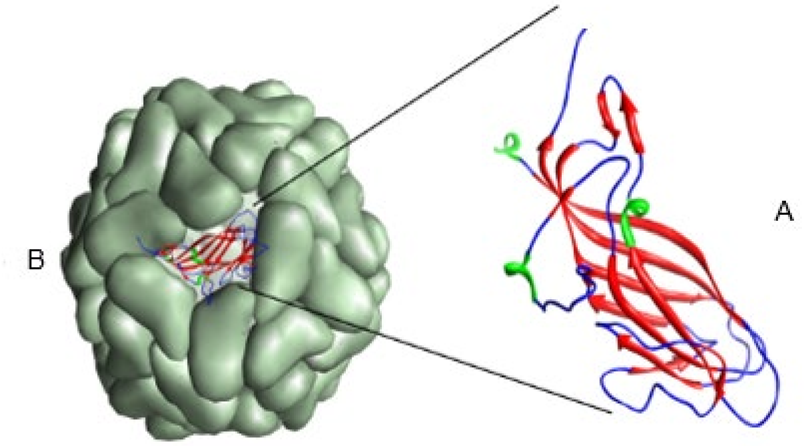


Figure 1: PCV2 Cap subunit model structure and assembly into a viral capsid. The ribbon model of the Cap subunit (A) with helices, loops and sheets shown in green, blue and red, respectively. Panel B shows a CP subunit placed in the context of the viral capsid. The remaining 59 Cap subunits are depicted in gray. **Source:** TRIBLE; ROWLAND, 2012.

3.2. Epidemiology

Phylogenetic analysis around the world identified PCV2 viruses as very similar (nucleotide sequences identity higher than 93%) to each other (OLVERA; CORTEY; SEGALÉS, 2007) but with application of bioinformatic tool, many research groups started to report the emergence of different genetic groups which later came to be called genotypes (SEGALÉS et al., 2008).

Nowadays the genotyping methodology proposed by (FRANZO; SEGALÉS, 2018) of maximum intra-genotype p-distance of 13% (calculated on the ORF2 gene), bootstrap support at the corresponding internal node higher than 70% and at least 15 available sequences. This method has been used for PCV2 genotyping and allows the definition of 8 genotypes (PCV2a to PCV2h).

PCV2a, PCV2b and PCV2d has been widely diagnosticated worldwide while

PCV2c was described in Denmark (DUPONT et al., 2008), in Brazil on feral pigs (FRANZO et al., 2015) and wild boars (SATO et al., 2017). PCV2e was first described in Mexico and USA (HARMON et al., 2015), PCV2f (BAO et al., 2018) and PCV2h (YAO et al., 2019) were described in China few years ago. In 2020 a new genotype, PCV2i, isolated from a USA pig was proposed by Wang (WANG et al., 2020).

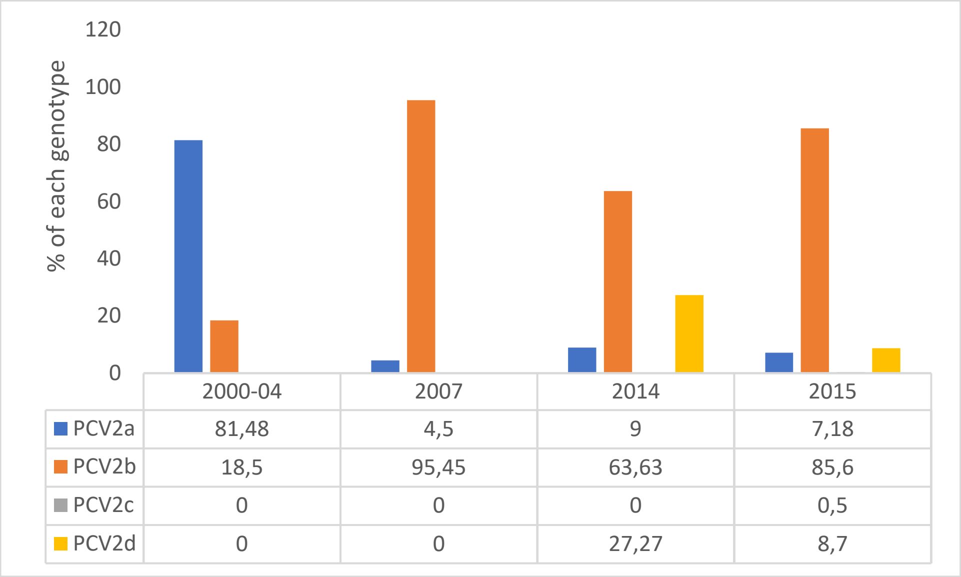
In the early 2000s, more severe clinical diseases were observed in pigs and PCVD became present worldwide. The most prevalent genotype identified and associated with the disease at the time was PCV2b (FIRTH et al., 2009; FRANZO; SEGALÉS, 2018).

The first global shift in the predominance of subtype was pointed to occur from PCV2a to PCV2b prior to 2003 (DUPONT et al., 2008) and few years after this first genotype prevalence shift, commercial PCV2a-based vaccines become widely used worldwide and these vaccines seemed to be highly efficacious against PCV2 infection (CHAE, 2012; OPRIESSNIG et al., 2009). However, in 2012 new PCVD outbreaks started to be reported in vaccinated farms in the USA and an emerging mutant PCV2b (mPCV2b) strain was identified (OPRIESSNIG et al., 2013). This mPCV2b found was very similar to the strain previously reported in 2010 in China (GUO et al., 2010) and later was designated as PCV2d. Since then, there has been an increase in the deposition of PCV2d sequences, indicating its predominance in Asia, Europe, North and South America (KHAYAT et al., 2010). This change could be, at least in part, induced by PCV2 vaccination pressure (REINER; HOFMEISTER; WILLEMS, 2015).

PCV2d shows an elongation of ORF2 by one Lysine (K) (XIAO; HALBUR; OPRIESSNIG, 2012). In addition to the nucleotide differences, structure-based sequence comparison demonstrate that each genotype possesses a unique combination of amino acids located on the surface of the capsid that undergo substitution (KHAYAT et al., 2010).

In the comparison of virulence, the Chinese PCV2d strain caused more serious disease compared to the PCV2a and PCV2b strains while the Korean and North American PCV2d strain exhibited similar virulence to PCV2a and PCV2b strains (CHO et al., 2020; GUO et al., 2012; OPRIESSNIG et al., 2014). Another study aiming to compare virulence between PCV2a, PCV2b and PCV2d, although concluding they have similar virulence. Animals infected with PCV2d had a significantly higher amount of PCV2 DNA and lymphoid lesions consistent with PCVD (OPRIESSNIG et al., 2014). Also PCV2d showed a significant higher virulence when coinfected with other pathogen, such as PRRSV (SUH et al., 2021).

This new mutant strain had its first identification in Brazil in 2014 (SALGADO et al., 2014). The strain was isolated from vaccinated pigs suffering of PMWS. Many authors in Brazil reported the presence of different PCV2 genotype along the years providing information that PCV2b until now, seemed to be the predominant genotype (Figure 2).



	2000-04	2007	2014	2015
🟦 PCV2a	81,48	4,5	9	7,18
🟧 PCV2b	18,5	95,45	63,63	85,6
◼ PCV2c	0	0	0	0,5
🟨 PCV2d	0	0	27,27	8,7

Figure 2: Percentage of the genotyped samples in the years 2000-04, 2007, 2014 and 2015. Data from: (CHIARELLI-NETO et al., 2009; DE CASTRO et al., 2008, 2012; FRANZO et al., 2015; GAVA et al., 2018; RODRIGUES; CRUZ; ARAÚJO JÚNIOR, 2018; SALGADO et al., 2014; SATO et al., 2017; SCHAEFER et al., 2015).

3.3. Pathogenesis, Clinical Signs and Lesions

PCV2 is the primary causative agent of PCVD, however it has been difficult to reproduce the disease under experimental conditions (FENAUX et al., 2002; OPRIESSNIG; HALBUR, 2012; OPRIESSNIG; MENG; HALBUR, 2007) and coinfections with other swine pathogens or immunostimulant are usually necessary to reproduce PCVD (OPRIESSNIG; HALBUR, 2012).

Clinical signs are usually present on pig with 8-16 weeks of age and a variety of symptoms can be associated to PCV2 as PCV2 systemic disease (PCV2-SD), PCV2 lung disease (PCV2-LD), PCV2 enteric disease (PCV2-ED), PCV2 reproductive disease (PCV2-RD) and Porcine dermatitis and nephropathy syndrome (PDNS) (SEGALÉS, 2012). All denominations are summarized on table 1. Nowadays PCV2 disease complex is collectively named Porcine Circovirus Diseases (PCVD) and designates all the above-mentioned conditions, including the PCV2 subclinical infection and PMWS (SEGALÉS, 2012).

Transmission of PCV2 is thought to occur through direct contact via oronasal, fecal, semen and urinary routes (OPRIESSNIG; MENG; HALBUR, 2007). The virus can be found in semen (LAROCHELLE et al., 2000), and vertical intrauterine transfer of PCV2 results in viremic or persistently infected piglets at birth (JOHNSON et al., 2002; O'CONNOR et al., 2001). PCV2 uses heparan sulfate and chondroitin sulfate B, glycosaminoglycans as receptors for its attachment and internalization to host cells (MISINZO et al., 2006).

Despite most of the pig population are infected with PCV2, a high percentage of animals shows no clinical signs of disease, indicating a subclinical infection (OPRIESSNIG et al., 2020). PCV2 subclinical infection (PCV2-SI) can be described as showing decreased average daily gain without any evident clinical sign, lack of notorious clinical signs, none or minimal histopathological lesions, low amount of PCV2 in tissues and also has been linked to decreased vaccine efficacy (OPRIESSNIG et al., 2006; SEGALÉS, 2012).

PMWS or PCV2-SD pigs have marked depletion of lymphocytes from lymphoid tissue and the replacement with histiocytes and macrophages (KRAKOWKA et al., 2002). These include depletion of B and T lymphocytes combined with decrease on IgM+ (DARWICH et al., 2002). The depletion of lymphocytes has been suggested to be a result of apoptosis, but the evidence for this theory is still lacking (WIKSTROM, 2008). Proposal mechanism that may enhance PCV2 replication during coinfection includes alteration of the host cytokine response to create a more favorable environment for PCV2 (increase of IFN-gamma and chemokines like IL10 and TNF-alfa) and initiation of host cell replication, necessary for the S-phase-dependent PCV2 replication (ELLIS, 2014; SEGALÉS; ALLAN; DOMINGO, 2005). PCV2-LD has a potential diagnostic overlapping with PCV2-SD since respiratory clinical signs can be easily present in cases of systemic disease (OPRIESSNIG; MENG; HALBUR, 2007; TICO; SEGALÉS; MARTI, 2013).

In cases of nephropathy syndrome (PDNS), extremely high PCV2 antibody amount triggers the development of fibrinous deposits (immune complexes) in kidney tissue. This immune complex can initiate an inflammatory process when deposited within the vascular or glomerular capillary walls added to an increased number of CD8+ cells in kidneys. This might be an explanation for the severe renal lesions (WELLENBERG; STOCKHOFE-ZURWIEDEN; JONG, 2004).

PCV2-ED is characterized by granulomatous inflammation and lymphoid depletion in the Peyer's patches in the small and large intestines (infiltrates of epithelioid cells and giant multinucleated cells), presence of intracytoplasmic inclusion bodies and some animal can show multifocal necrosis and ulceration with fibrin and neutrophils exuding from the ulcerated areas into the lumen (KIM et al., 2004)

PCV2-RD can be described as clinical manifestations of abortions, stillbirths, fetal mummification and increased preweaning mortalities (OPRIESSNIG; MENG; HALBUR, 2007). Affected herds are typically gilt startups or new populations. Nonsuppurative to necrotizing or fibrosing myocarditis associated with abundant PCV2 antigen is the hallmark lesion in stillborn and neonatal pigs from field cases (O'CONNOR et al., 2001; WEST et al., 1999). PCV2-associated microscopic lesions have not been reported in dams with PCV2-associated reproductive failure, and reproductive organs and placental sections are usually normal (RITTERBUSCH et al., 2012).

Table 1: Summary of denomination, gross and microscopic lesions on PCVD. Adapted from (SEGALÉS, 2012)

PCVD	Gross Lesions	Microscopic lesions
PCV2 subclinical infection (PCV2-SI)	None	None or slight lymphocyte depletion with granulomatous inflammation of lymphoid tissues
PCV2 systemic disease (PCV2-SD) Replaced terminology: Postweaning multisystemic wasting syndrome (PMWS), Porcine circovirosis, PCV2-associated systemic infection	Long rough hair coat, prominent backbone and relatively oversized head; Lymph node enlargement; Lack of pulmonary collapse. White spots on kidney's cortices; Atrophic and discolored liver, slightly, rough hepatic surface. Catarrhal enteritis with or without mesenteric edema; Occasional spleen infarcts.	Moderate to severe lymphocyte depletion with granulomatous nflammation of lymphoid tissues; possible presence of intracytoplasmic botryoid inclusion bodies; Lymphohistiocytic to granulomatous interstitial pneumonia; occasionally, peribronchiolar fibroplasia, mild to severe necrotizing bronchiolitis and/or proliferative and necrotizing pneumonia. Interstitial nephritis. Variable degree of lymphohistiocytic hepatitis, with apoptotic bodies, disorganization of hepatic plates, and/or perilobular fibrosis. Granulomatous enteritis. Possibility of lymphohistiocytic inflammation in virtually whatever tissue.
PCV2 lung disease (PCV2-LD) Replaced terminology: PCV2-associated respiratory disease Proliferative and necrotizing pneumonia (PNP)	Lack of pulmonary collapse and tan-mottled lungs	Granulomatous bronchointerstitial pneumonia with or without bronchiolitis and bronchiolar fibrosis. Lack of PCV2-SD hallmark lesions in lymphoid tissues.
PCV2 enteric disease (PCV2-ED) Replaced terminology: PCV2-associated enteritis	Catarrhal enteritis with or without mesenteric edema. Intestinal mucosa thickened. Enlargement of mesenteric lymph nodes.	Granulomatous enteritis. Lymphocyte depletion with granulomatous inflammation in Peyer's patches but not in other lymphoid tissues.
PCV2 reproductive disease (PCV2-RD) Replaces Terminology: PCV2-associated reproductive failure	Fetal mummification or edematous fetuses. Fetal hepatic enlargement and congestion. Fetal cardiac hypertrophy with multifocal areas of myocardial discoloration. Ascites, hydrothorax and hydropericardium in fetuses	Non-suppurative to necrotizing or fibrosing myocarditis of fetuses. Chronic, passive, hepatic congestion in fetuses. Mild pneumonia in fetuses.
Porcine dermatitis and nephropathy syndrome (PDNS)	Irregular, red-to-purple macules and papules in the skin; subcutaneous hemorrhages and edema of affected areas. Enlarged lymph nodes, mainly inguinal superficial one.	Systemic necrotizing vasculitis Fibrino-necrotizing glomerulitis with non-purulent interstitial nephritis. Chronic, fibrous interstitial nephritis with glomerulosclerosis in animals that recovered from the acute phase. From none to mild/moderate lymphocyte depletion with mild granulomatous inflammation of lymphoid tissues.

	Cutaneous scars in animals that recovered from the acute phase. Bilaterally enlarged kidneys, small cortical petechiae and edema of the renal pelvis. Occasional spleen infarcts.	

3.4. Diagnostic

The complexity of PCV2D diagnosis relies on the fact that the sole detection of PCV2 in serum or tissues of a pig, even in the presence of clinical signs compatible with PCV2D, is not conclusive to establish a diagnosis (PUIG, 2009). At present, three diagnostic criteria must be fulfilled to establish an individual diagnosis of PCVD (SEGALÉS; ALLAN; DOMINGO, 2005):

1) Presence of clinical signs such as wasting, weight loss, and respiratory disease;

2) Presence of the hallmark PCV2-associated microscopic lesions (lymphoid depletion and/or histiocytic replacement of follicles in lymphoid tissues), and

3) PCV2 antigen or nucleic acids associated with the microscopic lesions as determined by immunohistochemistry or ISH.

Some techniques might be useful to refine PMWS diagnosis but cannot be used alternatively to histopathology and detection of PCV2 in tissues. This techniques includes PCV2 load quantification in sera of 10^7 DNA copies/ml (OLVERA et al., 2004) and serological tests (FORT; OLVERA; SIBILA, 2007).

Subclinical PCV2 infection is established when, although PCV2 is detected in blood and/or tissues, the amount of viral load is low and associated with no or minimal lesions (OPRIESSNIG; MENG; HALBUR, 2007).

3.5. Immune Response

Cell mediated immune response and neutralizing antibodies (NA) are important for protection against PCV2 (DARWICH; MATEU, 2012) and the presence of NA is important in controlling virus replication (MEERTS et al., 2006). A decrease in viraemia coincides with an increase in NA titers in pigs inoculated with PCV2 suggesting that NAs represent an important mechanism for viral clearance and recovery from infection (FORT; OLVERA; SIBILA, 2007).

The immunogenic epitopes of the PCV2 capsid protein have been mapped and the residue 47 to 84, 113 to 131, 156 to 208 and 228 to 233 have been demonstrated as important neutralizing epitopes (HUANG et al., 2011; KHAYAT et al., 2011; LEKCHAROENSUK et al., 2004; MAHÉ et al., 2000; SHANG et al., 2009; TRUONG et al., 2001). Amino acid mutations were found in these regions suggesting that important antigenic differences may occur between genotypes and strains (HUANG et al., 2011; MENG, 2013; SAHA et al., 2012; WEI et al., 2019b).

Also vaccine trial studies has been extensively demonstrated by Opriessnig and other authors showing that PCV2a based vaccine are efficient against PCV2 infection and PCVD (CHAE, 2012; OPRIESSNIG et al., 2008, 2009, 2010, 2011; SEGALÉS et al., 2009; SINHA et al., 2010). But the lack of a consistent, precise and reproducible model of PCVD is one of the main obstacles to establishing clear parameters for the experimental evaluation of PCV2 vaccines (CHAE, 2012).

With the use of immuno-informatic tools, increased genetic diversity in epitope regions between field isolates and vaccines has been demonstrated and a fully protection might not be reached by current available products (BANDRICK et al., 2020; CONSTANS et al., 2015) what was demonstrated by (KANG et al., 2020), showing that sera from a commercial PCV2a based vaccine had a lower activity against PCV2d viruses.

The increase in the number of in silico analyzes, genetic diversity in epitope regions between field isolates and vaccines has been demonstrated. T- and B-cell epitopes in a PCV2a vaccine strain were not identified as epitopes in PCV2b and PCV2d field strains, indicating a difference in their antigenicity or binding affinity to receptors (CONSTANS et al., 2015). Also it was demonstrated that vaccines based only on PCV2a strain shared less T-cell epitopes with PCV2 field strains current circulating and that more than one genotype in vaccines are necessary for a better protection against PCV2 (BANDRICK et al., 2020; SEGALÉS, 2015).

4. MATERIALS AND METHODS

4.1. Samples sent to the laboratory used in this study

A total of 246 clinical samples_from Southeast (Minas Gerais-MG State), South (Paraná-PR, Santa Catarina-SC Rio Grande do Sul-RS States), and Midwest (Mato Grosso-MT, Mato Grosso do Sul-MS, Goiás-GO, Distrito Federal-DF States) regions of Brazil were obteined. Oral fluids, lymphoid organ and sera were received for routine diagnostic at the Laboratório de Pesquisa em Virologia Animal (LPVA), Department of Preventive Veterinary Medicine, School of Veterinary Medicine of the Universidade Federal de Minas Gerais (UFMG) from 2019 to 2021. These samples were originated from pig farms previously vaccinated against PCV2 and showing PCVD-like symptoms. The pigs were vaccinated against PCV2 with one out seven PCV2 vaccines available in Brazil, according to the farm's choice (Table 4). The state that sent the highest number of samples was Minas Gerais with 122 of 246 samples (49.5%), followed by Paraná (n= 33, 13.4%), Mato Grosso (n=22, 8.9%), Rio Grande do Sul (n=21, 8.54%), Santa Catarina (n=12, 4.88%), Mato Grosso do Sul (n=9, 3.6%), Goiás (n=4, 1.63%), Distrito Federal_(n=1, 0.40%) and (n=22, 9.94%) samples had no identification of origin. The most frequent clinical specimens received for PCV2 genotyping was lymphoid organ pool (n=90, 36.58%), followed by oral fluid (n=82, 33.33%) and serum (n=74, 30.08%). Fifty-eight samples were received in 2019 (n=44, 75.86% oral fluid; n=10, 7.24% lymphoid organ pool and n=4, 6.90% serum), ninety-one in 2020 (n=24, 26.37% oral fluid; n=55, 60.43% lymphoid organ pool and n=12, 13.19% serum), and ninety-seven in 2021 (n=14, 14.43% oral fluid; n=25, 25.77% lymphoid organ pool and n=58, 59.79% serum). Samples were received in the context of routine diagnosis and some information were missing such as the herd size and age of the animal. This field samples were used for genotyping by polymerase chain reaction (PCR).

4.2. PCV2 genotyping

Total DNA was extracted using mini spin DNA extraction kit (Kasvi, Brasil), according to the manufacturer's instructions, and eluted with 30 μL of nuclease free water. Two µL of extracted total DNA was mixed with 0.5 µM of each PCV-2-specific primers, 1.5 mM of $MgCl_2$, 200 µM of each dNTP and 1,5 U of Taq DNA polymerase (Phoneutria, Brasil), added up to a final volume of 25 µL. The DNA was stored at -80ºC until used. For genotyping of PCV2a, PCV2b and PCV2d, specific primers and PCR cycling were used according to Kwon et al (2017). All amplicons were analyzed by electrophoresis on a 1.5% agarose gel, stained by ethidium bromide and visualized in UV transilluminator.

4.3. Samples for sequencing

In addition, a total of 51 samples were used for complete sequencing of Open Reading frame 2 (ORF2) gene. Eighteen came from samples collected in the field from animals with clinical signs compatible with PCVD and 33 positive samples for PCV2 by conventional PCR, kindly provided by Microvet - Microbiologia Veterinária Especial, were used for ORF2 sequencing. All samples used for sequencing were collected in the year 2019. The ORF2 gene encodes for the capsid viral protein (Cap) and were used for genomic/protein analysis. All samples sent by Microvet came from vaccinated commercial pig herds in Brazil as well, and the sequencing was performed by Simbios Biotecnologia laboratory using Sanger method.

4.4. Phylogenetic analysis

Fifty-one samples were sent for sequencing, 34 of them were fully or partially sequenced, after manual polishing of sequences with the removal of important gaps , only 25 of them had enough quality to be analyzed. To estimate the phylogeny of the Brazilian PCV2 isolates, the OR2 gene from 25 Brazilian sequenced strains were aligned with 51 reference sequences described by FRANZO; SEGALÉS, (2018) from PCV2a, PCV2b and PCV2d, obtained in the National Center for Biotechnology information (NCBI) GenBank (Supplementary Figure 1), using MAFFT v7.471 (KATOH;STANDLEY, 2013), with globalpair method, adjust direction options and 1,000 iterations. The alignment was manually polished to remove poor-aligned regions with AliView (https://academic.oup.com/bioinformatics/article/30/22/3276/2391211) and used in the phylogeny estimation. Phylogeny was estimated by Neighbor-Joining (NJ) method (SAITOU; NEI, 1987) with 1,000 bootstrap replicates (FELSENSTEIN, 1985), using MEGA X software (KUMAR et al., 2018). The pairwise distance between sequences were estimated by p-distance method under 1,000 bootstrap replications using MEGA X software.

4.5. Sequence dataset

To evaluate the PCV2 isolates fluctuation from 1993 to 2019, a total of 3,544 ORF2 sequences and metadata deposited until March of 2019 were retrieved from NCBI (Table 2). The metadata containing the year of evaluation was used to plot a graph representing their occurrence along the years, using the ggplot library (https://link.springer.com/book/10.1007/978-3-319-24277-4) in R (https://www.R-project.org/).

Table 2: Sequences used in retrospective study

PCV2 Genotype	**PosVac**	**PreVac**	**Test**	**WildBoar**	**Others**
2a	275	260	0	17	3
2b	954	476	9	111	6
2c	1	0	0	0	0
2d	1270	9	15	21	3
2e	20	2	0	0	0
2f	19	6	0	0	0
2g	3	1	0	1	0
2h	61	1	0	0	0
Total	2603	755	24	150	12

4.6. Analysis of ORF2 of PCV2d from different strains and vaccines

To estimate the PCV2d ORF2 sequence variability and compare them to three available vaccine sequences, 1,300 PCV2d sequences from NCBI and 17 PCV2d strains from Brazil obtained in the present work were separated into 4 groups: 1 - Pre-Vaccination (PreVacD): PCV2d isolates collected before 2006 and not obtained from wild boars; 2 - Pos-Vaccination (PosVacD): isolates obtained from 2007 to 2020 and not obtained from wild boars; 3 - Test (TestD): PCV2d isolates sequenced in the present work; and 4 - Wild boar (WboarD): Isolates obtained from wild boars (Table 3 and Addendum). The sequences from each group were aligned with MAFFT v7.471 (KATOH; STANDLEY, 2013), with globalpair method, adjust direction options and 1,000 iterations. The alignment was manually polished and translated to amino acid sequences using AliView (https://academic.oup.com/bioinformatics/article/30/22/3276/2391211). Then, the consensus sequence of each group was generated in R, using the consensus function from the seqinr library (https://link.springer.com/chapter/10.1007/978-3-540-35306-5_10), where sequences that were not identical in > 90% of the isolates in the group were replaced by "-". Multiple alignment of the amino acid sequences of the capsid protein (encoded by ORF2) of the four consensus groups, PreVacD, PosVacD, WboarD and TestD, and three vaccine strains (tables 3 and 4) were performed using MAFFT v7.471 (KATOH; STANDLEY, 2013). The alignment was displayed and edited on Aliview software version 1.27, and the logo representation of the consensus sequence for each group was generated with the library ggseqlogo (https://academic.oup.com/bioinformatics/article/33/22/3645/3980251) in R. Alignment are displayed on figure 5.

Table 3: Number of PCV2d sequences in each group.

Group	Sequences
Pre-Vaccination	9
Pos-Vaccination	1270
Test	17
Wild boar	21

Table 4: Vaccine strains used in our study

Strain	GenBank Access Number	Genotype	Reference
Vac2000-2a	GU049340	PCV2a	(MEEHAN et al., 1998)
cVac2007-2a	AF264042	PCV2a	(BANDRICK et al., 2020)
cVac2009-2b	GU799576	PCV2b	(BANDRICK et al., 2020)

5. RESULTS AND DISCUSSION

5.1. Genotyping of field samples

From 246 field samples analyzed, 106 of 246 (43.09%) were genotyped by PCR. The amount of PCV2 positive samples for genotyping was 27.59% in 2019, 47.25% in 2020 and 48.45% in 2021 (Table 5). Considering that samples were received until June of 2021 and this amount was higher than in previous years, there was a significant increase in the submission of diagnostic material. This may have been due to the increase in clinical disease in the field, the need for differential diagnosis with other diseases or more PCV2 vaccines sponsoring diagnosis. Regarding genotype, studies in Brazil so far have shown the frequent detection of PCV2b (CASTRO, 2005; DE CASTRO et al., 2008, 2012; FERRARI, 2012; GAVA et al., 2018).

Most of the genotyped samples in this study was identified as PCV2d 80 of 106 (75.47%) followed by PCV2b 24 of 106 (22.64%). Coinfection between PCV2b and PCV2d were detected in 2 of 106 (1.89%) of the samples. No PCV2a was detected. This is the first study demonstrating that PCV2b is not the most present genotype and that PCV2d stood out over PCV2b in Brazil. Data showing year of collection and genotype is presented in Table 5.

Table 5: Total genotyped samples by PCR from 2019 to 2021.

Relation of subtyped samples				
Genotypes	**2019**	**2020**	**2021**	**Positivity (%)**
PCV2a	0/16 (0%)	0/43 (0%)	0/47 (0%)	0/106 (0%)
PCV2b	0/16 (0%)	7/43 (16.28%)	16/47 (34.04%)	23/106 (21.90%)
PCV2d	16/16 (100%)	33/43 (76.74%)	31/47 (65.96%)	80/106 (76.19%)
Coinfection A ESCRITA TEM DE SER CONSISTENTE EM TODA A DISSERTACAO (PCV2b+PCV2d)	0/16 (0%)	2/43 (4.65%)	0/47 (0%)	2/106 (1.89%)
Not genotyped	42/58 (66.6%)	48/91 (52.75%)	50/97 (51.55%)	141/246 (57.32%)
Total genotyped samples	16/58 (27.59%)	42/91 (47.25%)	47/97 (48.45%)	105/246 (43.09%)

Among the clinical specimens analyzed, oral fluid had the highest number of genotyped samples 40 of 106-(37.74%), followed by the pool of organs and serum, which had the same amount, with 33 of 106 (31.13%). Oral fluid sampling is well suited for detecting and monitoring presence of PCV2 and has gained growing interest as an even more cost and time-saving method while also considering animal welfare (KIM, 2010; NIELSEN et al., 2018; PRICKETT et al., 2011).

Of the 106 genotyped samples, the state with highest positivity was Minas Gerais, with 22 samples, followed by 20 from Mato Grosso, 14 from Paraná, 8 from Rio Grande do Sul, 2 from Santa Catarina, and 11 samples had no identification of origin, as described in the table 6. In all Brazilian States, the occurrence of genotype PCV2d prevailed over PCV2b.

Table 6: Number of samples tested and genotyped by Brazilian states from 2019 to 2021.

Brazilian States	Samples tested	Samples genotyped	PCV2a genotype	PCV2b genotype	PCV2d genotype	Mixed infections (PCV2a + PCV2d)
DF	1	0	0	0	0	0
GO	4	0	0	0	0	0
MT	22	20	0	0	19	1
MS	9	0	0	0	0	0
MG	122	51	0	10	41	0
PR	33	14	0	4	9	1
RS	21	8	0	1	7	0
SC	12	2	0	2	0	0
W/I	22	11	0	7	4	0
Total samples	**246**	**106**	**0**	**24**	**80**	**2**

Abreviativos: DF=Distrito Federal; GO=Goiás; MT=Mato Grosso; MS=Mato Grosso do Sul; MG=Minas Gerais; PR=Paraná; RS=Rio Grande do Sul; SC=Santa Catarina; W/I= Without identification

In Brazil, the PMWS was first identifies in 2000 and retrospective studies have demonstrated PCV2 circulation since 1978 (CIACCI-ZANELLA et al., 2009; da SILVA et al., 2011). Several studies have reported a relevant circulation of PCV2a and PCV2b genotypes in commercial pig herds (CASTRO et al., 2007; 2012; CHIARELLI-NETO et al., 2009; CIACCI-ZANELLA et al., 2009) and wild boars (BARBOSA et al., 2006; (DE CASTRO et al., 2012; FRANZO et al., 2015; SATO et al., 2017) in Brazil. However, the PCV2d genotype was only detected for the first time in 2010 from feral pig samples from Brazilian Pantanal (FRANZO et al., 2015) and in 2013-2014 from samples collected in conventional nursery and fattening commercial herds (SALGADO et al. 2014). The data from this study, associated to the PCR results previously demonstrated, indicates that PCV2d may be the most common genotype circulating in Brazilian herd nowadays.

This data corroborates several authors that concluded that PCV2d has become the most prevalent genotype worldwide (FRANZO et al., 2016a; FRANZO; SEGALÉS, 2018; KHAYAT et al., 2010; QU et al., 2018; XIAO; HALBUR; OPRIESSNIG, 2015; YAO et al., 2019). Due to the relevance of PCV2d as the predominant genotype circulation in Brazilian farms and its association with cases of perceived failure of PCV2 vaccination, this genotype was chosen to be evaluated at the amino acid level

5.2. DNA sequencing and ORF2 phylogenetic analysis

Although the ORF2 gene from 34 out of 51 PCV2 PCR positive samples were sequenced after alignment and exclusion of sequences with important gaps and poor quality, 25 sequences were selected for our phylogenetic tree (Figure 3).

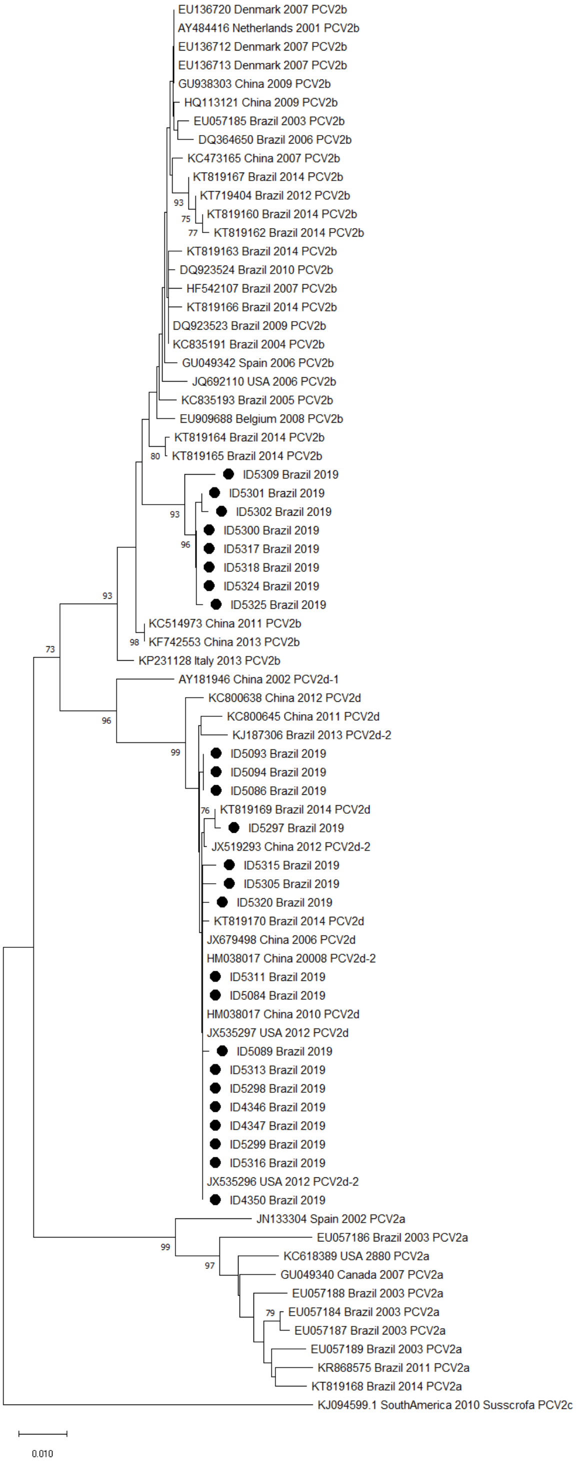


Figure 3: Phylogenetic analysis of 25 sequences from this study (eight are genotype PCV2b and seventeen are PCV2d) and 51 Reference strains from PCV2a, PCV2b, PCV2c and PCV2d) were used according FRANZO; SEGALÉS (2018). Sequences from this study are indicated by a solid circle. The phylogenetic tree was constructed based on the nucleotide sequences of the Cap gene (ORF2). The tree was inferred by using the Neighbor-Joining method with 1,000 bootstrap replicates. Only Bootstrap values ≥70% are shown. The division of PCV2d genotype sequences into PCV2d-1 (AY181946) and PCV2d-2 (KJ187306, JX519293, HM038017 and JX535296) was done by (XIAO; HALBUR; OPRIESSNIG, 2015).

Due a high mutation rate (compared to RNA virus such as Influenza virus i.e., 10^{-3}-10^{-4} substitution/site/year), progressive increase in sequence availability and the discovery of new genetically divergent clades of PCV2 genotypes are not recognized by the International Committee on Taxonomy of Viruses (ICTV). Even if a certain consensus has been achieved on the PCV2 nomenclature below the species level, this is essentially based on the criteria chosen with the main aim of establishing a common and shared language (FRANZO; SEGALÉS, 2018). Thus, in the present work, a new classification proposed by FRANZO; SEGALÉS (2018) was used. This classification allowed defining nine genotypes (PCV2a to PCV2i), based on three criteria: maximum intra-genotype p-distance of 13% (calculated on the ORF2 gene), bootstrap support at the corresponding internal node higher than 70%, using Neighbor-Joining (NJ) method and at least 15 reference sequences described by FRANZO; SEGALÉS (2018). With this classification, 17 of 25 Brazilian sequences clustered with PCV2d (68.00%) and 8 of 17 clustered with PCV2b (32.00%) (Figure 3). No PCV2a genotype was detected. Although other methods of phylogeny are more reliable (Maximum likelihood and Bayesian for example), FRANZO; SEGALES, (2018) proposed a simpler model able to be robust and with lasting approach for genotype definition and less susceptible to future database updates.

The eight PCV2b samples sequenced in the present study shared high genetic similarity with each other, ranging from 98.8% to 100% at nucleotide level. All Brazilian PCV2 grouped in a separate sub-cluster within the PCV2b clade supported by strong bootstrap values of 93. When they were compared to reference sequences, they shared high similarity with other Brazilian isolates, with values ranging from 97.3% to 98.3%. *P-distance* data at nucleotide level are shown in Supplementary Table 3.

The seventeen PCV2d sequences in the present study also shared high similarity with each other, ranging from 99.4% to 100% (Supplementary Table 4). The PCV2d genotype presented a clear separation into 2 distinct subclusters, PCV2d-1 and PCV2d-2, with bootstrap support >70%. All Brazilian samples were assigned to the PCV2d-2 subclade. Even though there are some potential subclades in PCV2d-2, they did not present bootstrap support > 70%. Hence, the currently used marker did not have enough descrimination power to segregate the intra-PCV2d-2 clade phylogeny. This division of PCV2d genotype into two subclades, PCV2d-1 and PCV2d-2, has already been reported, with most PCV2d-1 samples circulating during 1999 to 2011, while PCV2d-2 samples were only identified in 2006 (XIAO; HALBUR;

OPRIESSNIG, 2015). In a phylogenetic study of field samples from pigs with clinical signs of PCVD in Belgium collected between 2009 and 2018, it was also demonstrated that PCV2d-1 samples were found in 2009 and 2010, while in 2018 all sequences of PCV2d clustered in the PCVd-2 clade (WEI et al. 2019). Thus, researchers have suggested that PCV2d-1 is possibly an ancestor of PCV2d-2 (XIAO; HALBUR; OPRIESSNIG, 2015).

5.3. Genotype temporal distribution from 1993 to 2019

Three thousand five hundred and forty-four PCV2 ORF2 sequences available from GenBank (www.ncbi.nlm.nih.gov) were downloaded in March 2020 to evaluate PCV2 genotypes fluctuation from 1993 to 2019 (Supplementary Figure 1). Retrospective analysis of sequences available showed a clear temporal change in genotypes prevalence over time as previously describe (FRANZO; SEGALÉS, 2018).

The first PCV2 genotype with a considerable percentage of sequences available on GenBank was the PCV2a genotype. Around 2003, a genotype shift occurred and PCV2b became the most available genotype (Figure 4). This first genotype shift (from PCV2a to PCV2b) was described in several countries and was associated with the appearance of a more severe clinical disease outbreaks (FRANZO; SEGALÉS, 2020). From 2013, a second genotype shift (from PCV2b to PCV2d) occurred globally and it has been reported in cases of vaccination failure also associated with clinical disease outbreaks (OPRIESSNIG et al., 2013; XIAO; HALBUR; OPRIESSNIG, 2012). Since then, PCV2d became the genotype with the largest percentage of published sequences available. When evaluating PCV2d sequences deposited over time, two distinct peaks can be observed: a smaller one in the year of 2011, corresponding to approximately 40% of all sequence depositions and a higher peak, comprasing approximately 80% of the sequences available, in the year of 2016. According to WEI et al (2019), the origin of PCV2d strains can be traced back to 1998 in Switzerland and is now spread in many countries. The PCV2c, PCV2e, PCV2f, PCV2g, PCV2h and PCV2i genotypes are less prevalent and distributed in limited continents, thereby, there are few sequences deposited in GenBank. PCV2c was considered extinguish or non-detectable for a long time after a retrospective report from Denmark in 1980. PCV2c was again being identified only in feral pigs in Brazilian Pantanal and in domestic pigs in China (FRANZO et al., 2015; SATO et al., 2017; WANG et al., 2020) . PCV2e was identified in USA and Mexico, PCV2f and PCV2h in China, PCV2g in China, Europe and USA, and PCV2i in USA (WANG et al., 2020). The clinical significance of these genotypes is not known (FRANZO; SEGALÉS, 2018).

The scarce genotyping data in Brazil reflex a small number of sequence deposition in GenBank that does not allow to clear demonstrate the genotype shift reported above. According to the available data, PCV2b was until now the most predominant genotype in Brazil (CASTRO et al., 2007; 2008; FRANZO; SEGALÉS, 2018; GAVA et al., 2018).

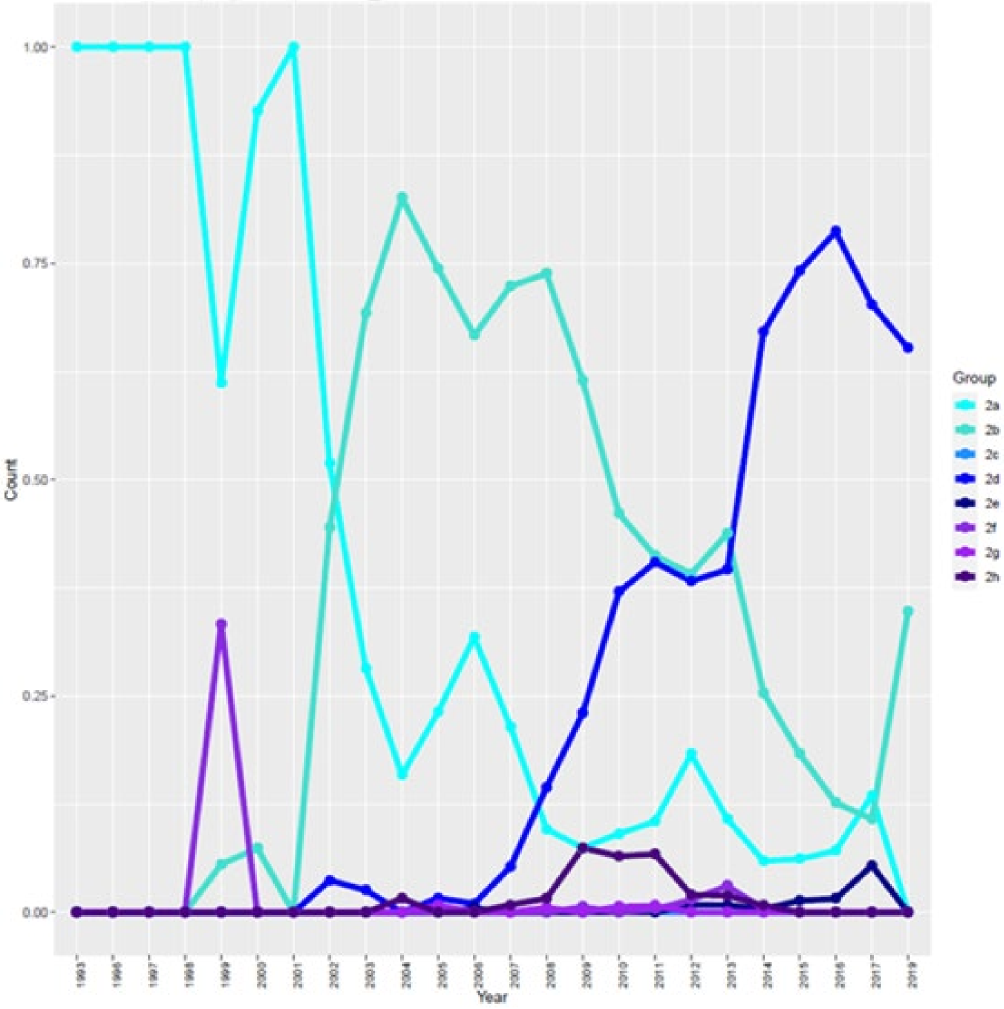


Figure 4: Count of sequences for each year. Different clusters are identified by color. Number of isolates evaluated per year, percentage of representativeness (for each year, the value on the curve corresponds to how many percent of the subgroup among the samples of the year).

5.4. Amino acid sequence analysis from Brazilian PCV2b and PCV2d genotypes

The nucleotide sequences of PCV2 ORF2 gene that codified a viral capsid protein (Cap) of all PCV2 Brazilian strains in this study had 695 nucleotides of length, with 231 amino acids. The last amino acids (position 232 to 233), due to the sequencing poor quality on this location, were not reliable and were excluded from the analysis.

Amino acid sequences of Cap protein from this study are conserved within genotypes. When comparing the conserved Brazilian sequences of PCV2b to PCV2d genotypes, there are mutations in 13 positions in the amino acid sequences Y8F, F53I, I57V, R59K, S64T, R89L/I, S90T, S121T, P134N, S169R/G, N207Y, E210D, V215I (displayed on Table 7). Nine of these 13 positions are found in immunogenic regions: 53, 57, 59, 64, 121, 134, 169, 207 and 210, highlighted in gray in Table 7.

At positions 32, 34 and 68, 24 out 25 (96%) sequences were identical, except for samples ID5297, ID5325, IDI15309, ID5297, which had the following mutations at positions P32H, H34N, N68A, 89 and 169, respectively. Of these mutations, only the mutation at position 68 (ID5309) was in an immunogenic region (Table 7).

Most of the polymorphisms between genotypes are presented at epitopes regions. Regions of the virus where interactions with the environment occur and this change may favor the virus to escape the host's immune response.

Table 7: Polymorphic sites within PCV2 ORF2 gene sequences from Brazil. Dashes represent amino acid position similar to GenBank accession number AF201311, according to MAHÉ et al., (2000). As a reference PCV2d genotype, The Genbank accession number KT819170, described by GAVA et al. (2018), was used as a reference PCV2d genotype The sequences with 100% amino acid identity were excluded.

Samples	**Amino acid position**															
	8	**32**	**34**	**53**	**57**	**59**	**64**	**68**	**89**	**90**	**121**	**134**	**169**	**207**	**210**	**215**
PCV2b																
AF201311	**Y**	**P**	**H**	**F**	**V**	**R**	**T**	**A**	**R**	**S**	**S**	**T**	**S**	**Y**	**E**	**V**
ID5324	-	-	-	-	I	-	S	N	-	-	-	P	-	N	-	-
ID5325	-	-	N	-	I	-	S	N	-	-	-	P	-	N	-	-
ID5309	-	-	-	-	I	-	S	-	-	-	-	P	-	N	-	-
PCV2d																
KT819170	**F**	**-**	**-**	**I**	**-**	**K**	**-**	**N**	**L**	**T**	**T**	**N**	**R**	**-**	**D**	**I**
ID4346	F	-	-	I	-	K	-	N	L	T	T	N	R	-	D	I
ID5305	F	-	-	I	-	K	-	N	I	T	T	N	R	-	D	I
ID5297	F	H	-	I	-	K	-	N	L	T	T	N	G	-	D	I
ID5320	F	-	-	I	-	K	-	N	L	T	T	N	R	-	D	I

*The sequences with 100% identity to ID5324 (ID5300, ID5302, ID5317, ID5318, ID5301) and to ID4346 (ID4347, ID4350, ID5084, ID5086, ID5089, ID5093, ID5094, ID5298, ID5299, ID5311, ID5316, ID5315, ID5313) were omitted from the table. Position of the immunogenic domains 53, 57, 59, 64, 68, 121,134, 169,207 and 2010 are highlighted in gray.

Compiling all the information described so far by MAHE et al. (2000); TRUONG, et al (2001); LEKCHAROENSUK et al. (2004); SHANG et al. (2009); HUANG et al. (2011); KHAYAT et al. (2011); HUANG et al. (2020), four general antibody recognition regions were identified in Cap protein, labeled A (47 to 94), B (113 to 137), C (156 to 2010) and D (230 to 233), in addition to the positions 88 and 228 (Table 9). These immunogenic regions comprise 54,7% (128/234) of all Cap amino acid residues. Generally, most amino acid residues within antigenic regions are similar, providing protection between vaccines. HUANG et al. (2020) analyzed the conservation of the amino acids in the epitope regions. However, some residues are different among genotypes, and there are also differences among strains of the same genotype (SASHA et al., 2012; HUANG et al., 2020). Of these, some single residues located on the outer surface of Cap protein (59, 89, 134 and 210) are responsible for the binding strength within the epitope and differ between PCV2b and PCV2d (LIU et al., 2013). Of these, the amino acids at positions 59 and 134 are involved not only in binding strength but in the difference in efficacy of neutralizing antibodies among monoclonal antibodies (mAb) against PCV2a, PCV2b and PCV2d genotypes (HUANG et al., 2020). According to HUANG et al. (2020), the positions 59 and 134 are moderately conserved among PCV2 strains (approximately 60%). The single mutation in T134 resulted in >50% loss of binding reactivity of mAb, while the mutation in A59 can reduce the binding reactivity of the mAb by approximately 30%.

5.5. Evolution before and after the vaccination introduction

There are many discussions about changes of the Cap protein encoded by ORF2 and the role vaccination can play on PCV2 evolution, immunological and vaccine escapes (KEKARAINEN; GONZALEZ; LLORENS, 2014; LV; GUO; ZHANG, 2014; REINER; HOFMEISTER; WILLEMS, 2015; SHEN; HALBUR; OPRIESSNIG, 2012). Vaccination was introduced in Brazil in 2006 and it was widely adopted after that (FRANZO et al., 2016b). Today there are several vaccines brands available in Brazil (Table 8), all with trial studies demonstrating efficacy (BANDRICK et al., 2020; MARTELLI et al., 2011; OPRIESSNIG et al., 2009, 2019). All currently available vaccines, independently from the production techniques (i.e. inactivation, chimeric PCV1-2 virus, Cap subunit expressed in baculovirus system), contain the immunogenic Cap protein of the PCV2a or PCV2b. Most of these vaccines are based on PCV2a genotype, one is based on PCV2b genotype and just one is a bivalent vaccine (PCV2a and PCV2b genotypes) (Table 8). The Cap protein, besides being the major immunogen, is more variable region of PCV2 genome thereby the most commonly used for diagnosis and classification purposes (FRANZO et al., 2016b).

Table 8: Commercial PCV2 vaccines currently registered for use in Brazil, its type and genotype.

Brand	Lab	Vaccine type	Genotype
Circovac®	CEVA	Killed Virus	PCV2a
Fostera Gold PCVMH®	Zoetis	Chimeric virus PCV1 expressing PCV2 ORF2	PCV2a + PCV2b
Ingelvac Circoflex®	Boehringer Ingelheim	Recombinant subunit expressed in the baculovirus	PCV2a
Porcilis PCV®	MSD	Recombinant subunit expressed in the baculovirus	PCV2a
Circunvent PCV®	MSD	Recombinant subunit expressed in the baculovirus	PCV2a
SafeSui®	OuroFino	Recombinant subunit expressed in the baculovirus	PCV2b
Pro-Vac®Circomaster	Dechra	Recombinant subunit	PCV2a

In recent decades, some concerns have been raised about the protection achieved against newly emerged genotypes such as PCV2d. Some publications and field reports attest episodes of vaccine failure in association with PCV2d genotype outbreaks (SALGADO et al., 2014; SEO et al., 2014; XIAO; HALBUR; OPRIESSNIG, 2012) due to presence of decoy epitopes that may affects the antibody neutralizing activity (JIN et al., 2018; TRIBLE; ROWLAND, 2012) or better ability of the virus to bind to host receptors (WEI et al., 2019b) or its higher virulence (GUO et al., 2012). The role of vaccination in the formation of viral evolution has been reported for different diseases that affect both animals and humans. When immunity is not sterilizing, wild strains are able to circulate in a new “challenging” environment made up of less susceptible and immune hosts (FRANZO et al., 2016b; READ et al., 2015) .

To evaluate the potential contribution of genotype PCV2a or PCV2b based vaccines over PCV2d genotype evolution, PCV2d amino acid consensus sequences before vaccination (PreVacD), after vaccination (PosVacD), wild boar (WboarD) and PCV2d Brazilian strains from this study (TestD) were compared. WboarD group was included in the study because these animals were not under vaccine pressure, in addition to represent an important source of genetic variability and/or simply viral exchange (FRANZO et al., 2016).

The amino acid consensus sequences before and after vaccination were divided according to two conservative time points; sequences collected before 2006 were assumed to originate from non-vaccinated animals, while sequences collected after 2007 were considered to originate from vaccinated animals. Although there is no guarantee that all sequences collected after 2007 originated from vaccinated animals, the widespread use of vaccination supported this criterion.

Also, those consensus sequence groups listed above were compared to three vaccine amino acid sequences available, licensed in Brazil (two PCV2a genotype: cVac2007-2a, Vac2000-2a and one PCV2b genotype: cVac2009-2b) (Table 8) and changes on amino acid residues in epitopes region of the Cap protein were analyzed. The alignment is shown on Figure 5.

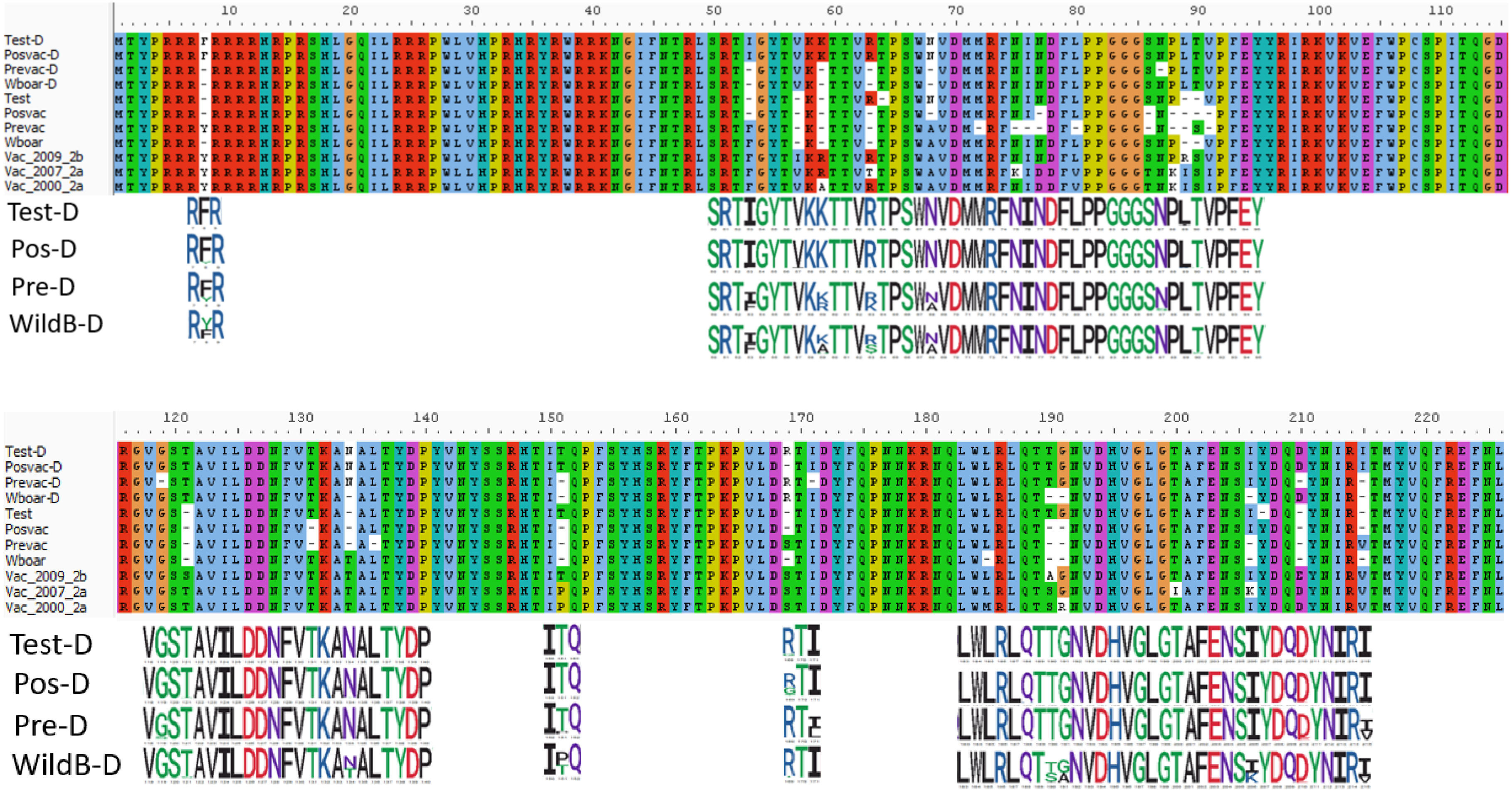


Figure 5: Alignment of amino acid from TestD, PosD, PreD and WboarD consensus sequences and amino acid sequences available from 3 vaccines licensed in Brazil. The letters correspond to amino acid residues that have differences between the analyzed groups. Amino Acids not identical in > 90% of the isolates in the group were replaced by "-".

The clinical expression of PCVD depends on the final balance between the virus, environmental factors and the host immune response. Different epitope regions have been recognized in the Rep and Cap proteins, but the Cap protein in particular is the main target of the immunity and can elicit antibodies and lymphocyte proliferative responses against PCV2 (TRIBLE et al., 2011).

Several linear or conformational epitopes within PCV2 ORF2 have been mapped by a set of techniques as: the generation of mutant viruses (PCV1/PCV2 chimeras, recombinant baculoviruses); PEPSCAN analysis for mapping and characterizing epitopes involving the synthesis of overlapping peptides and analysis of the peptides in enzyme-linked immunosorbent assays (ELISAs); development of monoclonal antibodies (mAb) against specific epitope residues from different genotype strains; evaluation of serological reactivity with experimental and natural infection anti-PCV2 antisera and others (MAHÉ et al., 2000; TRUONG, et al. 2001; MISINZO et al., 2006; SHANG et al., 2009; LEKCHAROENSUK et al., 2011; HUANG et a., 2011; KHAYAT et al., 2011; SAHA et al., 2012a,b; LIU et al., 2013; KURTZ et al., 2014; GAVA et al., 2018) (Table 9).

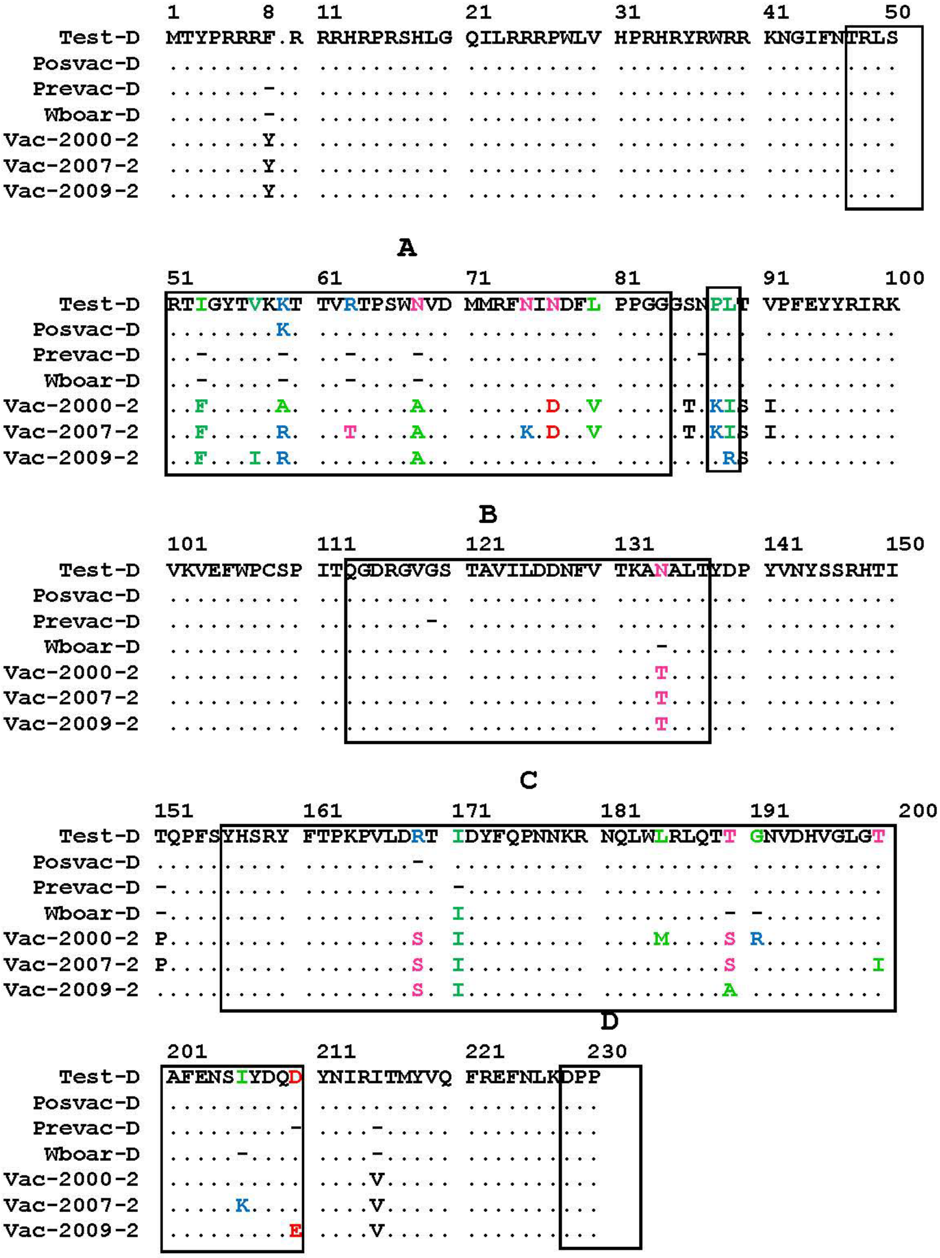
The identification of single amino acids that contributed to the recognition of antibodies within immunodominant Cap epitope regions has also been widely performed by the alanine scanning mutagenesis technique. Furthermore, the use of mAbs with neutralization activity which are specific for unique epitopes whitin the Cap protein have been used to map the dominant immunological epitopes important for neutralization of diferent field with biologically relevant differences or mutant strains. The understanding of the ability of specific mAbs to react against different PCV2 genotypes or different biologically relevant PCV2 strains is extremely important, in an attempt to elucidate issues related to how these differences may impact the virulence (SHANG et al., 2009; TRIBLE et al., 2011; SAHA et al., 2012; LIU et al., 2013; KURTZ et al., 2014; HUANG et al., 2011; 2020). To further explore the neutralization mechanism, predicted three-dimensional (3D) mapping of amino acids in the Cap PCV2 by *in silico* assays and evaluation of cryo electron microscopy (Cryo-EM) structure of virion-mAb complex also have been used (GAVA et al., 2018; HUANG et al., 2020).

Table 9: Linear or conformational epitope regions detected in Cap PCV amino acids in reference studies and the analyzed PCV genotypes.

Epitope Residues	PCV genotype analyzed	Reference
47-63	PCV1; PCV2a	LEKCHAROENSUK et al., 2004; HUANG et al., 2011;
55-62	PCV2a; PCV2b; PCV2d	HUANG et al., 2020
68-70	PCV2a; PCV2b; PCV2d	HUANG et al., 2020
165-200	PCV1; PCV2a	LEKCHAROENSUK et al., 2004
230-233	PCV1; PCV2a	LEKCHAROENSUK et al., 2004
69-83	PCV1; PCV2b	MAHE et al., 2000
88	PCV2a; PCV2b; PCV2d	HUANG et al., 2020
55-62	PCV2a; PCV2b; PCV2d	HUANG et al., 2020
128, 131-137	PCV2a, PCV2b, PCV2d	HUANG et al., 2020
117-131	PCV1; PCV2b	MAHE at al., 2000
204	PCV2a, PCV2b, PCV2d	HUANG et al., 2020
189, 231	PCV2a; PCV2b; PCV2d	HUANG et al., 2020
169-183	PCV1; PCV2b	MAHE at al., 2000
195-202	PCV1; PCV2a; PCV2b	SHANG et al., 2009
231-233	PCV1; PCV2a; PCV2b	SHANG et al., 2009
156-162	PCV1; PCV2a; PCV2b	SHANG et al., 2009
175-192	PCV1; PCV2a; PCV2b	SHANG et al., 2009
59, 63, 89, 206, 210, 130, 133	PCV2a; PCV2b	SAHA et al., 2012
117-131	PCV1; PCV2b	TRUONG, et al. 2001
69-83	PCV1; $PCV2^{CS}$*	KHAYAT et al., 2011
113-127	PCV1; $PCV2^{CS}$*	KHAYAT et al., 2011
169-183	PCV1; $PCV2^{CS}$*	KHAYAT et al., 2011
193-207	PCV1; $PCV2^{CS}$*	KHAYAT et al., 2011

***PCV2**^{CS}: consensus sequence of PCV2 analyzed available in GenBank.

The epitope recognition regions described to date (Table 9) have been combined and classified into four general antibody recognition regions labeled A (47 to 84), B (113 to 137), C (156 to 210) and D (228 to 233) plus positions 88. The consensus sequences PosVacD, PreVacD, WborD, TestD and amino acid sequences available from three vaccines are aligned and the locations of the immunoreactive regions are described in Figure 6.



```
           1       8  11        21        31        41       50
Test-D     MTYPRRRF.R RRHRPRSHLG QILRRRPWLV HPRHRYRWRR KNGIFNTRLS
Posvac-D   .......... .......... .......... .......... ..........
Prevac-D   .......-.. .......... .......... .......... ..........
Wboar-D    .......-.. .......... .......... .......... ..........
Vac-2000-2 .......Y.. .......... .......... .......... ..........
Vac-2007-2 .......Y.. .......... .......... .......... ..........
Vac-2009-2 .......Y.. .......... .......... .......... ..........

                           A
           51        61        71        81        91       100
Test-D     RTIGYTVKKT TVRTPSWNVD MMRFNINDFL PPGGGSNPLT VPFEYYRIRK
Posvac-D   ........K. .......... .......... .......... ..........
Prevac-D   ..-.....-. ..-....-.. .......... ......-... ..........
Wboar-D    ..-.....-. ..-....-.. .......... .......... ..........
Vac-2000-2 ..F.....A. .......A.. ......D..V .....T.KIS I.........
Vac-2007-2 ..F.....R. ..T....A.. ....K.D..V .....T.KIS I.........
Vac-2009-2 ..F...I.R. .......A.. .......... ........RS ..........

                                 B
           101       111       121       131       141      150
Test-D     VKVEFWPCSP ITQGDRGVGS TAVILDDNFV TKANALTYDP YVNYSSRHTI
Posvac-D   .......... .......... .......... .......... ..........
Prevac-D   .......... ........-. .......... .......... ..........
Wboar-D    .......... .......... .......... ...-...... ..........
Vac-2000-2 .......... .......... .......... ...T...... ..........
Vac-2007-2 .......... .......... .......... ...T...... ..........
Vac-2009-2 .......... .......... .......... ...T...... ..........

                                  C
           151       161       171       181       191       200
Test-D     TQPFSYHSRY FTPKPVLDRT IDYFQPNNKR NQLWLRLQTT GNVDHVGLGT
Posvac-D   .......... ........-. .......... .......... ..........
Prevac-D   -......... .......... -......... .......... ..........
Wboar-D    -......... .......... I......... .........- -.........
Vac-2000-2 P......... ........S. I......... ....M....S R.........
Vac-2007-2 P......... ........S. I......... .........S .........I
Vac-2009-2 .......... ........S. I......... .........A ..........
                                         D
           201       211       221      230
Test-D     AFENSIYDQD YNIRITMYVQ FREFNLKDPP
Posvac-D   .......... .......... ..........
Prevac-D   .........- ....-..... ..........
Wboar-D    .....-.... ....-..... ..........
Vac-2000-2 .......... ....V..... ..........
Vac-2007-2 .....K.... ....V..... ..........
Vac-2009-2 .........E ....V..... ..........
```

Figure 6: Location of the immunoreactive regions in the alignment of amino acid from TestD, PosD, PreD and WboarD consensus sequences and amino acid sequences available from 3 vaccines licensed in Brazil. Sequences that were not identical in > 90% of the isolates in the group were replaced by dashes. The black squares are four general antibody recognition regions labeled A (47 to 84), B (113 to 137), C (156 to 210) and D (228 to 233), plus at position 88. The D epitope was not demonstrated due to the exclusion of the last 3 amino acids of ORF2 from our Brazilian sequences. Dotted are the amino acid sequences identical to the TestD sequence. Colors indicates amino acid chemistry. Red: Acid Polar, Blue: Basic Polar, Pink: Neutral Polar, Green: Nonpolar

Table 10: Different amino acid residues in the Cap protein of PCV2d strains between TestD, PreVacD, WboarD, PosVacD, WboarD groups and vaccine strains. Vaccine strains are cVac2009-2b (GU799576), c2007-2a (AF264042) and Vac2000-2a (GU049340). Colors indicates amino acid chemistry. Red: Acid Polar, Blue: Basic Polar, Pink: Neutral Polar, Green: Nonpolar.

POSITION	EPITOPE	SEQUENCES				VACCINE STRAIN		
		PreVacD	WboarD	PosVacD	TestD	cVac2009-2b	cVac2007-2a	Vac2000-2a
53	A	F/Y	Y/F	I	I	F	F	F
57	A	V	V	V	V	I	V	V
59	A	K/R	K/A	K	K	R	R	A
63	A	R/K	R/S	R	R	R	T	R
68	A	N/A	N/A	N	N	A	A	A
75	A	N	N	N	N	N	K	N
77	A	N	N	N	N	N	D	D
80	A	L	L	L	L	L	V	V
88	A	P	P	P	P	P	K	K
89	A	L	L	L	L	R	I	I
134	B	N	N	N	N	T	T	T
169	C	R	R	R/G	R	S	S	S
171	C	I/C	I	I	I	I	I	I
185	C	L	L	L	L	L	L	M
190	C	T	T/S	T	T	A	S	S
191	C	G	G/A	G	G	G	G	R
200	C	T	T	T	T	T	I	T
206	C	I	I	I	I	I	K	I
210	C	D/E	D	D	D	E	D	D

Among consensus sequences WboarD, PreVacD (not under vaccine pressure) and PosVacD, epitope regions were analyzed searching for polymorphism. No drastic mutations were observed at the stereochemical level of amino acids between these three groups. But a fixation of some amino acids at epitope position can be observed: K/R/A59/K (fixation of K), RKS/63/R (fixation of R), N/A68/N (fixation of N), I/C171/I (fixation of I), T/S190/T (fixation of T), G/A191/G (fixation of G) and D/E210/D (fixation of D) (Table10). It seems that strains before the use of massive vaccines already were carrying the same amino acids present on current PCV2d samples. These data may suggest that PCV2d, first reported in 1998, already carried characteristics that distinguish it from other genotypes and that vaccines may have an important role on PCV2d evolution. It is known that PCV2a strains changed its viral capsid away from the vaccine antigen after vaccine introduction (FRANZO et al., 2016b). This same “distancing” seems be a behavior repeated by PCV2d because of its increase on size population. Not only vaccines are able to promote genotype shifts. In the case of the first genotype shift from PCV2a to PCV2b around 2003, it happened before the massive use of vaccines (2007) and this evolution was probably driven by infection immunity present in farms at that time (WEI et al., 2019b). This might be occurring with PCV2d due to its high prevalence on farms nowadays inducing a strong population immunity.

5.6. Differences between CAP amino acid sequences of Brazilian PCV2d (TesteD) and vaccine samples (cVac2000-2a, cVac2007-2a and cVac2009-2b)

Important changes between TestD and vaccine sequences were observed in epitope regions. Seventeen mutations in antigenic regions occurred between TestD and some or all vaccine strains at positions: (Epitope region A): I53F (all vaccine strains), V57I (cVac2009-2b), K59A (Vac2000-2a)/R (cVac2007-2a, cVac2009-2b), R63T (cVac2007-2a), N68A (all vaccine strains), N75K (cVac2007-2b), N77D (Vac2000-2a, cVac2007-2a), L80V (Vac2000-2a, cVac2007-2a); P88K (Vac2000-2a, cVac2007-2a), (L89I (Vac2000-2a, cVac2007-2a/R (cVac2009-2b; (Epitope region b): N134T (all vaccines). (Epitope region C): R169S (all vaccine strains), L185M (cVac2000-2a), T190S (Vac2000-2a, cVac2007-2a)/A (cVac2009-2b), G191R

(Vac2000-2a), T200I (cVac2007-2a), I206K (cVac2007-2a). Of these 17 positions with mutations in antigenic regions, 13 occurred in cVac2007-2a, 12 in Vac2000-2a and 10 in cVac2009-2b.

Of the 17 mutations that occurred in antigenic sites of the Cap protein between the Brazilian consensus amino acid sequences of PCV2d genotype (TestD) and vaccine samples, 6 (at positions 53, 57, 80,134, 185 and 210) did not change the physical-chemical property of the amino acids, therefore, they did not cause significant structural changes in the Cap protein. In 12 positions (59, 63, 68, 75, 77, 88, 89, 169, 190, 191, 200 and 206) mutations that altered the stereochemical properties of the amino acids were observed. These mutations are considered the most important for being able to cause significant structural changes in the Cap protein. Among these 12 analyzed mutations (with change on amino acid charge), the vaccine strain with the highest number of mutations was cVac2007-2a, with 8 mutations (at positions R63T, N68A, N75K, N77D, P88K, R169S, T200I, I206K), followed by Vac2000-2a with 6 mutations (at positions K59A, N68A, N77D, P88K, R169S, G191R) and cVac2009-2b, with 4 mutations (at positions N68A, L89R, R169S, T190A). All vaccine strains had an amino acid completely different from the TestD consensus at positions 59, 68, 89,134, 169 and 190 (Figure 6).

Several authors have reported that within an immunogenic region, some single amino acids are essential for the recognition of specific antibody binding and that mutations in these single amino acids can alter, favoring or inhibiting the recognition of antibodies by the antigenic site. Furthermore, mutations in single amino acids can also determine different levels of viral neutralization by a given mAb, suggesting a crucial role for these amino acids in the differential effectiveness of viral neutralization, between different PCV2 genotypes and even between the same genotype strains with different biological characteristics (SHANG et al., 2009; TRIBLE et al., 2011; SAHA et al., 2012a,b; LIU et al., 2013; KURTZ et al., 2014; HUANG et al., 2011; 2020).

Studies with universal monoclonal antibodies, which react with eight different PCV2 clusters within PCV2a and PCV2b genotypes, have demonstrated that eight amino acids positions are crucial for binding of the different mAbs: at positions 30, 59, 63 (Epitope region A), 89, 130, 133 (Epitope region B) and 206, 210 (Epitope region C) (SAHA et al., et al., 2012). These amino acids are located on the outer surface of a capsid protein. Positions 59 and 63 were in loop BC, position 89 in loop CD, positions 130 and 133 in loop EF; position 206 in loop HI and position 210 in β-strand. The flexibility of the loops facilitates the binding between the virion and Fab portion of antibodies (SAHA et al., et al., 2012; HUANG et al., 2020). Of these positions, two are considered universal, with similar sharing to all clusters strains: 130 and 133. As expected, our vaccines were identical to the Brazilian samples (TestD) in these two universal positions and also in 2 other positions: 89 and 210. There was a divergence in three positions, when comparing the TestD samples with the vaccines: 59 (all vaccines), 63 (cVac2007-2a) and 206 (cVac2007-2a).

Genotype specific important domains have also been identified using multiple sequence alignment, as six amino acid residues at positions 86 to 91 and four at positions 190, 191, 206 and 210 on the PCV2 Cap SEM SENTIDO (CHEUNG et al., 2011; CHEUNG; GREENLEE, 2011). As expected, since the vaccines have different genotypes (PCV2a or PCV2b) from the Brazilian PCV2d (TestD) samples, mutations were observed at positions 190 (all vaccines), 191 (cVac2000-2a) and 206 (cVac2007-2a).

Although PCV2 infected pigs produce high levels of Cap specific antibody, the onset and severity of PCVD are correlated with the absence or decreased levels of PCV2 neutralizing antibodies, suggesting a crucial role for neutralizing antibodies in the prevention of PCVD (MEERTS et al., 2006). Changes in single amino acids can switch the neutralizing phenotype of PCV2 Cap monoclonal antibodies (SAHA et al., 2012; LIU et al., 2013; KURTZ et al., 2014; HUANG et al., 2020). Studies with mAbs that have different reactivity or neutralization phenotypes have been used to identify these critical amino acids important for PCV2 neutralization being at positions: 59, 60, 131, 151, 190, 191 and the C-terminal area including residues at positions 231 to 233 (SAHA et al., 2012; LIU et al., 2013; KURTZ et al., 2014). Specific mutations in residues R59A, A60T, A151T/P allow the mutant to be recognized and neutralized by monoclonal antibodies, with complete gain of recognition and neutralization of mAbs against PCV2a or PCV2b. Inverse mutations in these regions result in a complete loss of neutralization. Mutations in other amino acid residues have also shown differences in neutralizing activity, such as T190A which result in complete loss of neutralization and mutations T131P and E191R results in partial but significant loss of neutralization (SAHA et al., 2012).

Recently, HUANG et al. (2020) detected by a monoclonal antibody that neutralizes the PCV2a, PCV2b and PCV2d genotypes 18 single amino acids responsible for this neutralization. Ten of these amino acids are completely conserved

(>99%) among all samples deposited in GenBank to date (55Y, 56T, 61T, 62V, 128N, 132K, 135A, 137T, 189T and 231L), and the rest showed variable levels of conservation, with 5 highly conserved (86.89% to 98.33%) at positions 58K, 60T, 131T, 133A and 136L, one moderately conserved (approximately 60%) at 134 position and two highly variable (<25%) at 59A and 88K positions. Most of the amino acids in the epitope regions that neutralizes PCV2a, PCV2b and PCV2d genotypes were conserved among different genotypes, which might explain the relatively broad-spectrum reactivity of a monoclonal antibody with PCV2 strains. However, mutations of some amino acids within the epitope regions had significant effects on the neutralizing activity of this specific mAb. Using cryo-electron microscopy single particle analysis in a complex with mAb Fab fragments and alanine scanning mutagenesis was observed that the single mutations at positions 128, 131, 132, 134, 135, 136 and 189 in the Cap protein resulted in >50% loss of binding reactivity of specific mAB, while the mutation at 59 position reduced the binding reactivity of the mAb by approximately 30%. The binding levels at 56 and 60 position mutations were similar to that of parenteral virus; however, their neutralization activities were significantly lower than that of parenteral virus.

When comparing the Brazilian amino acid sequences with significant effects on the neutralizing activity described of genotype D (TestD) with vaccines, 15 of the 18 positions were completely conserved among them (100%), with differences observed at positions 59, 88 and 134. In the Brazilian samples of PCV2d genotype (TestD), when compared to vaccine samples, the mutations were R (cVac2007-2a, cVac2009-2b/A and cVac2000-2a), 59K, K88P (cVac2000-2a and cVac2007-2a) and T134N (all vaccines). These results are in accordance with HUANG et al. (2020), which demonstrated that these positions were not conserved among different clusters strains, but they were conserved within specific genotypes, indicated that positions were involved in the differential neutralization efficacy of mAB against PCV2a, PCV2b and PCV2d.

In summary, the three vaccines analyzed have a difference in 3 of 8 (37.5%) single nucleotides crucial for monoclonal antibody binding, 3 of 10 (30%) differences among specific genotypes, and 5 t of 15 (33,3%) differences among a single amino acid responsible for viral neutralization, without considering the last 3 nucleotides, which were not analyzed. The vaccines that have the greatest variability in important residues for antibody binding within immunogenic regions and neutralization activity are the PCV2a genotype vaccines (cVac 2007-2a and cVac 2000-2a), followed by the PCV2b genotype vaccine (cVac 2009-2b). The question is how these antigenic differences could be related to vaccine failures observed worldwide, in relation to PCV2d. Reported studies have demonstrated that a set of single amino acids within epitope regions are responsible for differences in neutralization levels between different genotypes or samples of the same genotype that have biological differences. What has been widely sought after is a vaccine that protects against all strains or genotypes of PCV2.

The existence of a specific amino acid genotype in the crucial binding of mAbs may be the reason for somewhat better results in homologous situations. Cross-protection between PCV2 genotypes has been experimentally demonstrated. However, a recent experimental study indicated that a PCV2 vaccine based on the PCV2b genotype was more effective in protecting pigs against the effects of PCV2b or vaccinated with a bivalent PCV2a-PCV2b vaccine, than with a vaccine based on the PCV2a genotype, however that protection against PCV2 is known to be dependent on the generation of neutralizing activity (BANDRICK et al., 2020; OPRIESSNIG et al., 2013) (OPRIESSNIG et al., 2013). When PCV2a vaccinated pigs were challenged with PCV2b, then a higher percentage of animals were positive for viral DNA in nasal and fecal swabs 20 days after challenge than when they were challenged with PCV2a and vice versa (FORT et al., 2008; BEACH et al., 2011). According to the analyzed situations, we suggest that for a more effective neutralizing activity, the vaccine strains should be of the same genotype as the circulating virus, but single amino acids also established as crucial for neutralizing activity, regardless of genotype, should also be considered.

6. CONCLUSION

- 1- By the authors' knowledge is the first time that a predominance of PCV2d genotype has been demonstrated in diagnostic samples, suggesting a direct correlation with the genotype circulation on Brazilian commercial swine farms.
- 2- No PCV2a genotype was detected in recent years.
- 3- Contemporary Brazilian isolates of PCV2d had important mutations in immunogenic sites in front of PCV2a and PCV2b-based vaccines that compromise an efficient antibody binding and virus neutralization
- 4- The PCV2a genotype vaccines have more mutations in amino acid residues responsible for antibody binding and neutralizing activity than PCV2b vaccine;
- 5- The success achieved by PV2a and PCV2b-based vaccines is due to the great conservation of amino acid residues in epitope regions, which confers some cross-reaction between genotypes, but the emergence of new PCV2 variants and genotypes should not be neglected;
- 6- Although the viruses sequenced in this study are highly conserved among them, the change in genotype prevalences observed over the years associated with the high mutation rate of PCV2 are reasons for active monitoring of the virus.

7. REFERENCES

ALLAN, G. et al. **Novel porcine circoviruses from pigs with wasting disease syndromes.The Veterinary record**England, abr. 1998.

BANDRICK, M. et al. T cell epitope content comparison (EpiCC) analysis demonstrates a bivalent PCV2 vaccine has greater T cell epitope overlap with field strains than monovalent PCV2 vaccines. **Veterinary Immunology and Immunopathology**, v. 223, n. December 2019, 2020.

BAO, F. et al. Retrospective study of porcine circovirus type 2 infection reveals a novel genotype PCV2f. **Transboundary and Emerging Diseases**, v. 65, n. 2, p. 432–440, 2018.

CASTRO, A. M. M. G. DE. **Caracterização genética de amostras brasileiras de Circovírus suíno tipo 2 (PCV-2)**. [s.l: s.n.].

CHAE, C. Commercial porcine circovirus type 2 vaccines : Efficacy and clinical application. **The Veterinary Journal**, v. 194, n. 2, p. 151–157, 2012.

CHIARELLI-NETO, O. et al. Classification and putative origins of Brazilian porcine circovirus 2 inferred through phylogenetic and phylogeographical approaches. **Virus Research**, v. 140, n. 1–2, p. 57–63, 2009.

CHO, H. et al. Comparative study of the virulence of 3 major Korean porcine circovirus type 2 genotypes (a , b , and d). **The Canadian Journal of Veterinary Research**, v. 84, p. 235–240, 2020.

CIACCI-ZANELLA, J. R. **Situação atual da circovirose no Brasil**. XVIII Congresso da Abraves 2017. **Anais**...2017

CONSTANS, M. et al. Antigenic determinants of possible vaccine escape by porcine circovirus subtype 2b viruses. **Bioinformatics and Biology Insights**, v. 9, p. 1–12, 2015.

CROWTHER, R. A. et al. Comparison of the Structures of Three Circoviruses: Chicken Anemia Virus , Porcine Circovirus Type 2 , and Beak and Feather Disease Virus . **Journal of Virology**, v. 77, n. 24, p. 13036–13041, 2003.

DARWICH, L. et al. M-Positive Peripheral Blood Mononuclear Cells of Postweaning Multisystemic Wasting Syndrome-Affected Pigs and Age-Matched Uninfected Wasted and Healthy Pigs Correlate with Lesions and Porcine Circovirus Type 2 Load in Lymphoid Tissues. **Clinical and Diagnostics Laboratory Immunology**, v. 9, n. 2, p. 236–242, 2002.

DARWICH, L.; MATEU, E. Immunology of porcine circovirus type 2 (PCV2). **Virus Research**, v. 164, n. 1–2, p. 61–67, 2012.

DE CASTRO, A. M. M. G. et al. Genetic diversity of Brazilian strains of porcine circovirus type 2 (PCV-2) revealed by analysis of the cap gene (ORF-2). v. 2, p. 1435–1445, 2007.

DE CASTRO, A. M. M. G. et al. Molecular diversity of Brazilian strains of porcine circovirus type 2 (PCV-2). **Research in Veterinary Science**, v. 85, p. 197–200, 2008.

DE CASTRO, A. M. M. G. et al. Detection of porcine circovirus genotypes 2a and 2b in aborted foetuses from infected swine herds in the State of São Paulo, Brazil. **Acta veterinaria Scandinavica**, v. 54, p. 29, 2012.

DUPONT, K. et al. Genomic analysis of PCV2 isolates from Danish archives and a current PMWS case-control study supports a shift in genotypes with time. **Veterinary Microbiology**, v. 128, n. 1–2, p. 56–64, 2008.

ELLIS, J. Porcine Circovirus: A Historical Perspective. **Veterinary Pathology**, v. 51, n. 2, p. 315–327, 2014.

FENAUX, M. et al. Cloned Genomic DNA of Type 2 Porcine Circovirus Is Infectious When Injected Directly into the Liver and Lymph Nodes of Pigs: Characterization of Clinical Disease, Virus Distribution, and Pathologic Lesions. **Journal of Virology**, v. 76, n. 2, p. 541–551, 2002.

FERRARI, K. L. **Diversidade molecular do gene Cap (ORF-2) do circovírus suíno 2 (PCV2) detectado em amostras de pulmão com e sem lesões pneumônicas macroscópicas em suínos abatidos no Estado de São Paulo**. [s.l: s.n.].

FIRTH, C. et al. Insights into the Evolutionary History of an Emerging Livestock Pathogen: Porcine Circovirus 2. **Journal of Virology**, v. 83, n. 24, p. 12813–12821, 2009.

FORT, M.; OLVERA, A.; SIBILA, M. Detection of neutralizing antibodies in postweaning multisystemic wasting syndrome (PMWS) -affected and non-PMWS-affected pigs. **Veterinary Microbiology**, v. 125, p. 244–255, 2007.

FRANZO, G. et al. Genetic characterisation of Porcine circovirus type 2 (PCV2) strains from feral pigs in the Brazilian Pantanal: An opportunity to reconstruct the history of PCV2 evolution. **Veterinary Microbiology**, v. 178, n. 1–2, p. 158–162, 2015.

FRANZO, G. et al. Phylodynamic analysis of porcine circovirus type 2 reveals global waves of emerging genotypes and the circulation of recombinant forms. **Molecular Phylogenetics and Evolution**, v. 100, p. 269–280, 2016a.

FRANZO, G. et al. Porcine circovirus type 2 (PCV2) evolution before and after the vaccination introduction : A large scale epidemiological study. **Nature Publishing Group**, v. 2016, n. November, p. 1–10, 2016b.

FRANZO, G.; SEGALÉS, J. Porcine circovirus 2 (PCV-2) genotype update and proposal of a new genotyping methodology. **PLoS ONE**, v. 13, n. 12, p. 1–12, 2018.

FRANZO, G.; SEGALÉS, J. Vaccines : Multiple Genotypes but One Single Serotype. **Pathogen**, v. 9(12) 1049, p. 1–12, 2020.

GAO, Z. et al. ORF4-protein deficient PCV2 mutants enhance virus-induced apoptosis and show differential expression of mRNAs in vitro. **Virus Research**, v. 183, p. 56–62, 2014.

GAVA, D. et al. Structure analysis of capsid protein of Porcine circovirus type 2 from pigs with systemic disease. **Brazilian Journal of Microbiology**, v. 49, p. 351–357, 2018.

GIBBS, M. J.; WEILLER, G. F. Evidence that a plant virus switched hosts to infect a vertebrate and then recombined with a vertebrate-infecting virus. **Proceedings of the National Academy of Sciences of the United States of America**, v. 96, n. 14, p. 8022–8027, 1999.

GUO, L. et al. A Porcine Circovirus Type 2 (PCV2) Mutant with 234 Amino Acids in Capsid Protein Showed More Virulence In Vivo , Compared with Classical PCV2a / b Strain. **PLoS ONE**, v. 7, n. 7, p. e41463, 2012.

GUO, L. J. et al. Porcine circovirus type 2 (PCV2): Genetic variation and newly emerging genotypes in China. **Virology Journal**, v. 7, n. 1, p. 273, 2010.

HAMEL, A. L.; LIN, L. L.; NAYAR, G. P. S. Nucleotide Sequence of Porcine Circovirus Associated with Postweaning Multisystemic Wasting Syndrome in Pigs. **Journal of Virology**, v. 72, n. 6, p. 5262–5267, 1998.

HARDING, J. C. S. et al. Postweaning multisystemic wasting syndrome: Epidemiology and clinical presentation. **Journal of Swine Health and Production**, v. 6, n. 6, p. 249–254, 1998.

HARMON, K. M. et al. Whole-genome sequences of novel porcine circovirus type 2 viruses detected in swine from Mexico and the United States. **Genome Announcements**, v. 3, n. 6, p. 3–4, 2015.

HUANG, L. P. et al. Identification of one critical amino acid that determines a conformational neutralizing epitope in the capsid protein of porcine circovirus type 2. **BMC Microbiology**, v. 11, n. 1, p. 188, 2011.
JIN, J. et al. Biochemical and Biophysical Research Communications The level of decoy epitope in PCV2 vaccine affects the neutralizing activity of sera in the immunized animals. **Biochemical and Biophysical Research Communications**, v. 496, n. 3, p.

846–851, 2018.

JOHNSON, C. S. et al. Experimental in utero inoculation of late-term swine fetuses with porcine circovirus type 2. **Journal of Veterinary Diagnostic Investigation**, v. 14, p. 507–512, 2002.

KANG, S. et al. Genetic diversity and different cross- neutralization capability of porcine circovirus type 2 isolates recently circulating in South Korea. **BMC Veterinary Research**, v. 16, p. 334, 2020.

KEKARAINEN, T.; GONZALEZ, A.; LLORENS, A. Genetic variability of porcine circovirus 2 in vaccinating and non-vaccinating commercial farms. p. 1734–1742, 2014.

KHAYAT, R. et al. Structural characterization of the PCV2d genotype at 3.3 Å resolution reveals differences to PCV2a and PCV2b genotypes, a tetranucleotide, and an N-terminus near the icosahedral 3-fold axes. **Virology**, v. 537, p. 186–197, 2010.

KHAYAT, R. et al. The 2 . 3-Angstrom Structure of Porcine Circovirus 2. **JOURNAL OF VIROLOGY**, v. 85, n. 15, p. 7856–7862, 2011.

KIM, W. IL. Application of oral fluid sample to monitor porcine circovirus-2 infection in pig farms. **Journal of Veterinary Clinics**, v. 27, n. 6, p. 704–712, 2010.

KIM, J. et al. Short communication Communication brève Enteritis associated with porcine circovirus 2 in pigs Résumé. **The Canadian Journal of Veterinary Research**, v. 68, p. 218–221, 2004.

KRAKOWKA, S. et al. Viral wasting syndrome of swine: Experimental reproduction of postweaning multisystemic wasting syndrome in gnotobiotic swine by coinfection with porcine circovirus 2 and porcine parvovirus. **Veterinary Pathology**, v. 37, n. 3, p. 254–263, 2000.

KRAKOWKA, S. et al. Immunologic features of porcine circovirus type 2 infection. **Viral**

Immunology, v. 15, n. 4, p. 567–582, 2002.
KUMAR, S. et al. MEGA X: Molecular evolutionary genetics analysis across computing platforms. **Molecular Biology and Evolution**, v. 35, n. 6, p. 1547–1549, 2018.

LAROCHELLE, E. et al. PCR Detection and Evidence of Shedding of Porcine Circovirus Type 2 in Boar Semen. **Journal of Clinical Microbiology**, v. 38, n. 12, p. 4629–4632, 2000.

LEKCHAROENSUK, P. et al. Epitope Mapping of the Major Capsid Protein of Type 2 Porcine Circovirus (PCV2) by Using Chimeric PCV1 and PCV2. **Journal of Virology**, v. 78, n. 15, p. 8135–8145, 2004.

LIN, W.-L. The Porcine Circovirus Type 2 Nonstructural Protein ORF3 Induces Apoptosis in Porcine Peripheral Blood Mononuclear Cells. **The Open Virology Journal**, v. 5, n. 1, p. 148–153, 2011.

LV, Q. Z.; GUO, K. K.; ZHANG, Y. M. Current understanding of genomic DNA of porcine circovirus type 2. **Virus Genes**, v. 49, n. 1, p. 1–10, 2014.

MAHÉ, D. et al. Differential recognition of ORF2 protein from type 1 and type 2 porcine circoviruses and identification of immunorelevant epitopes. **Journal of General Virology**, v. 81, n. 7, p. 1815–1824, 2000.

MANKERTZ, A.; HILLENBRAND, B. Replication of porcine circovirus type 1 requires two proteins encoded by the viral rep gene. **Virology**, v. 279, n. 2, p. 429–438, 2001.

MARTELLI, P. et al. One dose of a porcine circovirus 2 subunit vaccine induces humoral and cell-mediated immunity and protects against porcine circovirus-associated disease under field conditions. **Veterinary Microbiology**, v. 149, n. 3–4, p. 339–351, 2011.

MEEHAN, B. M. et al. Characterization of novel circovirus DNAs associated with wasting syndromes in pigs. **Journal of General Virology**, v. 79, n. 9, p. 2171–2179, 1998.

MEERTS, P. et al. Correlation between the presence of neutralizing antibodies against porcine circovirus 2 (PCV2) and protection against replication of the virus and development of PCV2-associated disease. **BMC Veterinary Research**, v. 11, n. 2:6, p. 1–11, 2006.

MENG, X. Porcine Circovirus Type 2 (PCV2): Pathogenesis and Interaction with the Immune System. **The Annual Review ofAnimal Biosciences**, v. 1, p. 43–66, 2013.

MIELE, M. et al. O Desenvolvimento da Suinocultura Brasileira nos Últimos 35 anos. In: **O desenvolvimento da suinocultura brasileira nos últimos 35 anos.** Concórdia: Concórdia: Embrapa Suínos e Aves: Sonho, desafio e tecnologia: 35 anos de contribuições da Embrapa Suínos e Aves., 2011. p. 85–112.

MISINZO, G. et al. Porcine Circovirus 2 Uses Heparan Sulfate and Chondroitin Sulfate B Glycosaminoglycans as Receptors for Its Attachment to Host Cells. **Journal of Virology**, v. 80, n. 7, p. 3487–3494, 2006.

NAWAGITGUL, P. et al. Open reading frame 2 of porcine circovirus type 2 encodes a major capsid protein. **Journal of General Virology**, v. 81, n. 9, p. 2281–2287, 2000.

NIELSEN, G. B. et al. Comparison of serum pools and oral fluid samples for detection of porcine circovirus type 2 by quantitative real-time PCR in finisher pigs. **Porcine Health Management**, v. 4, n. 1, p. 2, 1 dez. 2018.

O’CONNOR, B. et al. Multiple porcine circovirus 2-associated abortions and reproductive failure in a multisite swine production unit. **Canadian Veterinary Journal**, v. 42, p. 551–553, 2001.

OLVERA, A. et al. Comparison of porcine circovirus type 2 load in serum quantified by a real time PCR in postweaning multisystemic wasting syndrome and porcine dermatitis and nephropathy syndrome naturally affected pigs. **Journal ofVirological Methods**, v. 117, p. 75–80, 2004.

OLVERA, A.; CORTEY, M.; SEGALÉS, J. Molecular evolution of porcine circovirus

type 2 genomes: Phylogeny and clonality. **Virology**, v. 357, n. 2, p. 175–185, 2007.
OPRIESSNIG, T. et al. Porcine circovirus type 2 infection decreases the efficacy of a modified live porcine reproductive and respiratory syndrome virus vaccine. **Clinical and Vaccine Immunology**, v. 13, n. 8, p. 923–929, 2006.

OPRIESSNIG, T. et al. Differences in virulence among porcine circovirus type 2 isolates are unrelated to cluster type 2a or 2b and prior infection provides heterologous protection. **Journal of General Virology**, v. 89, p. 2482–2491, 2008.
OPRIESSNIG, T. et al. Comparison of efficacy of commercial one dose and two dose PCV2 vaccines using a mixed PRRSV-PCV2-SIV clinical infection model 2-3-months post vaccination. **Vaccine**, v. 27, n. 7, p. 1002–1007, 2009.

OPRIESSNIG, T. et al. Comparison of the effectiveness of passive (dam) versus active (piglet) immunization against porcine circovirus type 2 (PCV2) and impact of passively derived PCV2 vaccine-induced immunity on vaccination. **Veterinary Microbiology**, v. 142, n. 3–4, p. 177–183, 2010.

OPRIESSNIG, T. et al. Porcine circovirus type 2 (PCV2) vaccination is effective in reducing disease and PCV2 shedding in semen of boars concurrently infected with PCV2 and Mycoplasma hyopneumoniae. **Theriogenology**, v. 76, n. 2, p. 351–360, 2011.

OPRIESSNIG, T. et al. Emergence of a novel mutant PCV2b variant associated with clinical PCVAD in two vaccinated pig farms in the U . S . concurrently infected with. **Veterinary Microbiology**, v. 163, n. 1–2, p. 177–183, 2013.

OPRIESSNIG, T. et al. Mutant USA strain of porcine circovirus type 2 (mPCV2) exhibits similar virulence to the classical PCV2a and PCV2b strains in caesarean-derived , colostrum-deprived pigs. **Journal of General Virology**, v. 2, n. 95, p. 2495–2503, 2014.

OPRIESSNIG, T. et al. A Porcine circovirus type 2b (PCV2b)-based experimental vaccine is effective in the PCV2b-Mycoplasma hyopneumoniae coinfection pig model. **Vaccine**, v. 37, n. 44, p. 6688–6695, 2019.

OPRIESSNIG, T. et al. Porcine circovirus type 2a or 2b based experimental vaccines provide protection against PCV2d / porcine parvovirus 2 co-challenge. **Vaccine**, v. 38, n. 8, p. 1975–1981, 2020.

OPRIESSNIG, T.; HALBUR, P. G. Concurrent infections are important for expression of porcine circovirus associated disease. **Virus Research**, v. 164, n. 1–2, p. 20–32, 2012.

OPRIESSNIG, T.; MENG, X. J.; HALBUR, P. G. Porcine circovirus type 2-associated disease: Update on current terminology, clinical manifestations, pathogenesis, diagnosis, and intervention strategies. **Journal of Veterinary Diagnostic Investigation**, v. 19, n. 6, p. 591–615, 2007.

PATTERSON, A. R.; OPRIESSNIG, T. Epidemiology and horizontal transmission of porcine circovirus type 2 (PCV2). **Animal health research reviews / Conference of Research Workers in Animal Diseases**, v. 11, n. 2, p. 217–234, 2010.

PRICKETT, J. R. et al. Prolonged Detection of PCV2 and Anti-PCV2 Antibody in Oral Fluids Following Experimental Inoculation. **Transboundary and Emerging Diseases**, v. 58, n. 2, p. 121–127, 2011.

PUIG, M. F. DE. **Characterization of immune responses to porcine circovirus type 2 (PCV2) infection and vaccination in pigs**. [s.l.] Facultat de veterinària de Barcelona, 2009.

QU, T. et al. High prevalence of PCV2d in Hunan province, China: a retrospective analysis of samples collected from 2006 to 2016. **Archives of Virology**, v. 163, n. 7, p. 1897–1906, 2018.

READ, A. F. et al. Imperfect vaccination can enhance the transmission of highly virulent pathogens. **PLoS Biology**, v. 13, n. 7, p. 1–18, 2015.

REINER, G.; HOFMEISTER, R.; WILLEMS, H. Genetic variability of porcine circovirus 2 (PCV2) field isolates from vaccinated and non-vaccinated pig herds in Germany.

Veterinary Microbiology, v. 180, n. 1–2, p. 377–378, 2015.

RITTERBUSCH, G. A. et al. Research in Veterinary Science Natural co-infection of torque teno virus and porcine circovirus 2 in the reproductive apparatus of swine. **Research in Veterinary Science**, v. 92, n. 3, p. 519–523, 2012.

RODRIGUES, C. P.; CRUZ, T. F.; ARAÚJO JÚNIOR, J. P. **Temporal variation study of the porcine circovirus species and genotypes prevalences (PCV1, PCV2a, PCV2b and PCV2d-2) in Brazil from 2009 to 2017**. In: XXIX Congresso Brasileiro de Virologia e XIII Encontro de Virologia do Mercosul, 2018, Gramado-RS. Anais do XXIX Congresso Brasileiro de Virologia e XIII Encontro de Virologia do Mercosul. **Anais**...2018

SAHA, D. et al. Single amino acid mutations in the capsid switch the neutralization phenotype of porcine circovirus 2. **Journal of General Virology**, v. 93, p. 1548–1555, 2012.

SALGADO, R. L. et al. Identification of an emergent porcine circovirus-2 in vaccinated pigs from a Brazilian farm during a postweaning multisystemic wasting syndrome outbreak. **Genome Announcements**, v. 2, n. 2, p. 1–2, 2014.

SATO, J. P. H. et al. Genetic characterization of porcine circovirus type 2 in captive wild boars in southern Brazil. **Tropical Animal Health and Production**, v. 49, n. 5, p. 1071–1075, 2017.

SCHAEFER, R. . et al. **XXV Brazilian Congress of Virology & IX Mercosur Meeting of Virology XXV Brazilian Congress of Virology & IX Mercosur Meeting of Virology**. 2015

SEGALÉS, J. et al. PCV-2 genotype definition and nomenclature. **Veterinary Record**, v. 162, n. 26, p. 867–868, 2008.

SEGALÉS, J. et al. A genetically engineered chimeric vaccine against porcine circovirus type 2 (PCV2) improves clinical , pathological and virological outcomes in postweaning multisystemic wasting syndrome affected farms. **Vaccine**, v. 27, p. 7313–7321, 2009.

SEGALÉS, J. Porcine circovirus type 2 (PCV2) infections: Clinical signs, pathology and laboratory diagnosis. **Virus Research**, v. 164, n. 1–2, p. 10–19, 2012.

SEGALÉS, J. Best practice and future challenges for vaccination against porcine circovirus type 2. **Expert Rev. Vaccines**, v. 14, p. 473–487, 2015.

SEGALÉS, J.; ALLAN, G. M.; DOMINGO, M. Porcine circovirus diseases. **Animal Health Research Reviews**, v. 6, n. 2, p. 119–142, 2005.

SEO, H. W. et al. Genetic and antigenic characterization of a newly emerging porcine circovirus type 2b mutant first isolated in cases of vaccine failure in Korea. **Archives of Virology**, v. 159, n. 11, p. 3107–3111, 2014.

SHANG, S. BIN et al. Fine mapping of antigenic epitopes on capsid proteins of porcine circovirus, and antigenic phenotype of porcine circovirus Type 2. **Molecular Immunology**, v. 46, n. 3, p. 327–334, 2009.

SHEN, H. G.; HALBUR, P. G.; OPRIESSNIG, T. Prevalence and phylogenetic analysis of the current porcine circovirus 2 genotypes after implementation of widespread vaccination programmes in the USA. **Journal of General Virology**, v. 93, n. 6, p. 1345–1355, 2012.

SINHA, A. et al. Porcine Reproductive and Respiratory Syndrome Virus Infection at the Time of Porcine Circovirus Type 2 Vaccination Has No Impact on Vaccine Efficacy. **Clinical and Vaccine Immunology**, v. 17, n. 12, p. 1940–1945, 2010.

SUH, J. et al. A Comparison of Virulence of Three Porcine Circovirus Type 2 (PCV2) Genotypes (a , b , and d) in Pigs Singularly Inoculated with PCV2 and Dually Inoculated with PCV2 and Porcine Reproductive and Respiratory Syndrome Virus. **Pathogens**, v. 10, p. 891, 2021.

TICO, G.; SEGALÉS, J.; MARTI, J. The blurred border between porcine circovirus type 2-systemic disease and porcine respiratory disease complex. **Veterinary Microbiology**, v. 163, p. 242–247, 2013.

TRIBLE, B. R.; ROWLAND, R. R. R. Genetic variation of porcine circovirus type 2 (PCV2) and its relevance to vaccination, pathogenesis and diagnosis. **Virus Research**, v. 164, n. 1–2, p. 68–77, 2012.

TRUONG, C. et al. Identification of an immunorelevant ORF2 epitope from porcine circovirus type 2 as a serological marker for experimental and natural infection. **Archives of Virology**, v. 146, n. 6, p. 1197–1211, 2001.

WANG, Y. et al. Genetic diversity and prevalence of porcine circovirus type 3 (PCV3) and type 2 (PCV2) in the Midwest of the USA during 2016–2018. **Transboundary and Emerging Diseases**, v. 67, n. 3, p. 1284–1294, 2020.

WEI, C. et al. Emergence of a novel recombinant porcine circovirus type 2 in China: PCV2c and PCV2d recombinant. **Transboundary and Emerging Diseases**, v. 66, n. 6, p. 2496–2506, 2019a.

WEI, R. et al. Changes on the viral capsid surface during the evolution of porcine circovirus type 2 (PCV2) from 2009 till 2018 may lead to a better receptor binding. **Virus Evolution**, v. 5, n. 2, p. 1–12, 2019b.

WELLENBERG, G. J.; STOCKHOFE-ZURWIEDEN, N.; JONG, M. F. DE. Excessive porcine circovirus type 2 antibody titres may trigger the development of porcine dermatitis and nephropathy syndrome : a case-control study. **Veterinary Microbiology**, v. 99, p. 203–214, 2004.

WEST, K. H. et al. Myocarditis and abortion associated with intrauterine infection of sows with porcine circovirus 2. **J Vet Diagn Invest**, v. 11, p. 530–532, 1999.

WIKSTROM, F. H. **Interaction Between Porcine Circovirus type 2 and the Immune System of the Pig. With Special Reference to Immunomodulatory Sequences in**

the Viral Genome. [s.l.] Swedish University of Agricultural Sciences, 2008.

XIAO, C.-T.; HALBUR, P. G.; OPRIESSNIG, T. Complete Genome Sequence of a Novel Porcine Circovirus Type 2b Variant Present in Cases of Vaccine Failures in the United States. **Journal of Virology**, v. 86, n. 22, p. 12469–12469, 2012.

XIAO, C.-T.; HALBUR, P. G.; OPRIESSNIG, T. Global molecular genetic analysis of porcine circovirus type 2 (PCV2) sequences confirms the presence of four main PCV2 genotypes and reveals a rapid increase of PCV2d. **Journal of General Virology**, v. 96, n. 7, p. 1830–1841, 2015.

YAO, J. et al. Genetic analysis of porcine circovirus type 2 (PCV2) strains between 2002 and 2016 reveals PCV2 mutant predominating in porcine population in Guangxi, China. **BMC Veterinary Research**, v. 15, n. 1, p. 1–11, 2019.

SUPPLEMENTARY

Supplementary Table 1: Sequences downloaded from GenBank (march, 2020) used as a reference in the construction of the phylogenetic tree.

GU938303_China_2009_PCV2b
HQ113121_China_2009_PCV2b
EU136713_Denmark_2007_PCV2b
EU136712_Denmark_2007_PCV2b
EU136720_Denmark_2007_PCV2b
AY484416_Netherlands_2001_PCV2b
DQ923523_Brazil_2009_PCV2b
KC835191_Brazil_2004_PCV2b
DQ923524_Brazil_2010_PCV2b
GU049342_Spain_2006_PCV2b
HF542107_Brazil_2007_PCV2b
JQ692110_USA_2006_PCV2b
EU057185_Brazil_2003_PCV2b
KC835193_Brazil_2005_PCV2b
DQ364650_Brazil_2006_PCV2b
KP231128_Italy_2013_PCV2b
KC473165_China_2007_PCV2b
KT819167_Brazil_2014_PCV2b
KT719404_Brazil_2012_PCV2b
KT819160_Brazil_2014_PCV2b
KT819162_Brazil_2014_PCV2b
KT819163_Brazil_2014_PCV2b
KT819164_Brazil_2014_PCV2b
KT819165_Brazil_2014_PCV2b
KT819166_Brazil_2014_PCV2b
KC514973_China_2011_PCV2b
KF742553_China_2013_PCV2b
EU909688_Belgium_2008_PCV2b
KC800638_China_2012_PCV2d
KC800645_China_2011_PCV2d
KJ187306_Brazil_2013_PCV2d-2
KT819169_Brazil_2014_PCV2d
KT819170_Brazil_2014_PCV2d
HM038017_China_2010_PCV2d
HM038017_China_20008_PCV2d-2
JX535297_USA_2012_PCV2d
JX535296_USA_2012_PCV2d-2
JX679498_China_2006_PCV2d
JX519293_China_2012_PCV2d-2
AY181946_China_2002_PCV2d-1
EU057186_Brazil_2003_PCV2a
EU057188_Brazil_2003_PCV2a
EU057189_Brazil_2003_PCV2a
KR868575_Brazil_2011_PCV2a
KC618389_USA_2880_PCV2a
GU049340_Canada_2007_PCV2a
KT819168_Brazil_2014_PCV2a
EU057184_Brazil_2003_PCV2a
EU057187_Brazil_2003_PCV2a
JN133304_Spain_2002_PCV2a
KJ094599.1_SouthAmerica_2010_Susscrofa_PCV2c

Supplementary Table 2: Sequences Dataset used in this study. Column GenBank corresponds to Access number at NCBI. Country: Country of isolation. Region: Continent of isolation. Year: year of isolation. Subgroup: PCV2 genotype.

GenBank	**Country**	**Region**	**Year**	**Subgroup**
KX960917	China	Asia	2002	2d
JX679498	China	Asia	2006	2d
KX161690	China	Asia	2006	2d
JQ390467	Taiwan	Asia	2006	2d
GQ404800	China	Asia	2006	2d
AF201897	Netherlands	Europe	2000	2b
AY484411	Netherlands	Europe	2004	2b
AY484413	Netherlands	Europe	2004	2b
DQ220737	Canada	NorthAmerica	2005	2b
HM038016	China	Asia	2005	2b
AY321984	France	Europe	2004	2b
AY321985	France	Europe	2004	2b
EF565357	Denmark	Europe	2003	2b
AY484408	Netherlands	Europe	2004	2b
AY484412	Netherlands	Europe	2004	2b
AY321986	France	Europe	2004	2b
AY188355	China	Asia	2005	2b
AY217743	China	Asia	2003	2b
AY536755	China	Asia	2004	2b
AY322000	France	Europe	2004	2b
AY484416	Netherlands	Europe	2004	2b
AY682990	China	Asia	2004	2b
HM038024	China	Asia	2005	2b
AY321990	France	Europe	2004	2b
AY484415	Netherlands	Europe	2004	2b
AY322002	France	Europe	2004	2b
EF565366	Denmark	Europe	2003	2b
AY484409	Netherlands	Europe	2004	2b
AY969004	China	Asia	2005	2b
EF565364	Denmark	Europe	2003	2b
KF374705	Brazil	SouthAmerica	2005	2b
FJ644919	China	Asia	2002	2b
HM038020	China	Asia	2004	2b
AY321992	France	Europe	2004	2b
AY321994	France	Europe	2004	2b
AY322001	France	Europe	2004	2b
AY604430	China	Asia	2004	2b
AY256457	Hungary	Europe	2003	2b
AY321997	France	Europe	2004	2b
AY321998	France	Europe	2004	2b

HQ831529	Portugal	Europe	2005	2b
DQ233257	Romania	Europe	2003	2b
EF565350	Denmark	Europe	2003	2b
AY321988	France	Europe	2004	2b
AY321989	France	Europe	2004	2b
EF493840	China	Asia	2006	2b
EF493841	China	Asia	2006	2b
EF493842	China	Asia	2006	2b
GU247992	China	Asia	2005	2b
AY321999	France	Europe	2004	2b
HM038021	China	Asia	2006	2b
KC835191	Brazil	SouthAmerica	2004	2b
AY321991	France	Europe	2004	2b
KM604666	China	Asia	2004	2b
AY641542	China	Asia	2004	2b
AY181945	China	Asia	2003	2b
FJ644563	China	Asia	2005	2b
AY291316	China	Asia	2003	2b
EF565367	Denmark	Europe	2003	2b
EF565356	Denmark	Europe	2003	2b
AY424405	Austria	Europe	2003	2b
AY484414	Netherlands	Europe	2004	2b
AY849938	China	Asia	2005	2b
EF565344	Denmark	Europe	2003	2b
FJ158606	China	Asia	2006	2b
KX161698	China	Asia	2006	2b
EF565358	Denmark	Europe	2003	2b
EF565365	Denmark	Europe	2003	2b
EF565361	Denmark	Europe	2003	2b
EF565354	Denmark	Europe	2003	2b
EF565368	Denmark	Europe	2003	2b
EF565346	Denmark	Europe	2003	2b
EF565347	Denmark	Europe	2003	2b
EF565362	Denmark	Europe	2003	2b
EF565363	Denmark	Europe	2003	2b
EF565349	Denmark	Europe	2003	2b
GU049341	Spain	Europe	2006	2b
GU049342	Spain	Europe	2006	2b
DQ017036	China	Asia	2005	2b
FJ905464	SouthKorea	Asia	2005	2b
HQ831521	Portugal	Europe	2004	2b
EF565343	Denmark	Europe	2003	2b
EF565352	Denmark	Europe	2003	2b
EF565353	Denmark	Europe	2003	2b
EF565348	Denmark	Europe	2003	2b
AY321995	France	Europe	2004	2b

AY321996	France	Europe	2004	2b
HQ831527	Portugal	Europe	2006	2b
EF421969	China	Asia	2006	2b
EF565351	Denmark	Europe	2003	2b
FJ935780	Denmark	Europe	2006	2b
KC835190	Brazil	SouthAmerica	2003	2b
FJ158605	China	Asia	2006	2b
HQ831524	Portugal	Europe	2003	2b
FJ644924	China	Asia	2006	2b
GU247991	China	Asia	2006	2b
EF565345	Denmark	Europe	2003	2b
EF565342	Denmark	Europe	2003	2b
DQ141322	China	Asia	2005	2b
KC835192	Brazil	SouthAmerica	2005	2b
EF565355	Denmark	Europe	2003	2b
HM009336	Slovakia	Europe	2005	2b
AY682993	China	Asia	2004	2b
FJ644558	China	Asia	2005	2b
FJ644561	China	Asia	2005	2b
AM086384	China	Asia	2004	2b
AY536756	China	Asia	2004	2b
FJ644925	China	Asia	2006	2b
AY691679	China	Asia	2004	2b
AY256460	Hungary	Europe	2003	2b
AY613854	China	Asia	2004	2b
AY321987	France	Europe	2004	2b
FJ644559	China	Asia	2005	2b
AY651850	China	Asia	2004	2b
AY686764	China	Asia	2004	2b
KM604667	China	Asia	2006	2b
DQ104422	China	Asia	2005	2b
FJ644920	China	Asia	2006	2b
FJ644921	China	Asia	2006	2b
GU247987	China	Asia	2005	2b
FJ905465	SouthKorea	Asia	2005	2b
AY424404	Austria	Europe	2003	2b
FJ644555	China	Asia	2005	2b
FJ905466	SouthKorea	Asia	2005	2b
HM038018	China	Asia	2005	2b
FJ905461	SouthKorea	Asia	2005	2b
HQ831531	Portugal	Europe	2004	2b
AY916791	China	Asia	2005	2b
EF493838	China	Asia	2006	2b
EF493839	China	Asia	2006	2b
EF421968	China	Asia	2006	2b
AY391729	China	Asia	2003	2b

AY686762	China	Asia	2004	2b
EF565359	Denmark	Europe	2003	2b
AY177626	China	Asia	2003	2b
EF421973	China	Asia	2006	2b
AY596823	China	Asia	2004	2b
DQ220738	Canada	NorthAmerica	2005	2b
KC835193	Brazil	SouthAmerica	2005	2b
DQ861895	Brazil	SouthAmerica	2004	2b
DQ861896	Brazil	SouthAmerica	2004	2b
DQ861899	Brazil	SouthAmerica	2003	2b
DQ861897	Brazil	SouthAmerica	2003	2b
DQ861898	Brazil	SouthAmerica	2003	2b
DQ861900	Brazil	SouthAmerica	2002	2b
DQ861901	Brazil	SouthAmerica	2002	2b
DQ861902	Brazil	SouthAmerica	2004	2b
DQ220727	Canada	NorthAmerica	2005	2b
DQ220728	Canada	NorthAmerica	2005	2b
DQ220729	Canada	NorthAmerica	2005	2b
DQ220730	Canada	NorthAmerica	2005	2b
DQ220739	Canada	NorthAmerica	2005	2b
DQ220731	Canada	NorthAmerica	2005	2b
DQ220734	Canada	NorthAmerica	2005	2b
DQ629115	USA	NorthAmerica	2005	2b
EF394777	Canada	NorthAmerica	2005	2b
EF394778	Canada	NorthAmerica	2005	2b
EF394779	Canada	NorthAmerica	2005	2b
HQ148879	Cuba	SouthAmerica	2005	2b
JQ994270	Canada	NorthAmerica	2006	2b
DQ629116	USA	NorthAmerica	2005	2b
FJ218000	USA	NorthAmerica	2006	2b
JF290418	Canada	NorthAmerica	2006	2b
JQ994268	Canada	NorthAmerica	2006	2b
DQ629117	USA	NorthAmerica	2005	2b
DQ629118	USA	NorthAmerica	2005	2b
DQ220735	Canada	NorthAmerica	2005	2b
DQ220736	Canada	NorthAmerica	2005	2b
DQ629119	USA	NorthAmerica	2005	2b
DQ220732	Canada	NorthAmerica	2005	2b
HQ713495	USA	NorthAmerica	2005	2b
EU126887	Canada	NorthAmerica	2006	2b
FJ644923	China	Asia	2006	2b
AY732494	China	Asia	2004	2b
KX161691	China	Asia	2006	2b
KX161692	China	Asia	2006	2b
DQ104420	China	Asia	2005	2b
FJ905462	SouthKorea	Asia	2005	2b

FJ644562	China	Asia	2005	2b
HM038027	China	Asia	2006	2b
EU346945	China	Asia	2004	2b
DQ220733	Canada	NorthAmerica	2005	2b
AY579893	China	Asia	2004	2b
GU247989	China	Asia	2005	2b
HQ831532	Portugal	Europe	2005	2b
HQ831530	Portugal	Europe	2003	2b
FJ644926	China	Asia	2006	2b
EF421970	China	Asia	2006	2b
EF421971	China	Asia	2006	2b
KX161679	China	Asia	2006	2b
EF421972	China	Asia	2006	2b
KX161663	China	Asia	2006	2b
KX161664	China	Asia	2006	2b
EF493837	China	Asia	2006	2b
GU247990	China	Asia	2005	2b
GU233804	China	Asia	2004	2b
HM038019	China	Asia	2005	2b
KX161686	China	Asia	2006	2b
GU247988	China	Asia	2006	2b
FJ644557	China	Asia	2005	2b
FJ158603	China	Asia	2006	2b
FJ905469	SouthKorea	Asia	2005	2b
FJ644556	China	Asia	2005	2b
HQ831528	Portugal	Europe	2006	2b
EU408780	Sweden	Europe	2003	2b
JX506730	VietNam	Asia	2004	2h
AB072301	Japan	Asia	2001	2a
AF381177	China	Asia	2001	2a
AF408635	Canada	NorthAmerica	2001	2a
AB072303	Japan	Asia	2001	2a
AF381175	China	Asia	2001	2a
AF118095	Canada	NorthAmerica	2000	2a
AF118097	Canada	NorthAmerica	2000	2a
EF394775	Canada	NorthAmerica	2005	2a
AY325495	SouthAfrica	Africa	2003	2a
MF964235	SouthKorea	Asia	2004	2a
AY094619	USA	NorthAmerica	2003	2a
EF394774	Canada	NorthAmerica	2005	2a
DQ629113	USA	NorthAmerica	2005	2a
FJ218001	USA	NorthAmerica	2006	2a
DQ629114	USA	NorthAmerica	2005	2a
DQ104421	China	Asia	2005	2a
DQ104423	China	Asia	2005	2a
AY181948	China	Asia	2003	2a

FJ218002	USA	NorthAmerica	2006	2a
EF394776	Canada	NorthAmerica	2005	2a
AF465211	Taiwan	Asia	2002	2a
AF109399	Canada	NorthAmerica	2000	2a
AY256456	Hungary	Europe	2003	2a
AY256458	Hungary	Europe	2003	2a
HM009337	Slovakia	Europe	2005	2a
AY322004	France	Europe	2004	2a
DQ870484	USA	NorthAmerica	2005	2a
AY874165	Hungary	Europe	2002	2a
AY874166	Hungary	Europe	2003	2a
AF381176	China	Asia	2001	2a
AY424401	Austria	Europe	2003	2a
NC005148	Austria	Europe	2003	2a
AY424403	Austria	Europe	2003	2a
AY424402	Austria	Europe	2003	2a
DQ915588	Greece	Europe	2004	2a
EU386606	Sweden	Europe	1993	2a
AB072302	Japan	Asia	2001	2a
EU148506	Denmark	Europe	1993	2a
AF117753	Canada	NorthAmerica	2000	2a
AY874164	Hungary	Europe	2002	2a
AY874169	Hungary	Europe	2003	2a
AY256455	Hungary	Europe	2003	2a
AY256459	Hungary	Europe	2003	2a
AF364094	Taiwan	Asia	2001	2a
AY146991	Taiwan	Asia	2002	2a
FJ483938	China	Asia	2005	2a
AY180397	Taiwan	Asia	2003	2a
AY146993	Taiwan	Asia	2002	2a
AY180396	Taiwan	Asia	2003	2a
JF683387	Taiwan	Asia	2002	2a
JF927978	Taiwan	Asia	2002	2a
JF927979	Taiwan	Asia	2002	2a
AY556474	China	Asia	2004	2a
MF139056	China	Asia	1996	2a
MF139057	China	Asia	1998	2a
MF139071	China	Asia	1998	2a
MF139072	China	Asia	1998	2a
MF139058	China	Asia	1999	2a
MF139062	China	Asia	1998	2a
MF139063	China	Asia	1999	2a
MF139064	China	Asia	1999	2a
MF139065	China	Asia	1999	2a
MF139066	China	Asia	1998	2a
MF139067	China	Asia	1998	2a

MF139068	China	Asia	1997	2a
MF139075	China	Asia	1998	2a
MF139069	China	Asia	1999	2a
MF139070	China	Asia	1998	2a
MF139061	China	Asia	1999	2a
MF139074	China	Asia	1999	2a
MF139059	China	Asia	1999	2a
MF139060	China	Asia	1998	2a
MF139073	China	Asia	1999	2a
MF278779	China	Asia	1999	2f
MF139078	China	Asia	1999	2f
MF278777	China	Asia	1999	2f
MF278778	China	Asia	1999	2f
MF139076	China	Asia	1999	2f
MF139077	China	Asia	1999	2f
FJ998185	China	Asia	2005	2g
KC620553	SouthKorea	Asia	2003	2d
KC620555	SouthKorea	Asia	2005	2d
KC620556	SouthKorea	Asia	2005	2d
KC620554	SouthKorea	Asia	2003	2d
EF421967	China	Asia	2006	2b
DQ915586	Greece	Europe	2002	2b
DQ915587	Greece	Europe	2003	2b
EU136712	Denmark	Europe	2003	2b
EU136720	Denmark	Europe	2002	2b
EU136713	Denmark	Europe	2003	2b
EU136718	Denmark	Europe	2002	2b
EU136716	Denmark	Europe	2003	2b
EU136714	Denmark	Europe	2003	2b
EU136719	Denmark	Europe	2002	2b
EU136715	Denmark	Europe	2003	2b
GQ404801	China	Asia	2006	2b
GQ404798	China	Asia	2006	2b
HM009335	Slovakia	Europe	2006	2b
KC620543	SouthKorea	Asia	2005	2b
KT868345	USA	NorthAmerica	2006	2b
KT868352	USA	NorthAmerica	2006	2b
KC620551	SouthKorea	Asia	2006	2b
KC620547	SouthKorea	Asia	2006	2b
JF683396	Taiwan	Asia	2005	2b
KC620534	SouthKorea	Asia	2002	2b
KC620535	SouthKorea	Asia	2002	2b
KC620541	SouthKorea	Asia	2005	2b
KT868268	USA	NorthAmerica	2006	2b
KT868123	USA	NorthAmerica	2006	2b
KC620538	SouthKorea	Asia	2004	2b

KC620533	SouthKorea	Asia	1999	2b
KC620548	SouthKorea	Asia	2006	2b
KC620552	SouthKorea	Asia	2006	2b
KC620540	SouthKorea	Asia	2005	2b
KC620546	SouthKorea	Asia	2006	2b
KC620549	SouthKorea	Asia	2006	2b
KT868521	USA	NorthAmerica	2006	2b
EU755375	Brazil	SouthAmerica	2005	2b
EU755378	Brazil	SouthAmerica	2005	2b
EU755379	Brazil	SouthAmerica	2005	2b
EU755380	Brazil	SouthAmerica	2005	2b
EU755376	Brazil	SouthAmerica	2005	2b
EU755381	Brazil	SouthAmerica	2005	2b
JF683390	Taiwan	Asia	2002	2b
JF927981	Taiwan	Asia	2003	2b
JF927976	Taiwan	Asia	2002	2b
JF927977	Taiwan	Asia	2002	2b
JF927980	Taiwan	Asia	2003	2b
KC620542	SouthKorea	Asia	2005	2b
KC620544	SouthKorea	Asia	2006	2b
KC620539	SouthKorea	Asia	2005	2b
KC620545	SouthKorea	Asia	2006	2b
KT868062	USA	NorthAmerica	2005	2b
KT868331	USA	NorthAmerica	2005	2b
KT867838	USA	NorthAmerica	2005	2b
KT867840	USA	NorthAmerica	2005	2b
KT867842	USA	NorthAmerica	2005	2b
KT867873	USA	NorthAmerica	2006	2b
KT867880	USA	NorthAmerica	2006	2b
KT867885	USA	NorthAmerica	2006	2b
KT867904	USA	NorthAmerica	2006	2b
KT867908	USA	NorthAmerica	2006	2b
KT867963	USA	NorthAmerica	2006	2b
KT867976	USA	NorthAmerica	2006	2b
KT867978	USA	NorthAmerica	2006	2b
KT867983	USA	NorthAmerica	2006	2b
KT867993	USA	NorthAmerica	2006	2b
KT868003	USA	NorthAmerica	2006	2b
KT868005	USA	NorthAmerica	2006	2b
KT868007	USA	NorthAmerica	2006	2b
KT868015	USA	NorthAmerica	2006	2b
KT868019	USA	NorthAmerica	2006	2b
KT868020	USA	NorthAmerica	2006	2b
KT868021	USA	NorthAmerica	2006	2b
KT868022	USA	NorthAmerica	2006	2b
KT868055	USA	NorthAmerica	2005	2b

KT868061	USA	NorthAmerica	2006	2b
KT868067	USA	NorthAmerica	2006	2b
KT868083	USA	NorthAmerica	2006	2b
KT868085	USA	NorthAmerica	2006	2b
KT868087	USA	NorthAmerica	2006	2b
KT868157	USA	NorthAmerica	2006	2b
KT868161	USA	NorthAmerica	2006	2b
KT868163	USA	NorthAmerica	2006	2b
KT868169	USA	NorthAmerica	2006	2b
KT868178	USA	NorthAmerica	2006	2b
KT868182	USA	NorthAmerica	2006	2b
KT868183	USA	NorthAmerica	2006	2b
KT868189	USA	NorthAmerica	2006	2b
KT868191	USA	NorthAmerica	2006	2b
KT868192	USA	NorthAmerica	2006	2b
KT868193	USA	NorthAmerica	2006	2b
KT868194	USA	NorthAmerica	2006	2b
KT868205	USA	NorthAmerica	2006	2b
KT868221	USA	NorthAmerica	2006	2b
KT868226	USA	NorthAmerica	2006	2b
KT868227	USA	NorthAmerica	2006	2b
KT868228	USA	NorthAmerica	2006	2b
KT868231	USA	NorthAmerica	2006	2b
KT868240	USA	NorthAmerica	2006	2b
KT868241	USA	NorthAmerica	2006	2b
KT868245	USA	NorthAmerica	2006	2b
KT868250	USA	NorthAmerica	2006	2b
KT868261	USA	NorthAmerica	2006	2b
KT868263	USA	NorthAmerica	2006	2b
KT868273	USA	NorthAmerica	2006	2b
KT868275	USA	NorthAmerica	2006	2b
KT868281	USA	NorthAmerica	2006	2b
KT868284	USA	NorthAmerica	2006	2b
KT868297	USA	NorthAmerica	2006	2b
KT868299	USA	NorthAmerica	2006	2b
KT868301	USA	NorthAmerica	2006	2b
KT868306	USA	NorthAmerica	2006	2b
KT868316	USA	NorthAmerica	2006	2b
KT868319	USA	NorthAmerica	2005	2b
KT868320	USA	NorthAmerica	2006	2b
KT868322	USA	NorthAmerica	2006	2b
KT868326	USA	NorthAmerica	2005	2b
KT868328	USA	NorthAmerica	2005	2b
KT868329	USA	NorthAmerica	2006	2b
KT868330	USA	NorthAmerica	2005	2b
KT868342	USA	NorthAmerica	2006	2b

KT868353	USA	NorthAmerica	2006	2b
KT868379	USA	NorthAmerica	2006	2b
KT868421	USA	NorthAmerica	2006	2b
KT868424	USA	NorthAmerica	2006	2b
KT868427	USA	NorthAmerica	2006	2b
KT868474	USA	NorthAmerica	2006	2b
KT868477	USA	NorthAmerica	2006	2b
KT868495	USA	NorthAmerica	2006	2b
KT868520	USA	NorthAmerica	2006	2b
KT867856	USA	NorthAmerica	2006	2b
KT867861	USA	NorthAmerica	2006	2b
KT867889	USA	NorthAmerica	2006	2b
KT867899	USA	NorthAmerica	2006	2b
KT868010	USA	NorthAmerica	2006	2b
KT868011	USA	NorthAmerica	2006	2b
KT868016	USA	NorthAmerica	2006	2b
KT868017	USA	NorthAmerica	2006	2b
KT868018	USA	NorthAmerica	2006	2b
KT868040	USA	NorthAmerica	2005	2b
KT868047	USA	NorthAmerica	2006	2b
KT868089	USA	NorthAmerica	2006	2b
KT868098	USA	NorthAmerica	2006	2b
KT868103	USA	NorthAmerica	2006	2b
KT868125	USA	NorthAmerica	2006	2b
KT868127	USA	NorthAmerica	2006	2b
KT868129	USA	NorthAmerica	2006	2b
KT868148	USA	NorthAmerica	2006	2b
KT868156	USA	NorthAmerica	2006	2b
KT868165	USA	NorthAmerica	2006	2b
KT868175	USA	NorthAmerica	2006	2b
KT868185	USA	NorthAmerica	2006	2b
KT868186	USA	NorthAmerica	2006	2b
KT868188	USA	NorthAmerica	2006	2b
KT868190	USA	NorthAmerica	2006	2b
KT868195	USA	NorthAmerica	2006	2b
KT868207	USA	NorthAmerica	2006	2b
KT868208	USA	NorthAmerica	2006	2b
KT868209	USA	NorthAmerica	2006	2b
KT868210	USA	NorthAmerica	2006	2b
KT868212	USA	NorthAmerica	2006	2b
KT868219	USA	NorthAmerica	2006	2b
KT868224	USA	NorthAmerica	2006	2b
KT868229	USA	NorthAmerica	2006	2b
KT868230	USA	NorthAmerica	2006	2b
KT868232	USA	NorthAmerica	2006	2b
KT868236	USA	NorthAmerica	2006	2b

KT868238	USA	NorthAmerica	2006	2b
KT868242	USA	NorthAmerica	2006	2b
KT868244	USA	NorthAmerica	2006	2b
KT868251	USA	NorthAmerica	2006	2b
KT868253	USA	NorthAmerica	2006	2b
KT868276	USA	NorthAmerica	2006	2b
KT868277	USA	NorthAmerica	2006	2b
KT868278	USA	NorthAmerica	2006	2b
KT868282	USA	NorthAmerica	2006	2b
KT868295	USA	NorthAmerica	2006	2b
KT868298	USA	NorthAmerica	2006	2b
KT868304	USA	NorthAmerica	2006	2b
KT868305	USA	NorthAmerica	2006	2b
KT868309	USA	NorthAmerica	2006	2b
KT868339	USA	NorthAmerica	2006	2b
KT868341	USA	NorthAmerica	2006	2b
KT868354	USA	NorthAmerica	2006	2b
KT868360	USA	NorthAmerica	2006	2b
KT868361	USA	NorthAmerica	2006	2b
KT868389	USA	NorthAmerica	2006	2b
KT868444	USA	NorthAmerica	2006	2b
KT868471	USA	NorthAmerica	2006	2b
KT868510	USA	NorthAmerica	2006	2b
KT868517	USA	NorthAmerica	2006	2b
KT868518	USA	NorthAmerica	2006	2b
KT868519	USA	NorthAmerica	2006	2b
KT867996	USA	NorthAmerica	2006	2b
KT868325	USA	NorthAmerica	2006	2b
KT868012	USA	NorthAmerica	2006	2b
KT868013	USA	NorthAmerica	2006	2b
KT868150	USA	NorthAmerica	2006	2b
KT868324	USA	NorthAmerica	2005	2b
KT868206	USA	NorthAmerica	2006	2b
KT868255	USA	NorthAmerica	2006	2b
KT868256	USA	NorthAmerica	2006	2b
KT868279	USA	NorthAmerica	2006	2b
KT868280	USA	NorthAmerica	2006	2b
KT868312	USA	NorthAmerica	2005	2b
KT868497	USA	NorthAmerica	2006	2b
KT868112	USA	NorthAmerica	2006	2b
KT868026	USA	NorthAmerica	2006	2b
KT868499	USA	NorthAmerica	2006	2b
KT868141	USA	NorthAmerica	2006	2b
KT868234	USA	NorthAmerica	2006	2b
KT868270	USA	NorthAmerica	2006	2b
KT868249	USA	NorthAmerica	2006	2b

KT868501	USA	NorthAmerica	2006	2b
KT867895	USA	NorthAmerica	2006	2b
KT868074	USA	NorthAmerica	2006	2b
KT868351	USA	NorthAmerica	2006	2b
KT868200	USA	NorthAmerica	2006	2b
KT867852	USA	NorthAmerica	2006	2b
KT867910	USA	NorthAmerica	2006	2b
KT867974	USA	NorthAmerica	2006	2b
KT868135	USA	NorthAmerica	2006	2b
KT868340	USA	NorthAmerica	2006	2b
KT868383	USA	NorthAmerica	2006	2b
KT867859	USA	NorthAmerica	2006	2b
KT867882	USA	NorthAmerica	2006	2b
KT868198	USA	NorthAmerica	2006	2b
KT868259	USA	NorthAmerica	2006	2b
KT868262	USA	NorthAmerica	2006	2b
KT868300	USA	NorthAmerica	2006	2b
KT867898	USA	NorthAmerica	2006	2b
KT868286	USA	NorthAmerica	2006	2b
KT868291	USA	NorthAmerica	2006	2b
KT868081	USA	NorthAmerica	2006	2b
KT868104	USA	NorthAmerica	2006	2b
KT868106	USA	NorthAmerica	2006	2b
KT868269	USA	NorthAmerica	2006	2b
KT868441	USA	NorthAmerica	2006	2b
KT868119	USA	NorthAmerica	2006	2b
KT868462	USA	NorthAmerica	2006	2b
KT868426	USA	NorthAmerica	2006	2b
KT868037	USA	NorthAmerica	2006	2b
KT868201	USA	NorthAmerica	2006	2b
KT868203	USA	NorthAmerica	2006	2b
KT868235	USA	NorthAmerica	2006	2b
KT868486	USA	NorthAmerica	2006	2b
JF683400	Taiwan	Asia	2006	2b
KT868180	USA	NorthAmerica	2006	2b
KT867863	USA	NorthAmerica	2006	2b
KT868386	USA	NorthAmerica	2006	2b
KT868466	USA	NorthAmerica	2006	2b
KT868483	USA	NorthAmerica	2006	2b
KT868045	USA	NorthAmerica	2006	2b
KT868077	USA	NorthAmerica	2006	2b
KT868093	USA	NorthAmerica	2006	2b
KT868336	USA	NorthAmerica	2005	2b
KT868095	USA	NorthAmerica	2006	2b
KT867967	USA	NorthAmerica	2006	2b
KT867971	USA	NorthAmerica	2006	2b

KT868450	USA	NorthAmerica	2006	2b
KT868453	USA	NorthAmerica	2006	2b
KT868459	USA	NorthAmerica	2006	2b
KT868117	USA	NorthAmerica	2006	2b
KT868480	USA	NorthAmerica	2006	2b
KT868091	USA	NorthAmerica	2006	2b
KT868308	USA	NorthAmerica	2006	2b
KT868434	USA	NorthAmerica	2006	2b
KT868222	USA	NorthAmerica	2006	2b
KT868223	USA	NorthAmerica	2006	2b
EU755372	Brazil	SouthAmerica	2005	2b
EU755374	Brazil	SouthAmerica	2005	2b
JF927982	Taiwan	Asia	2003	2b
KT868056	USA	NorthAmerica	2006	2b
EU755377	Brazil	SouthAmerica	2005	2b
KC620536	SouthKorea	Asia	2003	2b
EU755371	Brazil	SouthAmerica	2005	2b
EU755373	Brazil	SouthAmerica	2005	2b
AF201305	Germany	Europe	2000	2a
AF201306	Germany	Europe	2000	2a
KT868348	USA	NorthAmerica	2006	2a
KT868355	USA	NorthAmerica	2006	2a
KT868425	USA	NorthAmerica	2006	2a
KT867846	USA	NorthAmerica	2006	2a
KT867878	USA	NorthAmerica	2006	2a
KT868144	USA	NorthAmerica	2006	2a
KT868152	USA	NorthAmerica	2006	2a
KT868173	USA	NorthAmerica	2006	2a
KT868214	USA	NorthAmerica	2006	2a
KT867906	USA	NorthAmerica	2006	2a
KT868239	USA	NorthAmerica	2006	2a
KT868248	USA	NorthAmerica	2006	2a
KT868050	USA	NorthAmerica	2006	2a
KT868213	USA	NorthAmerica	2006	2a
KT868215	USA	NorthAmerica	2006	2a
KT868264	USA	NorthAmerica	2006	2a
KT868053	USA	NorthAmerica	2006	2a
KT868233	USA	NorthAmerica	2006	2a
JF683388	Taiwan	Asia	2003	2a
KT867892	USA	NorthAmerica	2006	2a
KT867893	USA	NorthAmerica	2006	2a
KT868332	USA	NorthAmerica	2005	2a
KT867948	USA	NorthAmerica	2006	2a
KT868246	USA	NorthAmerica	2006	2a
KT868247	USA	NorthAmerica	2006	2a
AF264038	USA	NorthAmerica	2000	2a

AF264039	USA	NorthAmerica	2000	2a
DQ397521	USA	NorthAmerica	2003	2a
AF264041	USA	NorthAmerica	2000	2a
AF454546	SouthKorea	Asia	2002	2a
AF544024	Korea	Asia	2002	2a
AF264042	USA	NorthAmerica	2000	2a
KC620521	SouthKorea	Asia	1999	2a
KC620524	SouthKorea	Asia	2000	2a
KC620526	SouthKorea	Asia	2001	2a
KC620529	SouthKorea	Asia	2002	2a
KT868310	USA	NorthAmerica	2004	2a
KT867875	USA	NorthAmerica	2006	2a
KT868014	USA	NorthAmerica	2006	2a
KT868008	USA	NorthAmerica	2006	2a
KT868371	USA	NorthAmerica	2006	2a
KT868437	USA	NorthAmerica	2006	2a
KT867986	USA	NorthAmerica	2006	2a
KT868187	USA	NorthAmerica	2006	2a
KT868154	USA	NorthAmerica	2006	2a
KT868265	USA	NorthAmerica	2006	2a
KT868009	USA	NorthAmerica	2006	2a
KT868115	USA	NorthAmerica	2006	2a
KT868131	USA	NorthAmerica	2006	2a
KT868137	USA	NorthAmerica	2006	2a
KT868139	USA	NorthAmerica	2006	2a
KT868327	USA	NorthAmerica	2006	2a
KT868346	USA	NorthAmerica	2006	2a
KT868357	USA	NorthAmerica	2006	2a
KT868359	USA	NorthAmerica	2006	2a
KT868447	USA	NorthAmerica	2006	2a
KT868503	USA	NorthAmerica	2006	2a
KT868504	USA	NorthAmerica	2006	2a
KT867897	USA	NorthAmerica	2006	2a
KT867953	USA	NorthAmerica	2006	2a
KT868100	USA	NorthAmerica	2006	2a
KT868064	USA	NorthAmerica	2005	2a
KT868042	USA	NorthAmerica	2006	2a
KT867887	USA	NorthAmerica	2006	2a
KC620522	SouthKorea	Asia	2000	2a
KT868318	USA	NorthAmerica	2003	2a
KT867890	USA	NorthAmerica	2006	2a
KT868099	USA	NorthAmerica	2006	2a
KT868142	USA	NorthAmerica	2006	2a
KT868218	USA	NorthAmerica	2006	2a
KT868260	USA	NorthAmerica	2006	2a
KT868283	USA	NorthAmerica	2006	2a

KT868293	USA	NorthAmerica	2006	2a
KT868302	USA	NorthAmerica	2006	2a
KT868033	USA	NorthAmerica	2005	2a
KT868311	USA	NorthAmerica	2004	2a
KT868096	USA	NorthAmerica	2006	2a
KT868108	USA	NorthAmerica	2006	2a
KT868422	USA	NorthAmerica	2006	2a
KT868184	USA	NorthAmerica	2006	2a
KT868350	USA	NorthAmerica	2006	2a
KT868367	USA	NorthAmerica	2006	2a
KT868267	USA	NorthAmerica	2006	2a
KT868335	USA	NorthAmerica	2005	2a
KT868334	USA	NorthAmerica	2005	2a
KT867868	USA	NorthAmerica	2006	2a
KT868370	USA	NorthAmerica	2005	2a
KT867866	USA	NorthAmerica	2006	2a
KT868375	USA	NorthAmerica	2006	2a
KT868167	USA	NorthAmerica	2006	2a
KT868271	USA	NorthAmerica	2006	2a
KT868307	USA	NorthAmerica	2006	2a
KC620523	SouthKorea	Asia	2000	2a
KT867981	USA	NorthAmerica	2006	2a
KT867989	USA	NorthAmerica	2006	2a
KT868065	USA	NorthAmerica	2006	2a
KT868110	USA	NorthAmerica	2006	2a
KT868121	USA	NorthAmerica	2006	2a
KT868204	USA	NorthAmerica	2006	2a
KT867841	USA	NorthAmerica	2006	2a
KT867843	USA	NorthAmerica	2006	2a
KT867844	USA	NorthAmerica	2006	2a
KT867845	USA	NorthAmerica	2006	2a
KT867979	USA	NorthAmerica	2006	2a
KT868252	USA	NorthAmerica	2006	2a
KT868274	USA	NorthAmerica	2006	2a
KT868296	USA	NorthAmerica	2006	2a
KT868456	USA	NorthAmerica	2006	2a
KT868243	USA	NorthAmerica	2006	2a
KT868071	USA	NorthAmerica	2006	2a
KC620528	SouthKorea	Asia	2001	2a
KT868382	USA	NorthAmerica	2005	2a
KT868391	USA	NorthAmerica	2006	2a
KT868257	USA	NorthAmerica	2006	2a
KT868343	USA	NorthAmerica	2006	2a
KC620530	SouthKorea	Asia	2003	2a
KT868315	USA	NorthAmerica	2005	2a
KT868171	USA	NorthAmerica	2006	2a

KT868237	USA	NorthAmerica	2006	2a
KT867870	USA	NorthAmerica	2006	2a
KT867847	USA	NorthAmerica	2006	2a
KT868023	USA	NorthAmerica	2006	2a
KT868024	USA	NorthAmerica	2006	2a
KT868025	USA	NorthAmerica	2006	2a
KT868197	USA	NorthAmerica	2006	2a
KT868041	USA	NorthAmerica	2006	2a
KT868211	USA	NorthAmerica	2006	2a
KT868349	USA	NorthAmerica	2006	2a
KT868051	USA	NorthAmerica	2004	2a
KT868070	USA	NorthAmerica	2005	2a
KT868423	USA	NorthAmerica	2006	2a
KT867980	USA	NorthAmerica	2006	2a
KT867871	USA	NorthAmerica	2006	2a
KT868147	USA	NorthAmerica	2006	2a
KT868058	USA	NorthAmerica	2005	2a
KT868378	USA	NorthAmerica	2005	2a
KT868060	USA	NorthAmerica	2005	2a
KT868314	USA	NorthAmerica	2004	2a
KT868362	USA	NorthAmerica	2005	2a
KT868333	USA	NorthAmerica	2005	2a
KT868358	USA	NorthAmerica	2006	2a
KT868217	USA	NorthAmerica	2006	2a
KT868254	USA	NorthAmerica	2006	2a
KT867839	USA	NorthAmerica	2006	2a
KT868366	USA	NorthAmerica	2005	2a
KT868258	USA	NorthAmerica	2006	2a
KT868202	USA	NorthAmerica	2006	2a
KC620525	SouthKorea	Asia	2001	2a
KC620527	SouthKorea	Asia	2001	2a
KT868433	USA	NorthAmerica	2006	2a
KT868044	USA	NorthAmerica	2005	2a
KT868337	USA	NorthAmerica	2002	2a
KT868027	USA	NorthAmerica	2005	2a
KT868266	USA	NorthAmerica	2006	2a
KT868272	USA	NorthAmerica	2006	2a
KT868159	USA	NorthAmerica	2006	2a
KT867902	USA	NorthAmerica	2006	2a
KT868196	USA	NorthAmerica	2006	2a
KT868216	USA	NorthAmerica	2006	2a
KT868220	USA	NorthAmerica	2006	2a
KT868225	USA	NorthAmerica	2006	2a
KC620531	SouthKorea	Asia	2004	2a
KC620532	SouthKorea	Asia	2004	2a
KT867958	USA	NorthAmerica	2006	2a

KT868303	USA	NorthAmerica	2006	2a
KT868199	USA	NorthAmerica	2006	2a
KT868356	USA	NorthAmerica	2006	2a
KT868374	USA	NorthAmerica	2005	2a
KT868430	USA	NorthAmerica	2003	2a
AY754022	Australia	Oceania	2002	2a
AY754016	Australia	Oceania	1999	2a
AY754018	Australia	Oceania	2000	2a
AY754017	Australia	Oceania	2000	2a
AY754019	Australia	Oceania	2000	2a
AY754020	Australia	Oceania	2000	2a
AY754021	Australia	Oceania	2000	2a
EU136711	Denmark	Europe	2003	2a
JF683391	Taiwan	Asia	2003	2a
KT867797	USA	NorthAmerica	2006	2e
KT867799	USA	NorthAmerica	2006	2e
AF201307	Germany	Europe	2000	2a
AF201308	Spain	Europe	2000	2a
AF201310	Spain	Europe	2000	2a
AF201309	Spain	Europe	2000	2a
AF264040	USA	NorthAmerica	2000	2a
AF520783	SouthKorea	Asia	2002	2a
AF264043	USA	NorthAmerica	2000	2a
AF201311	France	Europe	2000	2b
AY288134	China	Asia	2003	2b
KY126317	China	Asia	2016	2d
GU325760	China	Asia	2009	2d
GU325762	China	Asia	2009	2d
GU325763	China	Asia	2009	2d
KY126315	China	Asia	2015	2d
GU325769	China	Asia	2009	2d
KY126313	China	Asia	2016	2d
GU325767	China	Asia	2009	2d
GU325768	China	Asia	2009	2d
KY126312	China	Asia	2016	2d
GU325770	China	Asia	2009	2d
JX406425	China	Asia	2011	2d
MF679570	China	Asia	2015	2d
MF314274	Thailand	Asia	2013	2d
MF314298	Thailand	Asia	2014	2d
MF314309	Thailand	Asia	2015	2d
MF314299	Thailand	Asia	2014	2d
KT867935	USA	NorthAmerica	2013	2d
KT867936	USA	NorthAmerica	2013	2d
KT867937	USA	NorthAmerica	2013	2d
KT867938	USA	NorthAmerica	2013	2d

KT867939	USA	NorthAmerica	2013	2d
KT867940	USA	NorthAmerica	2013	2d
KT867941	USA	NorthAmerica	2013	2d
KT868036	USA	NorthAmerica	2014	2d
HM535640	China	Asia	2010	2d
HM755880	China	Asia	2010	2d
HM755881	China	Asia	2010	2d
KT359570	China	Asia	2013	2d
HM535641	China	Asia	2010	2d
MF169675	Taiwan	Asia	2016	2d
MF169680	Taiwan	Asia	2016	2d
MF169716	Taiwan	Asia	2017	2d
MF169710	Taiwan	Asia	2016	2d
MF169678	Taiwan	Asia	2016	2d
MF169679	Taiwan	Asia	2016	2d
MF169683	Taiwan	Asia	2016	2d
MF169684	Taiwan	Asia	2016	2d
KT868030	USA	NorthAmerica	2013	2d
KT868035	USA	NorthAmerica	2013	2d
KM191012	USA	NorthAmerica	2012	2d
KM191013	USA	NorthAmerica	2012	2d
KM191048	USA	NorthAmerica	2012	2d
KM191050	USA	NorthAmerica	2012	2d
KM191065	USA	NorthAmerica	2013	2d
KM191078	USA	NorthAmerica	2013	2d
KM191094	USA	NorthAmerica	2013	2d
KM191095	USA	NorthAmerica	2013	2d
KM191119	USA	NorthAmerica	2013	2d
KM191126	USA	NorthAmerica	2013	2d
KM191066	USA	NorthAmerica	2013	2d
KM191072	USA	NorthAmerica	2013	2d
KM191111	USA	NorthAmerica	2013	2d
KM191074	USA	NorthAmerica	2013	2d
KM191083	USA	NorthAmerica	2013	2d
KM191106	USA	NorthAmerica	2013	2d
KU697114	USA	NorthAmerica	2014	2d
KM191096	USA	NorthAmerica	2013	2d
KU697105	USA	NorthAmerica	2014	2d
KM191100	USA	NorthAmerica	2013	2d
KM191101	USA	NorthAmerica	2013	2d
KM191102	USA	NorthAmerica	2013	2d
KU697092	USA	NorthAmerica	2014	2d
KU697258	USA	NorthAmerica	2015	2d
KU697099	USA	NorthAmerica	2014	2d
KP243193	China	Asia	2014	2d
JN382188	Romania	Europe	2011	2d

KR559693	Italy	Europe	2012	2d
KR559696	Italy	Europe	2012	2d
KP245921	China	Asia	2012	2d
KR058352	China	Asia	2014	2d
KR058353	China	Asia	2014	2d
KR058358	China	Asia	2014	2d
KU697012	USA	NorthAmerica	2015	2d
KU697185	USA	NorthAmerica	2015	2d
KU697064	USA	NorthAmerica	2015	2d
KU697180	USA	NorthAmerica	2015	2d
KR058354	China	Asia	2014	2d
KR559686	Italy	Europe	2012	2d
KU697165	USA	NorthAmerica	2015	2d
KU697199	USA	NorthAmerica	2015	2d
KU697051	USA	NorthAmerica	2015	2d
KX510052	USA	NorthAmerica	2016	2d
KX510053	USA	NorthAmerica	2016	2d
KU697010	USA	NorthAmerica	2015	2d
GU574204	China	Asia	2009	2d
JF683392	Taiwan	Asia	2010	2d
JF927989	Taiwan	Asia	2010	2d
JN411094	China	Asia	2009	2d
KM190995	USA	NorthAmerica	2013	2d
KM190999	USA	NorthAmerica	2012	2d
KM191000	USA	NorthAmerica	2012	2d
KM191001	USA	NorthAmerica	2012	2d
KM191002	USA	NorthAmerica	2012	2d
KM191006	USA	NorthAmerica	2012	2d
KM191007	USA	NorthAmerica	2012	2d
KM191008	USA	NorthAmerica	2012	2d
KM191018	USA	NorthAmerica	2013	2d
KM191019	USA	NorthAmerica	2013	2d
KM191023	USA	NorthAmerica	2013	2d
KM191024	USA	NorthAmerica	2013	2d
KM191027	USA	NorthAmerica	2013	2d
KM191028	USA	NorthAmerica	2013	2d
KT867820	USA	NorthAmerica	2013	2d
KU697001	USA	NorthAmerica	2015	2d
KU697003	USA	NorthAmerica	2015	2d
KU697007	USA	NorthAmerica	2015	2d
KU697014	USA	NorthAmerica	2015	2d
KU697027	USA	NorthAmerica	2015	2d
KU697030	USA	NorthAmerica	2015	2d
KU697032	USA	NorthAmerica	2015	2d
KU697033	USA	NorthAmerica	2015	2d
KU697038	USA	NorthAmerica	2015	2d

KU697054	USA	NorthAmerica	2015	2d
KU697057	USA	NorthAmerica	2015	2d
KU697058	USA	NorthAmerica	2015	2d
KU697062	USA	NorthAmerica	2015	2d
KU697072	USA	NorthAmerica	2015	2d
KU697078	USA	NorthAmerica	2015	2d
KU697079	USA	NorthAmerica	2015	2d
KU697080	USA	NorthAmerica	2015	2d
KU697081	USA	NorthAmerica	2015	2d
KU697086	USA	NorthAmerica	2014	2d
KU697096	USA	NorthAmerica	2014	2d
KU697097	USA	NorthAmerica	2014	2d
KU697106	USA	NorthAmerica	2014	2d
KU697113	USA	NorthAmerica	2014	2d
KU697116	USA	NorthAmerica	2014	2d
KU697121	USA	NorthAmerica	2014	2d
KU697129	USA	NorthAmerica	2014	2d
KU697135	USA	NorthAmerica	2014	2d
KU697136	USA	NorthAmerica	2014	2d
KU697157	USA	NorthAmerica	2015	2d
KU697179	USA	NorthAmerica	2015	2d
KU697181	USA	NorthAmerica	2015	2d
KU697186	USA	NorthAmerica	2015	2d
KU697191	USA	NorthAmerica	2015	2d
KU697192	USA	NorthAmerica	2015	2d
KU697197	USA	NorthAmerica	2015	2d
KU697203	USA	NorthAmerica	2015	2d
KU697204	USA	NorthAmerica	2015	2d
KU697210	USA	NorthAmerica	2015	2d
KU697213	USA	NorthAmerica	2015	2d
KU697230	USA	NorthAmerica	2015	2d
KU697236	USA	NorthAmerica	2015	2d
KU697242	USA	NorthAmerica	2015	2d
KU697243	USA	NorthAmerica	2015	2d
KU697244	USA	NorthAmerica	2015	2d
KU697245	USA	NorthAmerica	2015	2d
KU697247	USA	NorthAmerica	2015	2d
KU697262	USA	NorthAmerica	2015	2d
KU697263	USA	NorthAmerica	2015	2d
KU697270	USA	NorthAmerica	2015	2d
KU697272	USA	NorthAmerica	2015	2d
KU697278	USA	NorthAmerica	2015	2d
KU697284	USA	NorthAmerica	2015	2d
KU697291	USA	NorthAmerica	2015	2d
KX098663	USA	NorthAmerica	2015	2d
KX098665	USA	NorthAmerica	2015	2d

KX098669	USA	NorthAmerica	2015	2d
KX098674	USA	NorthAmerica	2015	2d
KX098678	USA	NorthAmerica	2015	2d
KX098685	USA	NorthAmerica	2015	2d
KX098690	USA	NorthAmerica	2015	2d
KX098693	USA	NorthAmerica	2015	2d
KX098696	USA	NorthAmerica	2015	2d
KX098701	USA	NorthAmerica	2015	2d
KX098704	USA	NorthAmerica	2015	2d
KX098712	USA	NorthAmerica	2015	2d
KX098719	USA	NorthAmerica	2015	2d
KX098721	USA	NorthAmerica	2015	2d
KX098722	USA	NorthAmerica	2015	2d
KX098725	USA	NorthAmerica	2015	2d
KX098728	USA	NorthAmerica	2015	2d
KX098729	USA	NorthAmerica	2015	2d
KX098730	USA	NorthAmerica	2015	2d
KX098731	USA	NorthAmerica	2015	2d
KX098732	USA	NorthAmerica	2015	2d
KX098733	USA	NorthAmerica	2015	2d
KX098736	USA	NorthAmerica	2015	2d
KX098739	USA	NorthAmerica	2016	2d
KX098744	USA	NorthAmerica	2016	2d
KX098745	USA	NorthAmerica	2016	2d
KX098771	USA	NorthAmerica	2016	2d
KX098773	USA	NorthAmerica	2016	2d
KX098779	USA	NorthAmerica	2016	2d
KX510054	USA	NorthAmerica	2016	2d
KX510063	USA	NorthAmerica	2016	2d
KX510065	USA	NorthAmerica	2016	2d
KX510079	USA	NorthAmerica	2016	2d
KX510082	USA	NorthAmerica	2016	2d
KX510084	USA	NorthAmerica	2016	2d
KX808464	SouthKorea	Asia	2015	2d
KX808466	SouthKorea	Asia	2015	2d
KX808467	SouthKorea	Asia	2015	2d
LC310735	Japan	Asia	2016	2d
MF314301	Thailand	Asia	2014	2d
MF679588	China	Asia	2014	2d
KC238431	VietNam	Asia	2012	2d
KF035073	China	Asia	2012	2d
KM191034	USA	NorthAmerica	2013	2d
KU697023	USA	NorthAmerica	2015	2d
KU697110	USA	NorthAmerica	2014	2d
KT867821	USA	NorthAmerica	2013	2d
KT867822	USA	NorthAmerica	2013	2d

KU697041	USA	NorthAmerica	2015	2d
KU697070	USA	NorthAmerica	2015	2d
KU697137	USA	NorthAmerica	2014	2d
KX098708	USA	NorthAmerica	2015	2d
KU697158	USA	NorthAmerica	2015	2d
KU697189	USA	NorthAmerica	2015	2d
KU697190	USA	NorthAmerica	2015	2d
KU697214	USA	NorthAmerica	2015	2d
KU697235	USA	NorthAmerica	2015	2d
KU697271	USA	NorthAmerica	2015	2d
KU697279	USA	NorthAmerica	2015	2d
KX098697	USA	NorthAmerica	2015	2d
KX098772	USA	NorthAmerica	2016	2d
KX098778	USA	NorthAmerica	2016	2d
KX510066	USA	NorthAmerica	2016	2d
KX098727	USA	NorthAmerica	2015	2d
KX098749	USA	NorthAmerica	2016	2d
KX169318	China	Asia	2015	2d
KX169319	China	Asia	2015	2d
KX169323	China	Asia	2015	2d
KX510072	USA	NorthAmerica	2016	2d
MF679576	China	Asia	2015	2d
MF679577	China	Asia	2016	2d
MF679575	China	Asia	2014	2d
MF679599	China	Asia	2012	2d
KT867807	USA	NorthAmerica	2013	2d
KT867808	USA	NorthAmerica	2013	2d
KT867809	USA	NorthAmerica	2013	2d
KT867810	USA	NorthAmerica	2013	2d
KU697044	USA	NorthAmerica	2015	2d
KU697144	USA	NorthAmerica	2015	2d
KU697145	USA	NorthAmerica	2015	2d
KU697233	USA	NorthAmerica	2015	2d
KU697285	USA	NorthAmerica	2015	2d
KU697289	USA	NorthAmerica	2015	2d
KU697009	USA	NorthAmerica	2015	2d
KU697050	USA	NorthAmerica	2015	2d
KF035061	China	Asia	2011	2d
KT867805	USA	NorthAmerica	2014	2d
KT867811	USA	NorthAmerica	2015	2d
KT867817	USA	NorthAmerica	2014	2d
KU697017	USA	NorthAmerica	2015	2d
KU697020	USA	NorthAmerica	2015	2d
KU697026	USA	NorthAmerica	2015	2d
KU697035	USA	NorthAmerica	2015	2d
KU697069	USA	NorthAmerica	2015	2d

KU697075	USA	NorthAmerica	2015	2d
KU697115	USA	NorthAmerica	2014	2d
KU697149	USA	NorthAmerica	2015	2d
KU697161	USA	NorthAmerica	2015	2d
KU697167	USA	NorthAmerica	2015	2d
KU697168	USA	NorthAmerica	2015	2d
KU697177	USA	NorthAmerica	2015	2d
KU697184	USA	NorthAmerica	2015	2d
KU697207	USA	NorthAmerica	2015	2d
KU697217	USA	NorthAmerica	2015	2d
KU697225	USA	NorthAmerica	2015	2d
KX098667	USA	NorthAmerica	2015	2d
KX098679	USA	NorthAmerica	2015	2d
KX098709	USA	NorthAmerica	2015	2d
KX098737	USA	NorthAmerica	2016	2d
KX098746	USA	NorthAmerica	2016	2d
KX098747	USA	NorthAmerica	2016	2d
KX098765	USA	NorthAmerica	2016	2d
KX098774	USA	NorthAmerica	2016	2d
KX169337	China	Asia	2015	2d
KX510051	USA	NorthAmerica	2016	2d
KX510058	USA	NorthAmerica	2016	2d
KX510060	USA	NorthAmerica	2016	2d
KX510061	USA	NorthAmerica	2016	2d
KX510073	USA	NorthAmerica	2016	2d
KX808474	SouthKorea	Asia	2015	2d
KX808475	SouthKorea	Asia	2015	2d
MF314248	Thailand	Asia	2012	2d
MF314249	Thailand	Asia	2012	2d
MF314257	Thailand	Asia	2012	2d
MF314258	Thailand	Asia	2012	2d
MF314260	Thailand	Asia	2012	2d
MF314261	Thailand	Asia	2012	2d
MF314270	Thailand	Asia	2013	2d
MF314275	Thailand	Asia	2013	2d
MF314280	Thailand	Asia	2013	2d
MF314287	Thailand	Asia	2014	2d
MF314302	Thailand	Asia	2014	2d
MF314306	Thailand	Asia	2014	2d
MF314308	Thailand	Asia	2014	2d
MF679571	China	Asia	2015	2d
KU697166	USA	NorthAmerica	2015	2d
KX098743	USA	NorthAmerica	2016	2d
KX098775	USA	NorthAmerica	2016	2d
MF314259	Thailand	Asia	2012	2d
MF314276	Thailand	Asia	2013	2d

MF314282	Thailand	Asia	2013	2d
MF314283	Thailand	Asia	2013	2d
MG229679	China	Asia	2013	2d
KR058356	China	Asia	2014	2d
KU697015	USA	NorthAmerica	2015	2d
KU697016	USA	NorthAmerica	2015	2d
MF314290	Thailand	Asia	2014	2d
MF314291	Thailand	Asia	2014	2d
MF314292	Thailand	Asia	2014	2d
MF314303	Thailand	Asia	2014	2d
MF314310	Thailand	Asia	2015	2d
MF314311	Thailand	Asia	2015	2d
MF314315	Thailand	Asia	2015	2d
MF314316	Thailand	Asia	2015	2d
MF314319	Thailand	Asia	2015	2d
MF314320	Thailand	Asia	2015	2d
MF314321	Thailand	Asia	2015	2d
MF314322	Thailand	Asia	2015	2d
MF314323	Thailand	Asia	2015	2d
KU697232	USA	NorthAmerica	2015	2d
MF314246	Thailand	Asia	2012	2d
MF314247	Thailand	Asia	2012	2d
KX098763	USA	NorthAmerica	2016	2d
KX808468	SouthKorea	Asia	2015	2d
KX808469	SouthKorea	Asia	2015	2d
JN411099	China	Asia	2009	2d
MF679589	China	Asia	2015	2d
MG229678	China	Asia	2013	2d
LC310736	Japan	Asia	2016	2d
LC310737	Japan	Asia	2017	2d
MF314304	Thailand	Asia	2014	2d
MF314305	Thailand	Asia	2014	2d
KU697073	USA	NorthAmerica	2015	2d
KU697107	USA	NorthAmerica	2014	2d
MF679603	China	Asia	2017	2d
KU697018	USA	NorthAmerica	2015	2d
KU697056	USA	NorthAmerica	2015	2d
KU697220	USA	NorthAmerica	2015	2d
KU697221	USA	NorthAmerica	2015	2d
KX098677	USA	NorthAmerica	2015	2d
KX808477	SouthKorea	Asia	2015	2d
MG229681	China	Asia	2014	2d
KX098757	USA	NorthAmerica	2016	2d
KX098761	USA	NorthAmerica	2016	2d
KX808476	SouthKorea	Asia	2015	2d
MF679566	China	Asia	2017	2d

MF679567	China	Asia	2017	2d
MF679579	China	Asia	2015	2d
KP245919	China	Asia	2014	2d
KP245922	China	Asia	2012	2d
MF679553	China	Asia	2017	2d
MF679554	China	Asia	2016	2d
MF679555	China	Asia	2016	2d
MF679557	China	Asia	2016	2d
MF679560	China	Asia	2016	2d
MF679561	China	Asia	2016	2d
MF679562	China	Asia	2016	2d
MF679563	China	Asia	2017	2d
MF679565	China	Asia	2017	2d
MF679568	China	Asia	2015	2d
MF679569	China	Asia	2016	2d
MF679552	China	Asia	2017	2d
MF679572	China	Asia	2013	2d
MF679580	China	Asia	2016	2d
MF679559	China	Asia	2016	2d
KU697004	USA	NorthAmerica	2015	2d
KU697019	USA	NorthAmerica	2015	2d
KU697039	USA	NorthAmerica	2015	2d
KU697098	USA	NorthAmerica	2014	2d
KU697125	USA	NorthAmerica	2014	2d
KU697132	USA	NorthAmerica	2014	2d
KU697133	USA	NorthAmerica	2014	2d
KU697143	USA	NorthAmerica	2015	2d
KU697146	USA	NorthAmerica	2015	2d
KU697151	USA	NorthAmerica	2015	2d
KU697154	USA	NorthAmerica	2015	2d
KU697170	USA	NorthAmerica	2015	2d
KU697188	USA	NorthAmerica	2015	2d
KU697193	USA	NorthAmerica	2015	2d
KU697194	USA	NorthAmerica	2015	2d
KU697196	USA	NorthAmerica	2015	2d
KU697200	USA	NorthAmerica	2015	2d
KU697237	USA	NorthAmerica	2015	2d
KU697239	USA	NorthAmerica	2015	2d
KU697257	USA	NorthAmerica	2015	2d
KU697259	USA	NorthAmerica	2015	2d
KU697273	USA	NorthAmerica	2015	2d
KU697276	USA	NorthAmerica	2015	2d
KU697282	USA	NorthAmerica	2015	2d
KU697286	USA	NorthAmerica	2015	2d
KU697288	USA	NorthAmerica	2015	2d
KU697292	USA	NorthAmerica	2015	2d

KX098660	USA	NorthAmerica	2015	2d
KX098661	USA	NorthAmerica	2015	2d
KX098662	USA	NorthAmerica	2015	2d
KX098670	USA	NorthAmerica	2015	2d
KX098683	USA	NorthAmerica	2015	2d
KX098687	USA	NorthAmerica	2015	2d
KX098698	USA	NorthAmerica	2015	2d
KX098700	USA	NorthAmerica	2015	2d
KX098707	USA	NorthAmerica	2015	2d
KX098711	USA	NorthAmerica	2015	2d
KX098713	USA	NorthAmerica	2015	2d
KX098716	USA	NorthAmerica	2015	2d
KX098738	USA	NorthAmerica	2016	2d
KX098750	USA	NorthAmerica	2016	2d
KX098756	USA	NorthAmerica	2016	2d
KX098758	USA	NorthAmerica	2016	2d
KX098760	USA	NorthAmerica	2016	2d
KX098764	USA	NorthAmerica	2016	2d
KX098766	USA	NorthAmerica	2016	2d
KX098767	USA	NorthAmerica	2016	2d
KX098770	USA	NorthAmerica	2016	2d
KX510056	USA	NorthAmerica	2016	2d
KX510068	USA	NorthAmerica	2016	2d
KU697226	USA	NorthAmerica	2015	2d
KX098752	USA	NorthAmerica	2016	2d
KU697231	USA	NorthAmerica	2015	2d
KX098710	USA	NorthAmerica	2015	2d
KX098724	USA	NorthAmerica	2015	2d
KX098777	USA	NorthAmerica	2016	2d
KX098782	USA	NorthAmerica	2016	2d
KX169305	China	Asia	2015	2d
KX098769	USA	NorthAmerica	2016	2d
MF679581	China	Asia	2014	2d
MF169721	Taiwan	Asia	2014	2d
MF169727	Taiwan	Asia	2015	2d
MF169731	Taiwan	Asia	2015	2d
MF169732	Taiwan	Asia	2015	2d
MF169760	Taiwan	Asia	2015	2d
MF169726	Taiwan	Asia	2015	2d
MF169724	Taiwan	Asia	2014	2d
MF169725	Taiwan	Asia	2014	2d
KT867806	USA	NorthAmerica	2013	2d
KU697173	USA	NorthAmerica	2015	2d
JN411100	China	Asia	2009	2d
KU697047	USA	NorthAmerica	2015	2d
KU697090	USA	NorthAmerica	2014	2d

KX169320	China	Asia	2015	2d
KX169331	China	Asia	2015	2d
KX169336	China	Asia	2015	2d
MF169674	Taiwan	Asia	2016	2d
GQ845025	China	Asia	2009	2d
JF683394	Taiwan	Asia	2010	2d
KU697128	USA	NorthAmerica	2014	2d
KU697202	USA	NorthAmerica	2015	2d
KX098720	USA	NorthAmerica	2015	2d
KX098723	USA	NorthAmerica	2015	2d
KU697008	USA	NorthAmerica	2015	2d
KU697048	USA	NorthAmerica	2015	2d
KU697277	USA	NorthAmerica	2015	2d
KU697053	USA	NorthAmerica	2015	2d
KX098684	USA	NorthAmerica	2015	2d
KU697094	USA	NorthAmerica	2014	2d
KU697238	USA	NorthAmerica	2015	2d
KU697006	USA	NorthAmerica	2015	2d
KX098705	USA	NorthAmerica	2015	2d
KX098714	USA	NorthAmerica	2015	2d
KU697162	USA	NorthAmerica	2015	2d
KU697182	USA	NorthAmerica	2015	2d
KU697216	USA	NorthAmerica	2015	2d
KU697171	USA	NorthAmerica	2015	2d
KT867823	USA	NorthAmerica	2015	2d
KT867824	USA	NorthAmerica	2015	2d
KT867825	USA	NorthAmerica	2015	2d
KT867826	USA	NorthAmerica	2015	2d
KT867827	USA	NorthAmerica	2015	2d
KT867828	USA	NorthAmerica	2015	2d
KT867829	USA	NorthAmerica	2015	2d
KU697164	USA	NorthAmerica	2015	2d
KU697169	USA	NorthAmerica	2015	2d
KU697036	USA	NorthAmerica	2015	2d
KX098666	USA	NorthAmerica	2015	2d
KM191087	USA	NorthAmerica	2013	2d
KU697061	USA	NorthAmerica	2015	2d
KU697063	USA	NorthAmerica	2015	2d
KU697159	USA	NorthAmerica	2015	2d
MF314271	Thailand	Asia	2013	2d
KU697160	USA	NorthAmerica	2015	2d
KU697175	USA	NorthAmerica	2015	2d
KU697211	USA	NorthAmerica	2015	2d
KX098699	USA	NorthAmerica	2015	2d
JN411095	China	Asia	2011	2d
JN411096	China	Asia	2009	2d

KT867812	USA	NorthAmerica	2012	2d
KT867818	USA	NorthAmerica	2012	2d
KT867819	USA	NorthAmerica	2012	2d
KT867814	USA	NorthAmerica	2014	2d
KT867815	USA	NorthAmerica	2014	2d
KT867830	USA	NorthAmerica	2015	2d
KT867832	USA	NorthAmerica	2015	2d
KT867833	USA	NorthAmerica	2015	2d
KT867834	USA	NorthAmerica	2015	2d
KT867831	USA	NorthAmerica	2015	2d
KT867804	USA	NorthAmerica	2014	2d
KT867813	USA	NorthAmerica	2012	2d
KU697077	USA	NorthAmerica	2015	2d
KX169335	China	Asia	2015	2d
MF314326	Thailand	Asia	2015	2d
MF314327	Thailand	Asia	2015	2d
MF314328	Thailand	Asia	2015	2d
MF314329	Thailand	Asia	2015	2d
MF314330	Thailand	Asia	2015	2d
KU697066	USA	NorthAmerica	2015	2d
LC310733	Japan	Asia	2016	2d
KF035070	China	Asia	2012	2d
KP245925	China	Asia	2013	2d
GQ845028	China	Asia	2009	2d
JF927988	Taiwan	Asia	2010	2d
KX169317	China	Asia	2015	2d
KX169325	China	Asia	2015	2d
KR058359	China	Asia	2015	2d
KX510078	USA	NorthAmerica	2016	2d
KU697261	USA	NorthAmerica	2015	2d
KX098659	USA	NorthAmerica	2015	2d
KX098780	USA	NorthAmerica	2016	2d
KX510069	USA	NorthAmerica	2016	2d
KX098735	USA	NorthAmerica	2015	2d
KP245918	China	Asia	2014	2d
MG229677	China	Asia	2012	2d
MG229675	China	Asia	2013	2d
KU697205	USA	NorthAmerica	2015	2d
KU697218	USA	NorthAmerica	2015	2d
KX098759	USA	NorthAmerica	2016	2d
MF314250	Thailand	Asia	2012	2d
KF035068	China	Asia	2012	2d
MF314317	Thailand	Asia	2015	2d
MF314324	Thailand	Asia	2015	2d
MF314325	Thailand	Asia	2015	2d
MF314318	Thailand	Asia	2015	2d

KF035066	China	Asia	2012	2d
KU697156	USA	NorthAmerica	2015	2d
JF683389	Taiwan	Asia	2011	2d
JF683399	Taiwan	Asia	2010	2d
JF683401	Taiwan	Asia	2008	2d
JF683404	Taiwan	Asia	2009	2d
MF169733	Taiwan	Asia	2013	2d
MF169734	Taiwan	Asia	2013	2d
MF169735	Taiwan	Asia	2013	2d
JF927986	Taiwan	Asia	2010	2d
MF169730	Taiwan	Asia	2014	2d
JF683405	Taiwan	Asia	2010	2d
MF169673	Taiwan	Asia	2016	2d
JF927985	Taiwan	Asia	2010	2d
KY806070	UnitedKingdom	Europe	2013	2d
KY806071	UnitedKingdom	Europe	2014	2d
MF169660	Taiwan	Asia	2016	2d
MF169661	Taiwan	Asia	2016	2d
MF169662	Taiwan	Asia	2016	2d
MF169663	Taiwan	Asia	2016	2d
MF169667	Taiwan	Asia	2016	2d
MF169668	Taiwan	Asia	2016	2d
MF169681	Taiwan	Asia	2016	2d
MF169689	Taiwan	Asia	2016	2d
MF169693	Taiwan	Asia	2016	2d
MF169694	Taiwan	Asia	2016	2d
MF169699	Taiwan	Asia	2016	2d
MF169705	Taiwan	Asia	2016	2d
MF169706	Taiwan	Asia	2016	2d
MF169712	Taiwan	Asia	2016	2d
MF169718	Taiwan	Asia	2017	2d
MF169719	Taiwan	Asia	2017	2d
MF169722	Taiwan	Asia	2014	2d
MF169744	Taiwan	Asia	2012	2d
MF169748	Taiwan	Asia	2013	2d
MF169752	Taiwan	Asia	2014	2d
MF169666	Taiwan	Asia	2016	2d
MF169671	Taiwan	Asia	2016	2d
MF169676	Taiwan	Asia	2016	2d
MF169750	Taiwan	Asia	2014	2d
MF169753	Taiwan	Asia	2014	2d
MF169698	Taiwan	Asia	2016	2d
MF169702	Taiwan	Asia	2016	2d
MF169708	Taiwan	Asia	2016	2d
MF169745	Taiwan	Asia	2012	2d
MF169747	Taiwan	Asia	2013	2d

MF169690	Taiwan	Asia	2016	2d
MF169691	Taiwan	Asia	2016	2d
MF169709	Taiwan	Asia	2016	2d
MF169738	Taiwan	Asia	2012	2d
MF169739	Taiwan	Asia	2012	2d
MF169746	Taiwan	Asia	2013	2d
MF169707	Taiwan	Asia	2016	2d
MF169715	Taiwan	Asia	2017	2d
MF169717	Taiwan	Asia	2017	2d
MF169696	Taiwan	Asia	2016	2d
MF169697	Taiwan	Asia	2016	2d
MF169749	Taiwan	Asia	2014	2d
MF169714	Taiwan	Asia	2017	2d
MF169743	Taiwan	Asia	2012	2d
MF169672	Taiwan	Asia	2016	2d
MF169686	Taiwan	Asia	2016	2d
MF169688	Taiwan	Asia	2016	2d
MF169741	Taiwan	Asia	2014	2d
MF169742	Taiwan	Asia	2012	2d
MF169664	Taiwan	Asia	2016	2d
MF169669	Taiwan	Asia	2016	2d
MF169685	Taiwan	Asia	2016	2d
MF169687	Taiwan	Asia	2016	2d
MF169711	Taiwan	Asia	2016	2d
JF927984	Taiwan	Asia	2010	2d
MF169692	Taiwan	Asia	2016	2d
KX510055	USA	NorthAmerica	2016	2d
KX169316	China	Asia	2015	2d
KC238435	VietNam	Asia	2012	2d
MF169665	Taiwan	Asia	2016	2d
MF169701	Taiwan	Asia	2016	2d
MF169670	Taiwan	Asia	2016	2d
MF169713	Taiwan	Asia	2017	2d
MF169751	Taiwan	Asia	2015	2d
MF169682	Taiwan	Asia	2016	2d
MF169695	Taiwan	Asia	2016	2d
MF169759	Taiwan	Asia	2014	2d
MF169700	Taiwan	Asia	2016	2d
MF169704	Taiwan	Asia	2016	2d
KF035060	China	Asia	2012	2d
MF314215	Thailand	Asia	2010	2d
MF314225	Thailand	Asia	2011	2d
MF314245	Thailand	Asia	2012	2d
MF314273	Thailand	Asia	2013	2d
MF314296	Thailand	Asia	2014	2d
MF314297	Thailand	Asia	2014	2d

MF314312	Thailand	Asia	2015	2d
MF314277	Thailand	Asia	2013	2d
MF314279	Thailand	Asia	2013	2d
MF314313	Thailand	Asia	2015	2d
MF314314	Thailand	Asia	2015	2d
MF314307	Thailand	Asia	2014	2d
MF314253	Thailand	Asia	2012	2d
MF314254	Thailand	Asia	2012	2d
MF314255	Thailand	Asia	2012	2d
MF314256	Thailand	Asia	2012	2d
MF314278	Thailand	Asia	2013	2d
MF314295	Thailand	Asia	2014	2d
MF314284	Thailand	Asia	2013	2d
MF314285	Thailand	Asia	2013	2d
MF314294	Thailand	Asia	2014	2d
KU697037	USA	NorthAmerica	2015	2d
KX098681	USA	NorthAmerica	2015	2d
KX169321	China	Asia	2015	2d
KX169326	China	Asia	2015	2d
MF679548	China	Asia	2011	2d
MF679598	China	Asia	2013	2d
MF679600	China	Asia	2012	2d
KX808465	SouthKorea	Asia	2015	2d
KU697283	USA	NorthAmerica	2015	2d
KX098676	USA	NorthAmerica	2015	2d
KT867816	USA	NorthAmerica	2014	2d
MF169703	Taiwan	Asia	2016	2d
LC310738	Japan	Asia	2017	2d
HQ378157	Serbia	Europe	2010	2d
JX948769	China	Asia	2010	2d
KY810323	SouthKorea	Asia	2016	2d
KC527542	China	Asia	2013	2d
KU317485	China	Asia	2015	2d
KY810325	SouthKorea	Asia	2016	2d
MG715490	SouthKorea	Asia	2016	2d
MG715494	SouthKorea	Asia	2017	2d
MG715495	SouthKorea	Asia	2017	2d
MG715497	SouthKorea	Asia	2017	2d
MG715496	SouthKorea	Asia	2017	2d
MG715493	SouthKorea	Asia	2017	2d
MG715498	SouthKorea	Asia	2017	2d
MG715499	SouthKorea	Asia	2017	2d
MG715492	SouthKorea	Asia	2016	2d
KC514990	China	Asia	2012	2d
KC515008	China	Asia	2012	2d
KC515016	China	Asia	2012	2d

KP231162	Italy	Europe	2012	2d
KP231117	Italy	Europe	2012	2d
KU311017	China	Asia	2013	2d
KU317478	China	Asia	2015	2d
KU960929	China	Asia	2014	2d
MF589529	China	Asia	2016	2d
KC515023	China	Asia	2012	2d
KC515000	China	Asia	2012	2d
KX828230	SouthKorea	Asia	2016	2d
KX161666	China	Asia	2010	2d
KX161667	China	Asia	2010	2d
MF981846	China	Asia	2014	2d
KC515011	China	Asia	2012	2d
KU960935	China	Asia	2013	2d
KC515021	China	Asia	2012	2d
KC515009	China	Asia	2012	2d
KM272211	China	Asia	2014	2d
KM360054	China	Asia	2013	2d
FJ426398	China	Asia	2007	2d
KX828221	SouthKorea	Asia	2012	2d
KX828225	SouthKorea	Asia	2014	2d
FJ644929	China	Asia	2008	2d
GU001710	China	Asia	2009	2d
JX535296	USA	NorthAmerica	2012	2d
JX535297	USA	NorthAmerica	2012	2d
KC473167	China	Asia	2008	2d
KJ680359	China	Asia	2011	2d
KX828241	SouthKorea	Asia	2016	2d
KX828581	China	Asia	2010	2d
KX960936	China	Asia	2012	2d
JF928002	China	Asia	2011	2d
JX948778	China	Asia	2011	2d
JX948781	China	Asia	2010	2d
KC514986	China	Asia	2011	2d
KC515020	China	Asia	2012	2d
KP231167	Italy	Europe	2011	2d
KP824710	China	Asia	2014	2d
KX828238	SouthKorea	Asia	2016	2d
KX828239	SouthKorea	Asia	2016	2d
KJ680368	China	Asia	2012	2d
KJ680369	China	Asia	2012	2d
KJ680367	China	Asia	2012	2d
KC153106	China	Asia	2012	2d
KC515022	China	Asia	2012	2d
HM776439	China	Asia	2008	2d
HM776440	China	Asia	2008	2d

KP698394	Germany	Europe	2013	2d
HQ650833	China	Asia	2010	2d
KU311015	China	Asia	2013	2d
JN119255	China	Asia	2011	2d
KC514987	China	Asia	2012	2d
KM503044	China	Asia	2014	2d
KY677757	SouthKorea	Asia	2016	2d
KC514988	China	Asia	2012	2d
KC753772	China	Asia	2012	2d
KU311021	China	Asia	2014	2d
KX668491	China	Asia	2015	2d
KY677756	SouthKorea	Asia	2016	2d
KC514965	China	Asia	2011	2d
KC447454	China	Asia	2010	2d
KC788504	China	Asia	2012	2d
KC515019	China	Asia	2012	2d
KX247794	China	Asia	2015	2d
GQ359002	China	Asia	2008	2d
GU083583	China	Asia	2009	2d
HM776449	China	Asia	2009	2d
KJ729075	India	Asia	2013	2d
KP698396	Germany	Europe	2013	2d
KP698397	Germany	Europe	2013	2d
KU311034	China	Asia	2014	2d
HM038017	China	Asia	2008	2d
JF899334	China	Asia	2011	2d
JX948777	China	Asia	2011	2d
KJ680354	China	Asia	2012	2d
KX828240	SouthKorea	Asia	2016	2d
KX960933	China	Asia	2012	2d
KX960935	China	Asia	2012	2d
HM776453	China	Asia	2008	2d
KC473166	China	Asia	2008	2d
FJ870972	China	Asia	2008	2d
KC473168	China	Asia	2009	2d
KX828228	SouthKorea	Asia	2016	2d
KY810324	SouthKorea	Asia	2016	2d
KC514968	China	Asia	2011	2d
KC514974	China	Asia	2011	2d
KC753769	China	Asia	2012	2d
KU311029	China	Asia	2014	2d
KU311019	China	Asia	2013	2d
KU317479	China	Asia	2015	2d
KU317484	China	Asia	2015	2d
KU317487	China	Asia	2015	2d
KU317496	China	Asia	2015	2d

KU317477	China	Asia	2015	2d
KC800644	China	Asia	2012	2d
KJ680361	China	Asia	2011	2d
KX867819	China	Asia	2016	2d
HM776441	China	Asia	2009	2d
JQ413808	China	Asia	2011	2d
KC336418	China	Asia	2010	2d
KC753771	China	Asia	2012	2d
KP698398	Germany	Europe	2013	2d
KP698401	Germany	Europe	2014	2d
KC753770	China	Asia	2012	2d
KX247783	China	Asia	2014	2d
KX247792	China	Asia	2013	2d
KJ680341	China	Asia	2011	2d
KJ680344	China	Asia	2011	2d
KJ680351	China	Asia	2011	2d
JX948783	China	Asia	2011	2d
JX982221	China	Asia	2011	2d
FJ712215	China	Asia	2007	2d
JX912914	China	Asia	2011	2d
KX828236	SouthKorea	Asia	2016	2d
KC514970	China	Asia	2011	2d
JN119257	China	Asia	2011	2d
JX982222	China	Asia	2011	2d
KF027494	China	Asia	2012	2d
KP670418	China	Asia	2014	2d
HM776437	China	Asia	2009	2d
KU311030	China	Asia	2014	2d
MF589533	China	Asia	2014	2d
KU311025	China	Asia	2014	2d
KU317481	China	Asia	2015	2d
KY659553	China	Asia	2016	2d
HQ693093	China	Asia	2010	2d
KY659554	China	Asia	2016	2d
KX668492	China	Asia	2015	2d
KY659552	China	Asia	2016	2d
JX682407	China	Asia	2011	2d
KX960928	China	Asia	2011	2d
KX856425	China	Asia	2010	2d
KC249977	China	Asia	2009	2d
KX161676	China	Asia	2010	2d
KM460824	China	Asia	2013	2d
KX161677	China	Asia	2010	2d
KX247806	China	Asia	2013	2d
KJ680347	China	Asia	2011	2d
JX948775	China	Asia	2011	2d

JX948786	China	Asia	2011	2d
KC514985	China	Asia	2011	2d
KF742551	China	Asia	2012	2d
KC515015	China	Asia	2012	2d
KJ680370	China	Asia	2011	2d
JX982227	China	Asia	2011	2d
KC514971	China	Asia	2011	2d
KC753768	China	Asia	2012	2d
KU311028	China	Asia	2014	2d
KU311033	China	Asia	2014	2d
KF027496	China	Asia	2012	2d
FJ870970	China	Asia	2008	2d
KT819169	Brazil	SouthAmerica	2014	2d
KX161688	China	Asia	2010	2d
KX161689	China	Asia	2010	2d
KY305203	China	Asia	2016	2d
KY305204	China	Asia	2016	2d
KY646109	China	Asia	2015	2d
KJ437506	SouthKorea	Asia	2014	2d
KX247818	China	Asia	2015	2d
KX828227	SouthKorea	Asia	2015	2d
KM360051	China	Asia	2013	2d
KJ680363	China	Asia	2012	2d
FJ712216	China	Asia	2007	2d
KP231168	Italy	Europe	2014	2d
KU311016	China	Asia	2013	2d
KU311018	China	Asia	2013	2d
KU317488	China	Asia	2015	2d
JX982224	China	Asia	2011	2d
KC823055	China	Asia	2012	2d
KC823054	China	Asia	2012	2d
GU252370	China	Asia	2007	2d
KP670421	China	Asia	2013	2d
KC514984	China	Asia	2011	2d
KJ680358	China	Asia	2012	2d
KJ680364	China	Asia	2012	2d
KC515027	China	Asia	2012	2d
KX844824	China	Asia	2015	2d
KX867818	China	Asia	2016	2d
KP698399	Germany	Europe	2013	2d
KP698400	Germany	Europe	2013	2d
KC515005	China	Asia	2012	2d
KC515007	China	Asia	2012	2d
GU450329	China	Asia	2009	2d
GQ359005	China	Asia	2008	2d
KC514994	China	Asia	2012	2d

KM624033	China	Asia	2011	2d
KX960929	China	Asia	2011	2d
KY810320	SouthKorea	Asia	2016	2d
MF589540	China	Asia	2014	2d
JF272498	China	Asia	2009	2d
KF742548	China	Asia	2009	2d
KM624039	China	Asia	2014	2d
KX247828	China	Asia	2014	2d
JX406420	China	Asia	2011	2d
KC515028	China	Asia	2012	2d
KR258797	China	Asia	2015	2d
KT200363	China	Asia	2014	2d
KU311014	China	Asia	2013	2d
KU317474	China	Asia	2015	2d
KU960933	China	Asia	2015	2d
KX960920	China	Asia	2010	2d
KX960926	China	Asia	2011	2d
KX960932	China	Asia	2012	2d
KX960934	China	Asia	2012	2d
MF679596	China	Asia	2017	2d
MF679597	China	Asia	2016	2d
JX982228	China	Asia	2010	2d
KX960925	China	Asia	2011	2d
MF589539	China	Asia	2014	2d
KC515010	China	Asia	2012	2d
KX960943	China	Asia	2013	2d
KX960949	China	Asia	2013	2d
KC821781	China	Asia	2013	2d
KC821783	China	Asia	2013	2d
KC821784	China	Asia	2013	2d
KC821785	China	Asia	2013	2d
MF589537	China	Asia	2016	2d
KF530836	China	Asia	2012	2d
KM035760	China	Asia	2014	2d
KX960922	China	Asia	2011	2d
MF679591	China	Asia	2017	2d
MF679593	China	Asia	2016	2d
KT265712	China	Asia	2013	2d
KX960923	China	Asia	2010	2d
MF981845	China	Asia	2014	2d
KX855982	China	Asia	2016	2d
KC514992	China	Asia	2012	2d
KC515029	China	Asia	2012	2d
KC515018	China	Asia	2012	2d
KC515017	China	Asia	2012	2d
KX161668	China	Asia	2012	2d

KX161684	China	Asia	2013	2d
KX161687	China	Asia	2011	2d
KF530837	China	Asia	2012	2d
KJ133547	SouthKorea	Asia	2013	2d
KU960936	China	Asia	2014	2d
KX960916	China	Asia	2010	2d
MF679594	China	Asia	2016	2d
MF679590	China	Asia	2016	2d
JX948771	China	Asia	2011	2d
MF679595	China	Asia	2016	2d
JX948776	China	Asia	2011	2d
JX948782	China	Asia	2011	2d
KC823059	China	Asia	2011	2d
KM272212	China	Asia	2014	2d
KU960932	China	Asia	2014	2d
KJ680348	China	Asia	2011	2d
KJ680350	China	Asia	2011	2d
KM487708	China	Asia	2013	2d
KM487709	China	Asia	2013	2d
JX406422	China	Asia	2011	2d
JX948785	China	Asia	2011	2d
KC514993	China	Asia	2012	2d
KC515013	China	Asia	2012	2d
KX161678	China	Asia	2008	2d
KX161694	China	Asia	2007	2d
KX161695	China	Asia	2007	2d
KX161685	China	Asia	2013	2d
KX161696	China	Asia	2008	2d
HM776447	China	Asia	2009	2d
KP698395	Germany	Europe	2013	2d
KX981603	China	Asia	2016	2d
KC514966	China	Asia	2011	2d
KC514981	China	Asia	2011	2d
FJ870973	China	Asia	2008	2d
KX828224	SouthKorea	Asia	2012	2d
KJ680346	China	Asia	2012	2d
JN615187	China	Asia	2011	2d
KC514975	China	Asia	2011	2d
KU317495	China	Asia	2015	2d
KX831483	China	Asia	2015	2d
KM624035	China	Asia	2009	2d
KX668489	China	Asia	2016	2d
KC514983	China	Asia	2011	2d
KC514995	China	Asia	2012	2d
KJ680342	China	Asia	2007	2d
KJ680353	China	Asia	2011	2d

KU317499	China	Asia	2015	2d
KJ187306	Brazil	SouthAmerica	2013	2d
KU317497	China	Asia	2015	2d
KU317498	China	Asia	2015	2d
KF742552	China	Asia	2013	2d
KJ680343	China	Asia	2010	2d
KJ680352	China	Asia	2011	2d
KJ680340	China	Asia	2011	2d
KU311024	China	Asia	2014	2d
KJ680345	China	Asia	2008	2d
KX247826	China	Asia	2015	2d
KP231166	Italy	Europe	2010	2d
KP231169	Italy	Europe	2011	2d
KP231170	Italy	Europe	2011	2d
KP231171	Italy	Europe	2011	2d
KJ680349	China	Asia	2009	2d
MF589541	China	Asia	2015	2d
GQ359009	China	Asia	2008	2d
GQ359010	China	Asia	2008	2d
KF742547	China	Asia	2013	2d
KX828229	SouthKorea	Asia	2016	2d
KC860786	China	Asia	2012	2d
KU960937	China	Asia	2015	2d
JX406421	China	Asia	2011	2d
KC533811	China	Asia	2012	2d
KC533812	China	Asia	2011	2d
KJ596438	China	Asia	2013	2d
KJ867553	China	Asia	2013	2d
KJ867554	China	Asia	2013	2d
KJ867555	China	Asia	2013	2d
KM235961	China	Asia	2014	2d
KU311010	China	Asia	2013	2d
KU311011	China	Asia	2013	2d
KU311012	China	Asia	2013	2d
KU311013	China	Asia	2013	2d
KU317472	China	Asia	2014	2d
KJ867556	China	Asia	2013	2d
JX912915	China	Asia	2011	2d
KC821782	China	Asia	2013	2d
KM880084	China	Asia	2013	2d
KM880085	China	Asia	2014	2d
KM880086	China	Asia	2014	2d
KT336605	VietNam	Asia	2014	2d
KT336607	VietNam	Asia	2014	2d
KT336606	VietNam	Asia	2014	2d
KX828231	SouthKorea	Asia	2016	2d

KM434195	China	Asia	2013	2d
KC800641	China	Asia	2011	2d
KC800642	China	Asia	2011	2d
KC800643	China	Asia	2011	2d
MF326354	China	Asia	2016	2d
MF326356	China	Asia	2016	2d
MF326371	China	Asia	2016	2d
MF326367	China	Asia	2016	2d
MF326358	China	Asia	2016	2d
MF326357	China	Asia	2016	2d
MF326360	China	Asia	2016	2d
MF326373	China	Asia	2016	2d
MF326359	China	Asia	2016	2d
MF326361	China	Asia	2016	2d
MF326353	China	Asia	2016	2d
KC800645	China	Asia	2011	2d
KT336608	VietNam	Asia	2014	2d
GQ915288	China	Asia	2009	2d
KM624036	China	Asia	2010	2d
KM624037	China	Asia	2011	2d
KX247825	China	Asia	2015	2d
KX247833	China	Asia	2015	2d
KX247840	China	Asia	2015	2d
KX844825	China	Asia	2015	2d
HM038030	China	Asia	2008	2d
HM038031	China	Asia	2007	2d
GQ359011	China	Asia	2008	2d
KJ680362	China	Asia	2011	2d
KX960924	China	Asia	2011	2d
FJ644931	China	Asia	2008	2d
KX247788	China	Asia	2013	2d
KX247801	China	Asia	2014	2d
KY305199	China	Asia	2015	2d
KY305200	China	Asia	2015	2d
KX247787	China	Asia	2013	2d
KT220420	China	Asia	2014	2d
KU960930	China	Asia	2014	2d
KU960941	China	Asia	2015	2d
KY569375	China	Asia	2016	2d
KY569376	China	Asia	2015	2d
KY569380	China	Asia	2015	2d
KY569381	China	Asia	2015	2d
KY613026	China	Asia	2016	2d
KY652745	China	Asia	2016	2d
KY569382	China	Asia	2015	2d
KY613027	China	Asia	2016	2d

KY652746	China	Asia	2016	2d
KY613029	China	Asia	2016	2d
KY613032	China	Asia	2016	2d
KY569383	China	Asia	2015	2d
KY613028	China	Asia	2016	2d
KY613030	China	Asia	2016	2d
KY569379	China	Asia	2015	2d
KY613025	China	Asia	2016	2d
KY613031	China	Asia	2016	2d
KY569378	China	Asia	2015	2d
KY652744	China	Asia	2016	2d
KY569377	China	Asia	2015	2d
KP670419	China	Asia	2014	2d
KT200371	China	Asia	2014	2d
KX981604	China	Asia	2016	2d
JX948770	China	Asia	2011	2d
KM360055	China	Asia	2013	2d
KC800638	China	Asia	2012	2d
JX406419	China	Asia	2011	2d
JX982219	China	Asia	2011	2d
KX960921	China	Asia	2010	2d
KT200365	China	Asia	2014	2d
KT200366	China	Asia	2014	2d
KX828226	SouthKorea	Asia	2015	2d
KT200364	China	Asia	2014	2d
KX828237	SouthKorea	Asia	2016	2d
KC515006	China	Asia	2012	2d
KX828223	SouthKorea	Asia	2012	2d
KM360049	China	Asia	2013	2d
FJ598045	China	Asia	2008	2d
FJ870971	China	Asia	2008	2d
KC515004	China	Asia	2012	2d
JQ002671	China	Asia	2011	2d
KC514982	China	Asia	2011	2d
KC515001	China	Asia	2012	2d
JQ181600	VietNam	Asia	2011	2d
KT336598	VietNam	Asia	2014	2d
KT336600	VietNam	Asia	2014	2d
KT336601	VietNam	Asia	2014	2d
KT200368	China	Asia	2014	2d
KT336599	VietNam	Asia	2014	2d
KX247809	China	Asia	2013	2d
KF027493	China	Asia	2012	2d
KX247790	China	Asia	2015	2d
KX247823	China	Asia	2014	2d
KU311022	China	Asia	2014	2d

KU311023	China	Asia	2014	2d
KU317493	China	Asia	2015	2d
KJ680356	China	Asia	2010	2d
KX844823	China	Asia	2016	2d
KY652747	China	Asia	2016	2d
KX247795	China	Asia	2015	2d
KX247816	China	Asia	2015	2d
JX982220	China	Asia	2011	2d
KC515026	China	Asia	2012	2d
KU311031	China	Asia	2014	2d
KU311035	China	Asia	2014	2d
KU317483	China	Asia	2015	2d
KU317494	China	Asia	2015	2d
KP824725	China	Asia	2014	2d
KJ680355	China	Asia	2010	2d
KC800637	China	Asia	2011	2d
KC800640	China	Asia	2011	2d
KX247805	China	Asia	2014	2d
KX960937	China	Asia	2012	2d
KX247785	China	Asia	2013	2d
KX247791	China	Asia	2014	2d
KX247817	China	Asia	2015	2d
KX247822	China	Asia	2015	2d
KX960919	China	Asia	2010	2d
KX247786	China	Asia	2014	2d
KX247830	China	Asia	2014	2d
KX247797	China	Asia	2015	2d
KX247789	China	Asia	2015	2d
KX247829	China	Asia	2014	2d
KX247812	China	Asia	2015	2d
KX247819	China	Asia	2014	2d
KX247831	China	Asia	2014	2d
KX247798	China	Asia	2013	2d
KX247824	China	Asia	2015	2d
KX247800	China	Asia	2015	2d
KX247796	China	Asia	2015	2d
KX247808	China	Asia	2015	2d
KX247813	China	Asia	2015	2d
KX247811	China	Asia	2015	2d
KX247807	China	Asia	2015	2d
KX247815	China	Asia	2014	2d
KX247827	China	Asia	2014	2d
KX247803	China	Asia	2015	2d
KX247832	China	Asia	2015	2d
KX247834	China	Asia	2015	2d
KX247836	China	Asia	2015	2d

KX247838	China	Asia	2015	2d
KX247841	China	Asia	2015	2d
KX247837	China	Asia	2015	2d
KX247839	China	Asia	2014	2d
KX247835	China	Asia	2013	2d
KX828233	SouthKorea	Asia	2016	2d
KX828234	SouthKorea	Asia	2016	2d
KY305198	China	Asia	2014	2d
KP313253	China	Asia	2014	2d
KT819170	Brazil	SouthAmerica	2014	2d
KX247821	China	Asia	2015	2d
KX247799	China	Asia	2014	2d
KX247810	China	Asia	2013	2d
KX247820	China	Asia	2013	2d
KU960940	China	Asia	2015	2d
KX247804	China	Asia	2015	2d
KX668490	China	Asia	2015	2d
KP313251	China	Asia	2014	2d
MF326368	China	Asia	2016	2d
MF326370	China	Asia	2016	2d
MF326364	China	Asia	2016	2d
KC823056	China	Asia	2012	2d
KC823057	China	Asia	2012	2d
MF326362	China	Asia	2016	2d
KF850459	China	Asia	2010	2d
KF850469	China	Asia	2009	2d
KF850462	China	Asia	2010	2d
KF850464	China	Asia	2011	2d
JF317586	SouthKorea	Asia	2010	2d
HQ378158	Serbia	Europe	2010	2d
KF742542	China	Asia	2007	2d
KF742543	China	Asia	2007	2d
KX161675	China	Asia	2007	2d
KX009482	India	Asia	2015	2d
JF928004	China	Asia	2011	2d
JF928006	China	Asia	2011	2d
FJ644927	China	Asia	2008	2d
KP231157	Italy	Europe	2010	2d
KP231160	Italy	Europe	2010	2d
KC514977	China	Asia	2011	2d
KP081539	China	Asia	2013	2d
KP081540	China	Asia	2013	2d
KC514978	China	Asia	2011	2b
MF326363	China	Asia	2016	2b
MF326366	China	Asia	2016	2b
KM360053	China	Asia	2013	2b

KX865092	China	Asia	2015	2b
KP231140	Italy	Europe	2013	2d
KP231173	Italy	Europe	2013	2d
KP313254	China	Asia	2014	2d
KU960939	China	Asia	2015	2d
KX247784	China	Asia	2015	2d
KX247814	China	Asia	2015	2d
KX247793	China	Asia	2014	2d
KC800639	China	Asia	2011	2d
JF827599	China	Asia	2010	2d
JX406423	China	Asia	2011	2d
KX865094	China	Asia	2016	2d
KX247802	China	Asia	2014	2d
JX982226	China	Asia	2010	2d
KC515014	China	Asia	2012	2d
MG245867	China	Asia	2016	2d
MG870195	China	Asia	2016	2d
KX814348	China	Asia	2015	2d
KC800646	China	Asia	2011	2d
KC514999	China	Asia	2012	2d
HM776444	China	Asia	2009	2b
HQ378159	Serbia	Europe	2009	2b
HQ378161	Serbia	Europe	2009	2b
HM038026	China	Asia	2007	2b
HQ591380	Croatia	Europe	2009	2b
KX828222	SouthKorea	Asia	2012	2b
HQ378160	Serbia	Europe	2009	2b
KC835194	Brazil	SouthAmerica	2007	2b
MF150185	Brazil	SouthAmerica	2010	2b
MF150188	Brazil	SouthAmerica	2010	2b
MF150182	Brazil	SouthAmerica	2007	2b
MF150186	Brazil	SouthAmerica	2010	2b
MF150183	Brazil	SouthAmerica	2009	2b
MF150189	Brazil	SouthAmerica	2010	2b
HQ591375	Croatia	Europe	2008	2b
GQ359000	China	Asia	2007	2b
HQ831525	Portugal	Europe	2007	2b
HQ591371	Croatia	Europe	2008	2b
HQ591372	Croatia	Europe	2007	2b
KY388470	Germany	Europe	2013	2b
KY388473	Germany	Europe	2013	2b
KY388472	Germany	Europe	2013	2b
KY388471	Germany	Europe	2013	2b
HQ591378	Croatia	Europe	2009	2b
KJ920205	Germany	Europe	2011	2b
KY084478	Brazil	SouthAmerica	2008	2b

HM038023	China	Asia	2007	2b
KM624034	China	Asia	2007	2b
MF926252	China	Asia	2015	2b
HM776445	China	Asia	2008	2b
KX981602	China	Asia	2016	2b
KP231141	Italy	Europe	2009	2b
KP231142	Italy	Europe	2009	2b
KP231143	Italy	Europe	2009	2b
EU886637	Australia	Oceania	2007	2b
GQ227412	China	Asia	2007	2b
KP231102	Italy	Europe	2008	2b
KP231103	Italy	Europe	2008	2b
KP231104	Italy	Europe	2008	2b
KP231105	Italy	Europe	2008	2b
KP231132	Italy	Europe	2008	2b
KP231133	Italy	Europe	2008	2b
KP231135	Italy	Europe	2008	2b
HQ591368	Croatia	Europe	2007	2b
HQ591373	Croatia	Europe	2007	2b
HQ831526	Portugal	Europe	2007	2b
KX826908	China	Asia	2015	2b
KP231116	Italy	Europe	2011	2b
KP231115	Italy	Europe	2012	2b
KP231164	Italy	Europe	2012	2b
EU684164	Australia	Oceania	2008	2b
HM776451	China	Asia	2009	2b
HM641752	China	Asia	2007	2b
HQ831534	Portugal	Europe	2008	2b
KY388478	Germany	Europe	2013	2b
KY388479	Germany	Europe	2013	2b
JF317575	SouthKorea	Asia	2009	2b
HQ591376	Croatia	Europe	2008	2b
HQ591377	Croatia	Europe	2008	2b
KY659551	China	Asia	2016	2b
KY388474	Germany	Europe	2013	2b
HM038028	China	Asia	2008	2b
JF317579	SouthKorea	Asia	2009	2b
GQ359006	China	Asia	2008	2b
KY440165	Germany	Europe	2013	2b
KY440166	Germany	Europe	2013	2b
KM624031	China	Asia	2007	2b
HQ831537	Portugal	Europe	2008	2b
HQ831535	Portugal	Europe	2007	2b
HQ831538	Portugal	Europe	2009	2b
HQ591365	Croatia	Europe	2008	2b
KP231159	Italy	Europe	2010	2b

JF317569	SouthKorea	Asia	2009	2b
JF317572	SouthKorea	Asia	2009	2b
JF317570	SouthKorea	Asia	2009	2b
KF732649	China	Asia	2012	2b
JQ955679	China	Asia	2010	2b
KP231130	Italy	Europe	2008	2b
KP231134	Italy	Europe	2008	2b
HQ831540	Portugal	Europe	2010	2b
KF742546	China	Asia	2008	2b
HM776446	China	Asia	2008	2b
GQ174519	China	Asia	2008	2b
GQ996404	China	Asia	2009	2b
KX009480	India	Asia	2013	2b
KX009481	India	Asia	2012	2b
JQ181590	VietNam	Asia	2011	2b
JQ181601	VietNam	Asia	2011	2b
JQ181591	VietNam	Asia	2011	2b
HQ231328	Germany	Europe	2009	2b
KY388468	Germany	Europe	2013	2b
KY388469	Germany	Europe	2013	2b
JQ002672	China	Asia	2011	2b
KM624032	China	Asia	2008	2b
KM624030	China	Asia	2007	2b
JF317585	SouthKorea	Asia	2010	2b
JF317588	SouthKorea	Asia	2010	2b
FJ644930	China	Asia	2008	2b
KF742541	China	Asia	2011	2b
HM038032	China	Asia	2008	2b
HF542107	Brazil	SouthAmerica	2007	2b
FJ905463	SouthKorea	Asia	2007	2b
HQ591370	Croatia	Europe	2008	2b
HQ591369	Croatia	Europe	2007	2b
FJ905459	SouthKorea	Asia	2007	2b
FJ233905	Canada	NorthAmerica	2008	2b
FJ233906	Canada	NorthAmerica	2008	2b
JF317576	SouthKorea	Asia	2009	2b
FJ233907	Canada	NorthAmerica	2007	2b
KX828232	SouthKorea	Asia	2016	2b
JF317580	SouthKorea	Asia	2009	2b
FJ905460	SouthKorea	Asia	2007	2b
KP081545	China	Asia	2014	2b
JF317565	SouthKorea	Asia	2009	2b
KM042399	VietNam	Asia	2009	2b
EU555439	China	Asia	2008	2b
KP231145	Italy	Europe	2010	2b
GQ449672	China	Asia	2009	2b

KP231129	Italy	Europe	2008	2b
GU083582	China	Asia	2009	2b
KP231118	Italy	Europe	2011	2d
KP231146	Italy	Europe	2010	2d
KP081552	China	Asia	2014	2b
KP081556	China	Asia	2013	2b
KP081548	China	Asia	2014	2b
FJ716703	China	Asia	2008	2b
KP231137	Italy	Europe	2013	2b
HQ831523	Portugal	Europe	2007	2b
KP231128	Italy	Europe	2013	2b
FJ905467	SouthKorea	Asia	2007	2b
KT819166	Brazil	SouthAmerica	2014	2b
KT819163	Brazil	SouthAmerica	2014	2b
KX161680	China	Asia	2010	2b
KT819164	Brazil	SouthAmerica	2014	2b
KT819165	Brazil	SouthAmerica	2014	2b
KX161673	China	Asia	2007	2b
KX161674	China	Asia	2007	2b
KX828219	SouthKorea	Asia	2012	2b
JF317568	SouthKorea	Asia	2009	2b
JF317577	SouthKorea	Asia	2009	2b
JF317578	SouthKorea	Asia	2009	2b
JF317583	SouthKorea	Asia	2009	2b
FJ905470	SouthKorea	Asia	2007	2b
KC473165	China	Asia	2007	2b
KX161697	China	Asia	2007	2b
KY388476	Germany	Europe	2013	2b
KY388477	Germany	Europe	2013	2b
KT719404	Brazil	SouthAmerica	2012	2b
KT819160	Brazil	SouthAmerica	2014	2b
KT819162	Brazil	SouthAmerica	2014	2b
KT819167	Brazil	SouthAmerica	2014	2b
FJ905468	SouthKorea	Asia	2007	2b
JF317571	SouthKorea	Asia	2009	2b
KY810319	SouthKorea	Asia	2016	2b
KJ094604	Brazil	SouthAmerica	2010	2b
FJ440338	China	Asia	2008	2b
KR054744	Japan	Asia	2008	2b
GU450327	China	Asia	2009	2b
GU450328	China	Asia	2009	2b
KX161693	China	Asia	2007	2b
HM038029	China	Asia	2007	2b
JF272497	China	Asia	2010	2b
HM776450	China	Asia	2009	2b
KX161665	China	Asia	2008	2b

HM038022	China	Asia	2008	2b
JF682792	China	Asia	2010	2b
FJ870975	China	Asia	2008	2b
GQ915289	China	Asia	2009	2b
JX948773	China	Asia	2011	2b
JX948780	China	Asia	2011	2b
FJ870969	China	Asia	2008	2b
KM624038	China	Asia	2014	2b
KX904946	China	Asia	2010	2b
EU921255	China	Asia	2008	2b
KM035761	China	Asia	2014	2b
HM776448	China	Asia	2009	2b
KF742549	China	Asia	2013	2b
KX867820	China	Asia	2016	2b
KM235959	China	Asia	2014	2b
KX960939	China	Asia	2012	2b
KU311020	China	Asia	2014	2b
KU317473	China	Asia	2015	2b
KU317476	China	Asia	2015	2b
KU317480	China	Asia	2015	2b
KU317482	China	Asia	2015	2b
KU317489	China	Asia	2015	2b
KU317490	China	Asia	2015	2b
KU317491	China	Asia	2015	2b
KU311026	China	Asia	2014	2b
KU311027	China	Asia	2014	2b
KU317492	China	Asia	2015	2b
KX831476	China	Asia	2015	2b
KX831478	China	Asia	2015	2b
KX831479	China	Asia	2015	2b
KX831480	China	Asia	2015	2b
KX831481	China	Asia	2015	2b
KX960938	China	Asia	2012	2b
KF027491	China	Asia	2012	2b
JF317566	SouthKorea	Asia	2009	2b
KT200369	China	Asia	2014	2b
KM235960	China	Asia	2014	2b
MF589531	China	Asia	2014	2b
KU557355	China	Asia	2015	2b
KU317475	China	Asia	2015	2b
KX831477	China	Asia	2015	2b
KX831482	China	Asia	2015	2b
KM067384	China	Asia	2014	2b
KX960940	China	Asia	2012	2b
KF926650	China	Asia	2013	2b
KM880080	China	Asia	2013	2b

KC514998	China	Asia	2012	2b
KM880083	China	Asia	2013	2b
KT200362	China	Asia	2014	2b
KX161670	China	Asia	2009	2b
KX161671	China	Asia	2009	2b
KC859451	China	Asia	2012	2b
KX960941	China	Asia	2013	2b
KC336417	China	Asia	2010	2b
KC514973	China	Asia	2011	2b
KF742553	China	Asia	2013	2b
MF589532	China	Asia	2015	2b
JX945575	China	Asia	2011	2b
KX867821	China	Asia	2016	2b
KJ599673	China	Asia	2012	2b
KM974911	China	Asia	2014	2b
MF679592	China	Asia	2015	2b
KX831475	China	Asia	2015	2b
KU960934	China	Asia	2015	2b
KX298474	China	Asia	2014	2b
KM880082	China	Asia	2013	2b
KY305201	China	Asia	2015	2b
KJ680366	China	Asia	2011	2b
KX826907	China	Asia	2014	2b
KX247842	China	Asia	2013	2b
KX247843	China	Asia	2015	2b
KX247844	China	Asia	2015	2b
KM880081	China	Asia	2013	2b
KU557354	China	Asia	2015	2b
KC751546	China	Asia	2012	2b
KX855983	China	Asia	2016	2b
KX855984	China	Asia	2016	2b
KP637021	China	Asia	2014	2b
KT200367	China	Asia	2014	2b
KY347899	China	Asia	2016	2b
KX960942	China	Asia	2014	2b
MF589528	China	Asia	2017	2b
EU780074	China	Asia	2008	2b
EU780073	China	Asia	2008	2b
KU193766	China	Asia	2013	2b
GQ359007	China	Asia	2008	2b
EU656143	China	Asia	2008	2b
FJ041151	China	Asia	2007	2b
GQ358992	China	Asia	2007	2b
KU960931	China	Asia	2015	2b
KU960938	China	Asia	2013	2b
KX161672	China	Asia	2008	2b

KX161682	China	Asia	2013	2b
KX161681	China	Asia	2013	2b
JX406426	China	Asia	2011	2b
FJ644922	China	Asia	2008	2b
GU252369	China	Asia	2009	2b
KP231114	Italy	Europe	2011	2b
KP231119	Italy	Europe	2011	2b
KP231156	Italy	Europe	2011	2b
KP231158	Italy	Europe	2011	2b
FJ644928	China	Asia	2008	2b
KF742545	China	Asia	2012	2b
KC823053	China	Asia	2012	2b
GQ359004	China	Asia	2008	2b
JF928005	China	Asia	2011	2b
FJ644932	China	Asia	2008	2b
FJ158602	China	Asia	2007	2b
GQ358996	China	Asia	2007	2b
KF850461	China	Asia	2010	2b
KC514979	China	Asia	2011	2b
GQ358999	China	Asia	2007	2b
GQ358994	China	Asia	2007	2b
KP231106	Italy	Europe	2007	2b
KP231112	Italy	Europe	2008	2b
KP231136	Italy	Europe	2008	2b
KP231152	Italy	Europe	2010	2b
KP231150	Italy	Europe	2010	2b
KP231151	Italy	Europe	2010	2b
KP231161	Italy	Europe	2012	2b
KP231153	Italy	Europe	2010	2b
KP231107	Italy	Europe	2008	2b
KP231110	Italy	Europe	2008	2b
KP231111	Italy	Europe	2008	2b
KP231131	Italy	Europe	2008	2b
KP231165	Italy	Europe	2008	2b
KP231148	Italy	Europe	2010	2b
KP231108	Italy	Europe	2009	2b
KP231147	Italy	Europe	2010	2b
KP231121	Italy	Europe	2011	2b
KP231124	Italy	Europe	2013	2b
KP231144	Italy	Europe	2010	2b
KP231109	Italy	Europe	2007	2b
KP231120	Italy	Europe	2008	2b
KP231113	Italy	Europe	2009	2b
KP231122	Italy	Europe	2011	2b
KP231123	Italy	Europe	2013	2b
KP231126	Italy	Europe	2013	2b

KP231125	Italy	Europe	2013	2b
KP231127	Italy	Europe	2013	2b
KP231149	Italy	Europe	2010	2b
KX960944	China	Asia	2014	2b
KY305202	China	Asia	2015	2b
KC514980	China	Asia	2011	2b
EU921254	China	Asia	2008	2b
EU921256	China	Asia	2008	2b
EU921257	China	Asia	2008	2b
GU450330	China	Asia	2008	2b
HM038025	China	Asia	2008	2b
FJ623185	China	Asia	2008	2b
GQ449670	China	Asia	2009	2b
KX828220	SouthKorea	Asia	2012	2b
KX828235	SouthKorea	Asia	2016	2b
MF589525	China	Asia	2013	2b
MG229682	China	Asia	2013	2b
MF589535	China	Asia	2013	2b
KC514991	China	Asia	2012	2b
JX948784	China	Asia	2011	2b
GQ358997	China	Asia	2007	2b
FJ870974	China	Asia	2008	2b
KX161669	China	Asia	2015	2b
JX274295	China	Asia	2011	2b
KU193767	China	Asia	2013	2b
GQ359008	China	Asia	2008	2b
GQ358998	China	Asia	2007	2b
HM776438	China	Asia	2009	2b
FJ870976	China	Asia	2008	2b
JQ181585	VietNam	Asia	2011	2b
JQ181589	VietNam	Asia	2011	2b
KF742544	China	Asia	2013	2b
KF742550	China	Asia	2010	2b
KM042406	VietNam	Asia	2011	2b
JQ181597	VietNam	Asia	2011	2b
KT336604	VietNam	Asia	2014	2b
HM776442	China	Asia	2009	2b
KF742540	China	Asia	2010	2b
KT819161	Brazil	SouthAmerica	2014	2b
KF850463	China	Asia	2011	2b
JX945577	China	Asia	2011	2b
JX945576	China	Asia	2011	2b
KC514997	China	Asia	2012	2b
JX534236	China	Asia	2012	2b
JX534237	China	Asia	2012	2b
KF850465	China	Asia	2011	2b

HQ693092	China	Asia	2009	2b
MF326355	China	Asia	2016	2b
JF317567	SouthKorea	Asia	2009	2b
JF317573	SouthKorea	Asia	2009	2b
KX865093	China	Asia	2016	2b
KJ139962	China	Asia	2013	2b
JX294717	China	Asia	2012	2d
KC515003	China	Asia	2012	2d
KT804910	China	Asia	2015	2d
KC514967	China	Asia	2011	2d
KP231163	Italy	Europe	2011	2d
JF690916	Malaysia	Asia	2007	2b
JF690917	Malaysia	Asia	2007	2b
GQ911590	Taiwan	Asia	2007	2b
KM360052	China	Asia	2013	2b
KM360056	China	Asia	2013	2b
KP081538	China	Asia	2013	2d
KP081542	China	Asia	2013	2d
FJ804417	Germany	Europe	2008	2b
HQ231329	Germany	Europe	2008	2b
FJ233910	Canada	NorthAmerica	2007	2b
KP231138	Italy	Europe	2008	2b
KP231139	Italy	Europe	2008	2b
HQ591367	Croatia	Europe	2008	2b
KP081547	China	Asia	2014	2b
KC514976	China	Asia	2011	2d
KP081541	China	Asia	2013	2d
JF690918	Malaysia	Asia	2007	2b
KT819159	Brazil	SouthAmerica	2014	2d
HM776443	China	Asia	2009	2h
JX099781	VietNam	Asia	2009	2h
KM042400	VietNam	Asia	2009	2h
KM042402	VietNam	Asia	2009	2h
KJ729074	India	Asia	2013	2h
KJ729072	India	Asia	2013	2h
JQ181604	VietNam	Asia	2011	2h
JQ181605	VietNam	Asia	2011	2h
JQ181606	VietNam	Asia	2011	2h
JX099782	VietNam	Asia	2009	2h
KM042394	VietNam	Asia	2008	2h
KM042396	VietNam	Asia	2008	2h
JQ181598	VietNam	Asia	2011	2h
JQ181599	VietNam	Asia	2011	2h
JX099783	VietNam	Asia	2009	2h
KT336603	VietNam	Asia	2013	2h
JQ181596	VietNam	Asia	2011	2h

KM042407	VietNam	Asia	2011	2h
JX099784	VietNam	Asia	2010	2h
JQ181603	VietNam	Asia	2011	2h
JX099785	VietNam	Asia	2010	2h
KM042398	VietNam	Asia	2009	2h
KM042403	VietNam	Asia	2010	2h
KT336602	VietNam	Asia	2013	2h
JX099780	VietNam	Asia	2009	2h
KM042401	VietNam	Asia	2009	2h
JQ181586	VietNam	Asia	2011	2h
JQ181587	VietNam	Asia	2011	2h
JQ181593	VietNam	Asia	2011	2h
JQ181594	VietNam	Asia	2011	2h
JQ181592	VietNam	Asia	2011	2h
JQ181602	VietNam	Asia	2011	2h
JQ181588	VietNam	Asia	2011	2h
KC515012	China	Asia	2012	2h
JQ181607	VietNam	Asia	2011	2h
KM042395	VietNam	Asia	2008	2h
HQ701665	Thailand	Asia	2007	2h
HQ701666	Thailand	Asia	2007	2h
JQ866916	Thailand	Asia	2009	2h
JQ866917	Thailand	Asia	2009	2h
JN411097	China	Asia	2009	2h
JN411098	China	Asia	2010	2h
MF314213	Thailand	Asia	2010	2h
MF314214	Thailand	Asia	2010	2h
MF314216	Thailand	Asia	2010	2h
MF314226	Thailand	Asia	2011	2h
MF314281	Thailand	Asia	2013	2h
MF314289	Thailand	Asia	2014	2h
MF314300	Thailand	Asia	2014	2h
MF314217	Thailand	Asia	2010	2h
MF314219	Thailand	Asia	2010	2h
MF314251	Thailand	Asia	2012	2h
MF314252	Thailand	Asia	2012	2h
MF314218	Thailand	Asia	2010	2h
MF314244	Thailand	Asia	2012	2h
MF314272	Thailand	Asia	2013	2h
KC238429	VietNam	Asia	2012	2h
KC238434	VietNam	Asia	2012	2h
KX130941	Indonesia	Asia	2013	2h
KM042404	VietNam	Asia	2011	2h
KC238432	VietNam	Asia	2012	2h
MF314288	Thailand	Asia	2014	2d
KJ094605	Brazil	SouthAmerica	2010	2d

KJ094606	Brazil	SouthAmerica	2010	2d
KM360050	China	Asia	2013	2d
KY810321	SouthKorea	Asia	2016	2a
KC618389	USA	NorthAmerica	2008	2a
FJ870967	China	Asia	2008	2a
FJ870968	China	Asia	2008	2a
KF850458	China	Asia	2009	2a
KX828216	SouthKorea	Asia	2016	2a
KX828218	SouthKorea	Asia	2016	2a
KF850468	China	Asia	2011	2a
FJ905471	SouthKorea	Asia	2007	2a
KX828217	SouthKorea	Asia	2016	2a
KX828215	SouthKorea	Asia	2016	2a
KT819168	Brazil	SouthAmerica	2014	2a
GU049340	Canada	NorthAmerica	2007	2a
KP231099	Italy	Europe	2008	2a
FJ233908	Canada	NorthAmerica	2007	2a
KC188796	SouthKorea	Asia	2012	2a
JQ994269	Canada	NorthAmerica	2007	2a
JF317584	SouthKorea	Asia	2010	2a
GU370064	China	Asia	2009	2a
KF850466	China	Asia	2011	2a
KJ094603	Brazil	SouthAmerica	2010	2a
KP081543	China	Asia	2013	2a
KP081551	China	Asia	2014	2a
KJ094601	Brazil	SouthAmerica	2010	2a
KJ729073	India	Asia	2012	2a
HQ591366	Croatia	Europe	2008	2a
HQ591374	Croatia	Europe	2008	2a
KM042397	VietNam	Asia	2008	2a
HQ831522	Portugal	Europe	2008	2a
KP231101	Italy	Europe	2012	2a
HQ831520	Portugal	Europe	2008	2a
HQ831536	Portugal	Europe	2008	2a
HQ831533	Portugal	Europe	2007	2a
GQ359003	China	Asia	2008	2a
KC514989	China	Asia	2012	2a
KY388466	Germany	Europe	2013	2a
KY388467	Germany	Europe	2013	2a
KM035762	China	Asia	2014	2a
KX828213	SouthKorea	Asia	2012	2a
KY388475	Germany	Europe	2013	2a
HQ831539	Portugal	Europe	2009	2a
KP231100	Italy	Europe	2010	2a
MF326369	China	Asia	2016	2a
HQ831519	Portugal	Europe	2008	2a

KX960946	China	Asia	2013	2a
GQ358993	China	Asia	2007	2a
FJ501957	China	Asia	2007	2a
KM067385	China	Asia	2014	2a
KY810322	SouthKorea	Asia	2016	2a
MF326365	China	Asia	2016	2a
KC515002	China	Asia	2012	2a
EU886638	Australia	Oceania	2007	2a
KX814347	China	Asia	2015	2a
HM038034	China	Asia	2008	2a
JF682791	China	Asia	2010	2a
HM038033	China	Asia	2007	2a
HQ402903	China	Asia	2008	2a
JF682793	China	Asia	2011	2a
JF682794	China	Asia	2011	2a
GU001709	China	Asia	2009	2a
GU370063	China	Asia	2009	2a
JF928003	China	Asia	2011	2a
KM880087	China	Asia	2014	2a
KM880088	China	Asia	2014	2a
KM880089	China	Asia	2014	2a
JX982223	China	Asia	2011	2a
KC515024	China	Asia	2012	2a
KX960945	China	Asia	2013	2a
KX960947	China	Asia	2013	2a
KY347898	China	Asia	2016	2a
KT284886	China	Asia	2015	2a
KT284887	China	Asia	2015	2a
KT284888	China	Asia	2015	2a
JX948774	China	Asia	2011	2a
MF589538	China	Asia	2017	2a
KF027495	China	Asia	2012	2a
JX982225	China	Asia	2011	2a
KT284889	China	Asia	2015	2a
KY659550	China	Asia	2016	2a
KT200370	China	Asia	2014	2a
KX298473	China	Asia	2014	2a
KJ680365	China	Asia	2012	2a
KX960930	China	Asia	2011	2a
MF326372	China	Asia	2016	2a
KX960948	China	Asia	2013	2a
KP081549	China	Asia	2014	2a
KM360057	China	Asia	2013	2a
KP245929	China	Asia	2013	2a
KR058357	China	Asia	2014	2a
KC514996	China	Asia	2012	2a

MF589526	China	Asia	2014	2a
MF589534	China	Asia	2014	2a
KP670420	China	Asia	2013	2a
FJ660969	China	Asia	2007	2a
KX169324	China	Asia	2015	2a
KX169327	China	Asia	2015	2a
KX169334	China	Asia	2015	2a
KX169307	China	Asia	2015	2a
KC800634	China	Asia	2010	2a
KC800635	China	Asia	2011	2a
KC800636	China	Asia	2012	2a
JN639856	China	Asia	2011	2a
KC515025	China	Asia	2012	2a
KX960927	China	Asia	2011	2a
HM776452	China	Asia	2009	2f
LC004753	India	Asia	2013	2f
KT369067	Indonesia	Asia	2013	2f
KT369069	Indonesia	Asia	2013	2f
KT369068	Indonesia	Asia	2013	2f
KT369070	Indonesia	Asia	2013	2f
LC004739	India	Asia	2013	2f
LC004745	India	Asia	2013	2f
LC004748	India	Asia	2012	2f
LC004751	India	Asia	2013	2f
LC004750	India	Asia	2013	2f
LC004749	India	Asia	2013	2f
LC004736	India	Asia	2012	2f
LC004746	India	Asia	2012	2f
LC008134	India	Asia	2012	2f
LC008135	India	Asia	2012	2f
LC008137	India	Asia	2013	2f
LC008141	India	Asia	2014	2f
LC004738	India	Asia	2011	2f
KJ094602	Brazil	SouthAmerica	2010	2b
KJ094600	Brazil	SouthAmerica	2010	2a
JX099786	VietNam	Asia	2008	2g
KX960931	China	Asia	2011	2g
JX948768	China	Asia	2011	2g
FJ948168	China	Asia	2008	2d
KY940522	China	Asia	2013	2d
KY940524	China	Asia	2014	2d
KY940526	China	Asia	2014	2d
KY940534	China	Asia	2015	2d
KY940537	China	Asia	2014	2d
KY940541	China	Asia	2014	2d
KY940538	China	Asia	2014	2d

KY940530	China	Asia	2013	2d
KY940533	China	Asia	2013	2d
KY940543	China	Asia	2015	2d
KY940528	China	Asia	2014	2d
KY940539	China	Asia	2014	2d
KY940540	China	Asia	2014	2d
MF679564	China	Asia	2012	2d
GU938302	China	Asia	2009	2d
HQ113119	China	Asia	2009	2d
KX928996	China	Asia	2015	2d
HQ113118	China	Asia	2009	2d
KX929018	China	Asia	2015	2d
KX929007	China	Asia	2015	2d
JN176181	China	Asia	2010	2d
HQ113117	China	Asia	2009	2d
KM245558	China	Asia	2014	2d
KX928995	China	Asia	2015	2d
KX929006	China	Asia	2015	2d
KX814350	China	Asia	2016	2d
KX929015	China	Asia	2015	2d
KX929008	China	Asia	2015	2d
JX204386	China	Asia	2012	2d
KX929016	China	Asia	2015	2d
KX928993	China	Asia	2015	2d
KX929012	China	Asia	2015	2d
KX929013	China	Asia	2015	2d
KX929014	China	Asia	2015	2d
KX929010	China	Asia	2015	2d
KX928999	China	Asia	2015	2d
KP179231	China	Asia	2014	2d
KX928998	China	Asia	2015	2d
KX929011	China	Asia	2015	2d
KX929005	China	Asia	2015	2d
JF683402	Taiwan	Asia	2010	2d
KX169302	China	Asia	2015	2d
KX169303	China	Asia	2015	2d
MF314293	Thailand	Asia	2014	2d
KX169322	China	Asia	2015	2d
MF679582	China	Asia	2016	2d
MF679550	China	Asia	2017	2d
MF679558	China	Asia	2016	2d
KU697087	USA	NorthAmerica	2014	2d
KX098672	USA	NorthAmerica	2015	2d
KX098686	USA	NorthAmerica	2015	2d
KX098706	USA	NorthAmerica	2015	2d
KX098755	USA	NorthAmerica	2016	2d

KX510083	USA	NorthAmerica	2016	2d
KX098702	USA	NorthAmerica	2015	2d
KX098703	USA	NorthAmerica	2015	2d
KX510070	USA	NorthAmerica	2016	2d
KX098751	USA	NorthAmerica	2016	2d
MF169756	Taiwan	Asia	2014	2d
JF683408	Taiwan	Asia	2009	2d
GU808525	India	Asia	2007	2d
KM042405	VietNam	Asia	2011	2b
GU938303	China	Asia	2009	2b
GU938304	China	Asia	2009	2b
HQ113120	China	Asia	2009	2b
HQ113121	China	Asia	2009	2b
KX928994	China	Asia	2015	2b
KJ956689	China	Asia	2014	2b
KJ956690	China	Asia	2014	2b
KJ956691	China	Asia	2014	2b
KJ956692	China	Asia	2014	2b
KX814349	China	Asia	2016	2b
KX814351	China	Asia	2016	2b
KX814352	China	Asia	2016	2b
KX928997	China	Asia	2015	2b
KX929009	China	Asia	2015	2b
GU325764	China	Asia	2009	2b
GU325766	China	Asia	2009	2b
EU521708	China	Asia	2007	2b
GQ404799	China	Asia	2007	2b
GQ404802	China	Asia	2007	2b
EU521707	China	Asia	2007	2b
GU325765	China	Asia	2009	2b
FJ598044	China	Asia	2008	2b
GU325761	China	Asia	2009	2b
KX845692	China	Asia	2016	2b
KX845694	China	Asia	2016	2b
KY126314	China	Asia	2016	2b
KX845695	China	Asia	2016	2b
KY126311	China	Asia	2016	2b
GU325759	China	Asia	2009	2b
GQ404804	China	Asia	2007	2b
GQ404806	China	Asia	2007	2b
GQ404805	China	Asia	2007	2b
GQ404803	China	Asia	2007	2b
GQ404808	China	Asia	2008	2b
KM096530	China	Asia	2010	2b
EU909688	Belgium	Europe	2008	2b
KM190984	USA	NorthAmerica	2012	2b

KM191011	USA	NorthAmerica	2012	2b
KM191030	USA	NorthAmerica	2013	2b
KU697005	USA	NorthAmerica	2015	2b
KU697022	USA	NorthAmerica	2015	2b
KM191003	USA	NorthAmerica	2012	2b
KM191004	USA	NorthAmerica	2012	2b
KX808471	SouthKorea	Asia	2015	2b
KX808472	SouthKorea	Asia	2015	2b
KX808473	SouthKorea	Asia	2015	2b
KU697002	USA	NorthAmerica	2015	2b
KU697028	USA	NorthAmerica	2015	2b
KU697093	USA	NorthAmerica	2014	2b
KM191055	USA	NorthAmerica	2013	2b
KM191085	USA	NorthAmerica	2013	2b
MF679556	China	Asia	2016	2b
MF679584	China	Asia	2014	2b
MF679585	China	Asia	2015	2b
MF679573	China	Asia	2013	2b
MF679574	China	Asia	2013	2b
KU697024	USA	NorthAmerica	2015	2b
KT867961	USA	NorthAmerica	2012	2b
KX510050	USA	NorthAmerica	2016	2b
KX510059	USA	NorthAmerica	2016	2b
KU697103	USA	NorthAmerica	2014	2b
KU697268	USA	NorthAmerica	2015	2b
KU697155	USA	NorthAmerica	2015	2b
KU697280	USA	NorthAmerica	2015	2b
KU697043	USA	NorthAmerica	2015	2b
KU697234	USA	NorthAmerica	2015	2b
GQ404807	China	Asia	2008	2b
KY806021	UnitedKingdom	Europe	2008	2b
KY806043	UnitedKingdom	Europe	2012	2b
HM009333	Slovakia	Europe	2007	2b
HM565924	Argentina	SouthAmerica	2008	2b
HQ378162	Serbia	Europe	2010	2b
JQ866914	Thailand	Asia	2008	2b
JQ866915	Thailand	Asia	2008	2b
KJ415567	India	Asia	2008	2b
KJ415568	India	Asia	2008	2b
KP245927	China	Asia	2013	2b
KT868439	USA	NorthAmerica	2009	2b
KT868449	USA	NorthAmerica	2009	2b
KY806008	UnitedKingdom	Europe	2008	2b
KY806034	UnitedKingdom	Europe	2012	2b
MF314207	Thailand	Asia	2010	2b
MF314208	Thailand	Asia	2010	2b

MF314209	Thailand	Asia	2010	2b
MF314210	Thailand	Asia	2010	2b
MF314211	Thailand	Asia	2010	2b
MF314212	Thailand	Asia	2010	2b
MF314223	Thailand	Asia	2011	2b
MF314228	Thailand	Asia	2012	2b
MF314229	Thailand	Asia	2012	2b
MF314230	Thailand	Asia	2012	2b
MF314231	Thailand	Asia	2012	2b
MF314232	Thailand	Asia	2012	2b
MF314234	Thailand	Asia	2012	2b
MF314243	Thailand	Asia	2012	2b
JQ866918	Thailand	Asia	2010	2b
KY806007	UnitedKingdom	Europe	2008	2b
KY806039	UnitedKingdom	Europe	2012	2b
KY806064	UnitedKingdom	Europe	2015	2b
KY806068	UnitedKingdom	Europe	2015	2b
LC310727	Japan	Asia	2015	2b
JQ387582	Thailand	Asia	2007	2b
KY806040	UnitedKingdom	Europe	2012	2b
HM565921	Argentina	SouthAmerica	2008	2b
HQ378167	Serbia	Europe	2010	2b
JF927987	Taiwan	Asia	2010	2b
KY806015	UnitedKingdom	Europe	2008	2b
KY806024	UnitedKingdom	Europe	2009	2b
KY806030	UnitedKingdom	Europe	2011	2b
MF314220	Thailand	Asia	2011	2b
MF314221	Thailand	Asia	2011	2b
MF314238	Thailand	Asia	2012	2b
MF314239	Thailand	Asia	2012	2b
JF683397	Taiwan	Asia	2007	2b
KR559688	Italy	Europe	2010	2b
KY806042	UnitedKingdom	Europe	2013	2b
HM565918	Argentina	SouthAmerica	2007	2b
HM565922	Argentina	SouthAmerica	2007	2b
HM565925	Argentina	SouthAmerica	2008	2b
KY806009	UnitedKingdom	Europe	2008	2b
KY806047	UnitedKingdom	Europe	2013	2b
KY806026	UnitedKingdom	Europe	2009	2b
KY806013	UnitedKingdom	Europe	2008	2b
KY806031	UnitedKingdom	Europe	2011	2b
KY806050	UnitedKingdom	Europe	2013	2b
HM565923	Argentina	SouthAmerica	2007	2b
KY806065	UnitedKingdom	Europe	2015	2b
HM565920	Argentina	SouthAmerica	2007	2b
KY806011	UnitedKingdom	Europe	2008	2b

KY806012	UnitedKingdom	Europe	2008	2b
KY806059	UnitedKingdom	Europe	2014	2b
KR559689	Italy	Europe	2012	2b
KT868287	USA	NorthAmerica	2007	2b
KT868133	USA	NorthAmerica	2007	2b
KT868431	USA	NorthAmerica	2007	2b
KT868432	USA	NorthAmerica	2007	2b
KP245924	China	Asia	2013	2b
LC310739	Japan	Asia	2017	2b
JN989555	China	Asia	2008	2b
KY806035	UnitedKingdom	Europe	2012	2b
KY806056	UnitedKingdom	Europe	2014	2b
HM009329	Slovakia	Europe	2007	2b
MF314268	Thailand	Asia	2013	2b
KR559695	Italy	Europe	2011	2b
KR559694	Italy	Europe	2010	2b
MF314224	Thailand	Asia	2011	2b
KY806051	UnitedKingdom	Europe	2013	2b
KY806066	UnitedKingdom	Europe	2014	2b
KY806063	UnitedKingdom	Europe	2015	2b
JN382190	Romania	Europe	2011	2b
JN382192	Romania	Europe	2011	2b
JN382186	Romania	Europe	2011	2b
JN382191	Romania	Europe	2011	2b
KY806041	UnitedKingdom	Europe	2011	2b
KR559692	Italy	Europe	2012	2b
KY806025	UnitedKingdom	Europe	2009	2b
KY806052	UnitedKingdom	Europe	2012	2b
KY806016	UnitedKingdom	Europe	2008	2b
KY806017	UnitedKingdom	Europe	2008	2b
KY806005	UnitedKingdom	Europe	2008	2b
KY806020	UnitedKingdom	Europe	2008	2b
KY806018	UnitedKingdom	Europe	2008	2b
JF927983	Taiwan	Asia	2007	2b
KY806037	UnitedKingdom	Europe	2012	2b
JF683407	Taiwan	Asia	2009	2b
HM565919	Paraguay	SouthAmerica	2007	2b
KY806023	UnitedKingdom	Europe	2009	2b
KY806045	UnitedKingdom	Europe	2011	2b
HQ735207	Thailand	Asia	2007	2b
KT261750	China	Asia	2013	2b
KY806002	UnitedKingdom	Europe	2008	2b
KY806003	UnitedKingdom	Europe	2008	2b
KY806004	UnitedKingdom	Europe	2008	2b
KY806010	UnitedKingdom	Europe	2008	2b
KY806044	UnitedKingdom	Europe	2013	2b

MF314235	Thailand	Asia	2012	2b
MF314236	Thailand	Asia	2012	2b
MF314237	Thailand	Asia	2012	2b
KY806022	UnitedKingdom	Europe	2009	2b
KR559687	Italy	Europe	2011	2b
KR559697	Italy	Europe	2013	2b
KR559690	Italy	Europe	2012	2b
KR559691	Italy	Europe	2012	2b
JF683393	Taiwan	Asia	2010	2b
JF683395	Taiwan	Asia	2010	2b
JF683406	Taiwan	Asia	2010	2b
JF927990	Taiwan	Asia	2010	2b
KY806029	UnitedKingdom	Europe	2009	2b
GQ845026	China	Asia	2009	2b
JN989557	China	Asia	2008	2b
KF035059	China	Asia	2012	2b
KY806055	UnitedKingdom	Europe	2014	2b
KF035063	China	Asia	2011	2b
KY806061	UnitedKingdom	Europe	2014	2b
MF314266	Thailand	Asia	2013	2b
KF035062	China	Asia	2013	2b
KF035071	China	Asia	2012	2b
KF035065	China	Asia	2012	2b
KF035067	China	Asia	2012	2b
KX169296	China	Asia	2015	2b
KX169299	China	Asia	2015	2b
KX169300	China	Asia	2015	2b
KX169301	China	Asia	2015	2b
KX169304	China	Asia	2015	2b
KX169309	China	Asia	2015	2b
KX169313	China	Asia	2015	2b
KX169314	China	Asia	2015	2b
KX169315	China	Asia	2015	2b
KF035064	China	Asia	2012	2b
KP245923	China	Asia	2013	2b
KP245928	China	Asia	2012	2b
KR149371	China	Asia	2013	2b
MG229680	China	Asia	2014	2b
KX169306	China	Asia	2015	2b
HQ378163	Serbia	Europe	2010	2b
MF679602	China	Asia	2017	2b
HM009334	Slovakia	Europe	2008	2b
KY806027	UnitedKingdom	Europe	2009	2b
KY806019	UnitedKingdom	Europe	2008	2b
MF314262	Thailand	Asia	2013	2b
MF314264	Thailand	Asia	2013	2b

MF314265	Thailand	Asia	2013	2b
MF314263	Thailand	Asia	2013	2b
MF314233	Thailand	Asia	2012	2b
MF314240	Thailand	Asia	2012	2b
MF314241	Thailand	Asia	2012	2b
MF314242	Thailand	Asia	2012	2b
MF314286	Thailand	Asia	2014	2b
MF314222	Thailand	Asia	2011	2b
KY806057	UnitedKingdom	Europe	2014	2b
HM009331	Slovakia	Europe	2009	2b
HM009332	Slovakia	Europe	2009	2b
HM535639	China	Asia	2010	2b
KY806053	UnitedKingdom	Europe	2014	2b
KC238436	VietNam	Asia	2012	2b
KY806036	UnitedKingdom	Europe	2012	2b
KP245920	China	Asia	2012	2b
HM030908	China	Asia	2009	2b
MG715491	SouthKorea	Asia	2016	2b
KY806014	UnitedKingdom	Europe	2008	2b
KY806033	UnitedKingdom	Europe	2011	2b
KY806006	UnitedKingdom	Europe	2008	2b
KY806049	UnitedKingdom	Europe	2013	2b
KY806054	UnitedKingdom	Europe	2014	2b
KY806058	UnitedKingdom	Europe	2014	2b
MF169720	Taiwan	Asia	2014	2b
MF169737	Taiwan	Asia	2012	2b
MF169740	Taiwan	Asia	2013	2b
MF169754	Taiwan	Asia	2015	2b
MF169755	Taiwan	Asia	2015	2b
MF169728	Taiwan	Asia	2015	2b
MF169736	Taiwan	Asia	2015	2b
MF169757	Taiwan	Asia	2014	2b
MF169758	Taiwan	Asia	2014	2b
MF169723	Taiwan	Asia	2015	2b
MF169729	Taiwan	Asia	2014	2b
MF314269	Thailand	Asia	2013	2b
KY806000	UnitedKingdom	Europe	2008	2b
KT868487	USA	NorthAmerica	2007	2b
KT868500	USA	NorthAmerica	2007	2b
KT868505	USA	NorthAmerica	2007	2b
KM190987	USA	NorthAmerica	2007	2b
KM190993	USA	NorthAmerica	2012	2b
KM191016	USA	NorthAmerica	2012	2b
KM191025	USA	NorthAmerica	2013	2b
KM191026	USA	NorthAmerica	2013	2b
KM191037	USA	NorthAmerica	2011	2b

KM191042	USA	NorthAmerica	2011	2b
KT867835	USA	NorthAmerica	2007	2b
KT867836	USA	NorthAmerica	2007	2b
KT867837	USA	NorthAmerica	2007	2b
KT867849	USA	NorthAmerica	2009	2b
KT867853	USA	NorthAmerica	2009	2b
KT867855	USA	NorthAmerica	2013	2b
KT867883	USA	NorthAmerica	2013	2b
KT867907	USA	NorthAmerica	2013	2b
KT867950	USA	NorthAmerica	2010	2b
KT867966	USA	NorthAmerica	2013	2b
KT867984	USA	NorthAmerica	2007	2b
KT867987	USA	NorthAmerica	2007	2b
KT868006	USA	NorthAmerica	2007	2b
KT868038	USA	NorthAmerica	2007	2b
KT868075	USA	NorthAmerica	2007	2b
KT868076	USA	NorthAmerica	2007	2b
KT868084	USA	NorthAmerica	2007	2b
KT868086	USA	NorthAmerica	2007	2b
KT868088	USA	NorthAmerica	2007	2b
KT868101	USA	NorthAmerica	2007	2b
KT868105	USA	NorthAmerica	2007	2b
KT868107	USA	NorthAmerica	2007	2b
KT868109	USA	NorthAmerica	2007	2b
KT868116	USA	NorthAmerica	2007	2b
KT868124	USA	NorthAmerica	2007	2b
KT868132	USA	NorthAmerica	2007	2b
KT868145	USA	NorthAmerica	2007	2b
KT868153	USA	NorthAmerica	2007	2b
KT868155	USA	NorthAmerica	2007	2b
KT868166	USA	NorthAmerica	2007	2b
KT868168	USA	NorthAmerica	2007	2b
KT868172	USA	NorthAmerica	2007	2b
KT868179	USA	NorthAmerica	2007	2b
KT868181	USA	NorthAmerica	2007	2b
KT868289	USA	NorthAmerica	2007	2b
KT868294	USA	NorthAmerica	2007	2b
KT868344	USA	NorthAmerica	2007	2b
KT868364	USA	NorthAmerica	2013	2b
KT868376	USA	NorthAmerica	2007	2b
KT868438	USA	NorthAmerica	2008	2b
KT868442	USA	NorthAmerica	2007	2b
KT868454	USA	NorthAmerica	2007	2b
KT868455	USA	NorthAmerica	2008	2b
KT868457	USA	NorthAmerica	2007	2b
KT868458	USA	NorthAmerica	2008	2b

KT868472	USA	NorthAmerica	2007	2b
KT868475	USA	NorthAmerica	2007	2b
KT868512	USA	NorthAmerica	2007	2b
KT868514	USA	NorthAmerica	2007	2b
KU697067	USA	NorthAmerica	2015	2b
KU697095	USA	NorthAmerica	2014	2b
KU697102	USA	NorthAmerica	2014	2b
KM191009	USA	NorthAmerica	2012	2b
KM191017	USA	NorthAmerica	2012	2b
KM191053	USA	NorthAmerica	2013	2b
KM191058	USA	NorthAmerica	2013	2b
KT867947	USA	NorthAmerica	2007	2b
KT867949	USA	NorthAmerica	2009	2b
KT867954	USA	NorthAmerica	2009	2b
KT867964	USA	NorthAmerica	2009	2b
KT867968	USA	NorthAmerica	2009	2b
KT867991	USA	NorthAmerica	2010	2b
KT868028	USA	NorthAmerica	2008	2b
KT868068	USA	NorthAmerica	2007	2b
KT868082	USA	NorthAmerica	2007	2b
KT868090	USA	NorthAmerica	2007	2b
KT868094	USA	NorthAmerica	2007	2b
KT868126	USA	NorthAmerica	2007	2b
KT868128	USA	NorthAmerica	2007	2b
KT868130	USA	NorthAmerica	2007	2b
KT868140	USA	NorthAmerica	2007	2b
KT868143	USA	NorthAmerica	2007	2b
KT868158	USA	NorthAmerica	2007	2b
KT868164	USA	NorthAmerica	2007	2b
KT868290	USA	NorthAmerica	2012	2b
KT868292	USA	NorthAmerica	2007	2b
KT868363	USA	NorthAmerica	2007	2b
KT868387	USA	NorthAmerica	2007	2b
KT868420	USA	NorthAmerica	2007	2b
KT868498	USA	NorthAmerica	2007	2b
KT868516	USA	NorthAmerica	2007	2b
KU697109	USA	NorthAmerica	2014	2b
KM191086	USA	NorthAmerica	2013	2b
KT868488	USA	NorthAmerica	2008	2b
KT867988	USA	NorthAmerica	2010	2b
KM191120	USA	NorthAmerica	2013	2b
KT868002	USA	NorthAmerica	2007	2b
KT868057	USA	NorthAmerica	2007	2b
KT868048	USA	NorthAmerica	2007	2b
KT868149	USA	NorthAmerica	2007	2b
KT868502	USA	NorthAmerica	2007	2b

KT868066	USA	NorthAmerica	2007	2b
KT868079	USA	NorthAmerica	2007	2b
KT868443	USA	NorthAmerica	2009	2b
KT868446	USA	NorthAmerica	2009	2b
KT867982	USA	NorthAmerica	2008	2b
KT868031	USA	NorthAmerica	2014	2b
KT868032	USA	NorthAmerica	2015	2b
KT868177	USA	NorthAmerica	2007	2b
KM191029	USA	NorthAmerica	2013	2b
KM191036	USA	NorthAmerica	2011	2b
KM191117	USA	NorthAmerica	2013	2b
KT868429	USA	NorthAmerica	2007	2b
KT868073	USA	NorthAmerica	2007	2b
KT868043	USA	NorthAmerica	2007	2b
KT868162	USA	NorthAmerica	2007	2b
KT867960	USA	NorthAmerica	2009	2b
KT868151	USA	NorthAmerica	2007	2b
KT868428	USA	NorthAmerica	2007	2b
KT868451	USA	NorthAmerica	2007	2b
KT868445	USA	NorthAmerica	2008	2b
KT868448	USA	NorthAmerica	2008	2b
KT868460	USA	NorthAmerica	2007	2b
KT868465	USA	NorthAmerica	2008	2b
KT868468	USA	NorthAmerica	2008	2b
KT868470	USA	NorthAmerica	2008	2b
KT868473	USA	NorthAmerica	2008	2b
KT868476	USA	NorthAmerica	2008	2b
KT868478	USA	NorthAmerica	2007	2b
KT868481	USA	NorthAmerica	2007	2b
KT868485	USA	NorthAmerica	2008	2b
KT868493	USA	NorthAmerica	2007	2b
KT868506	USA	NorthAmerica	2007	2b
KT868507	USA	NorthAmerica	2007	2b
KT868509	USA	NorthAmerica	2007	2b
KT868461	USA	NorthAmerica	2008	2b
KT868494	USA	NorthAmerica	2008	2b
KM191035	USA	NorthAmerica	2011	2b
KM191092	USA	NorthAmerica	2013	2b
KX098718	USA	NorthAmerica	2015	2b
KC699530	USA	NorthAmerica	2012	2b
KC699531	USA	NorthAmerica	2012	2b
KM190996	USA	NorthAmerica	2012	2b
KM190997	USA	NorthAmerica	2012	2b
KM190983	USA	NorthAmerica	2013	2b
KM191020	USA	NorthAmerica	2013	2b
KM191021	USA	NorthAmerica	2013	2b

KT868078	USA	NorthAmerica	2007	2b
KT868118	USA	NorthAmerica	2007	2b
KT868174	USA	NorthAmerica	2007	2b
KU697034	USA	NorthAmerica	2015	2b
KX098691	USA	NorthAmerica	2015	2b
KX510077	USA	NorthAmerica	2016	2b
KT868511	USA	NorthAmerica	2007	2b
KM191057	USA	NorthAmerica	2013	2b
KT867864	USA	NorthAmerica	2013	2b
KT867867	USA	NorthAmerica	2013	2b
KT867865	USA	NorthAmerica	2013	2b
KM191005	USA	NorthAmerica	2012	2b
KU697091	USA	NorthAmerica	2014	2b
KM191079	USA	NorthAmerica	2013	2b
KT867854	USA	NorthAmerica	2012	2b
KT867955	USA	NorthAmerica	2010	2b
KT868469	USA	NorthAmerica	2007	2b
KT868508	USA	NorthAmerica	2007	2b
KT867985	USA	NorthAmerica	2010	2b
KT868072	USA	NorthAmerica	2007	2b
KT868134	USA	NorthAmerica	2007	2b
KM191033	USA	NorthAmerica	2013	2b
KM191108	USA	NorthAmerica	2013	2b
KU697025	USA	NorthAmerica	2015	2b
KU697040	USA	NorthAmerica	2015	2b
KM190988	USA	NorthAmerica	2012	2b
KT867876	USA	NorthAmerica	2013	2b
KT867942	USA	NorthAmerica	2013	2b
KT867943	USA	NorthAmerica	2013	2b
KU697055	USA	NorthAmerica	2015	2b
KU697059	USA	NorthAmerica	2015	2b
KT867944	USA	NorthAmerica	2013	2b
KT867945	USA	NorthAmerica	2013	2b
KT867946	USA	NorthAmerica	2013	2b
KU697269	USA	NorthAmerica	2015	2b
KM190989	USA	NorthAmerica	2012	2b
KM190991	USA	NorthAmerica	2012	2b
KM190992	USA	NorthAmerica	2012	2b
KT867956	USA	NorthAmerica	2012	2b
KT867969	USA	NorthAmerica	2012	2b
KT867972	USA	NorthAmerica	2012	2b
KT867973	USA	NorthAmerica	2012	2b
KM190990	USA	NorthAmerica	2012	2b
KM191063	USA	NorthAmerica	2013	2b
KT867858	USA	NorthAmerica	2013	2b
KT867965	USA	NorthAmerica	2012	2b

KT867975	USA	NorthAmerica	2012	2b
KT867977	USA	NorthAmerica	2012	2b
KM191067	USA	NorthAmerica	2013	2b
KT867851	USA	NorthAmerica	2013	2b
KT867857	USA	NorthAmerica	2012	2b
KT867877	USA	NorthAmerica	2013	2b
KT867881	USA	NorthAmerica	2013	2b
KT867884	USA	NorthAmerica	2013	2b
KT867970	USA	NorthAmerica	2013	2b
KM191071	USA	NorthAmerica	2013	2b
KM191088	USA	NorthAmerica	2013	2b
KM191125	USA	NorthAmerica	2013	2b
KT867850	USA	NorthAmerica	2012	2b
KT867909	USA	NorthAmerica	2013	2b
KT867912	USA	NorthAmerica	2013	2b
KT867951	USA	NorthAmerica	2012	2b
KU697060	USA	NorthAmerica	2015	2b
KM191077	USA	NorthAmerica	2013	2b
KT868046	USA	NorthAmerica	2012	2b
KT868052	USA	NorthAmerica	2012	2b
KT868136	USA	NorthAmerica	2007	2b
KT867886	USA	NorthAmerica	2013	2b
KT867888	USA	NorthAmerica	2013	2b
KT867891	USA	NorthAmerica	2013	2b
KT867896	USA	NorthAmerica	2013	2b
KT867900	USA	NorthAmerica	2013	2b
KT867901	USA	NorthAmerica	2013	2b
KT867905	USA	NorthAmerica	2013	2b
KT868490	USA	NorthAmerica	2007	2b
KM191045	USA	NorthAmerica	2013	2b
KM191015	USA	NorthAmerica	2012	2b
KT868288	USA	NorthAmerica	2012	2b
KT867894	USA	NorthAmerica	2013	2b
KM191068	USA	NorthAmerica	2013	2b
KT867911	USA	NorthAmerica	2013	2b
KT867957	USA	NorthAmerica	2013	2b
KM191099	USA	NorthAmerica	2013	2b
KM191089	USA	NorthAmerica	2013	2b
KU697178	USA	NorthAmerica	2015	2b
KX098776	USA	NorthAmerica	2016	2b
KT867913	USA	NorthAmerica	2013	2b
KT867915	USA	NorthAmerica	2013	2b
KT867916	USA	NorthAmerica	2013	2b
KT867917	USA	NorthAmerica	2013	2b
KT867918	USA	NorthAmerica	2013	2b
KT867919	USA	NorthAmerica	2013	2b

KT867920	USA	NorthAmerica	2013	2b
KT867922	USA	NorthAmerica	2013	2b
KT867921	USA	NorthAmerica	2013	2b
KT867914	USA	NorthAmerica	2013	2b
KT868039	USA	NorthAmerica	2011	2b
KT868338	USA	NorthAmerica	2008	2b
KM190994	USA	NorthAmerica	2012	2b
KT867879	USA	NorthAmerica	2013	2b
KU697264	USA	NorthAmerica	2015	2b
KU697227	USA	NorthAmerica	2015	2b
KX098692	USA	NorthAmerica	2015	2b
KX098781	USA	NorthAmerica	2016	2b
KM191059	USA	NorthAmerica	2013	2b
KM191124	USA	NorthAmerica	2013	2b
KM191031	USA	NorthAmerica	2013	2b
KT868414	USA	NorthAmerica	2012	2b
KT868415	USA	NorthAmerica	2012	2b
KT868416	USA	NorthAmerica	2012	2b
KT868417	USA	NorthAmerica	2012	2b
KM191022	USA	NorthAmerica	2013	2b
KT868522	USA	NorthAmerica	2013	2b
KM191062	USA	NorthAmerica	2013	2b
KM191091	USA	NorthAmerica	2013	2b
KT868496	USA	NorthAmerica	2007	2b
KT867872	USA	NorthAmerica	2013	2b
KT867874	USA	NorthAmerica	2013	2b
KT867962	USA	NorthAmerica	2013	2b
KM191115	USA	NorthAmerica	2013	2b
GQ995584	Brazil	SouthAmerica	2009	2b
KJ136262	Belarus	Europe	2011	2b
MF314267	Thailand	Asia	2013	2b
LC310724	Japan	Asia	2015	2b
LC310731	Japan	Asia	2015	2b
LC310734	Japan	Asia	2016	2b
KR058355	China	Asia	2014	2b
MF314198	Thailand	Asia	2009	2b
MF314199	Thailand	Asia	2009	2b
MF314200	Thailand	Asia	2009	2b
JN989553	China	Asia	2008	2b
JN989554	China	Asia	2008	2b
JN989556	China	Asia	2008	2b
EU296794	China	Asia	2007	2b
KC238430	VietNam	Asia	2012	2b
KM191049	USA	NorthAmerica	2012	2b
KX098688	USA	NorthAmerica	2015	2b
KP245926	China	Asia	2013	2b

KT868419	USA	NorthAmerica	2014	2b
KY806067	UnitedKingdom	Europe	2016	2b
KX169297	China	Asia	2015	2b
KY806028	UnitedKingdom	Europe	2009	2b
MF314197	Thailand	Asia	2009	2b
KF524259	China	Asia	2012	2b
KX808470	SouthKorea	Asia	2015	2b
KY806069	UnitedKingdom	Europe	2015	2b
JQ866919	Thailand	Asia	2010	2b
KU697126	USA	NorthAmerica	2014	2b
KU697074	USA	NorthAmerica	2015	2b
KU697076	USA	NorthAmerica	2015	2b
KU935610	China	Asia	2015	2b
JX872376	China	Asia	2011	2b
KM191084	USA	NorthAmerica	2013	2b
FJ948167	China	Asia	2008	2b
HM003569	China	Asia	2009	2b
KJ128269	Lithuania	Europe	2009	2b
KJ128270	Lithuania	Europe	2009	2b
HM003570	China	Asia	2009	2b
GU799576	USA	NorthAmerica	2009	2b
KJ128272	Lithuania	Europe	2009	2b
KJ128273	Lithuania	Europe	2009	2b
KY940536	China	Asia	2014	2b
LC004752	India	Asia	2013	2b
KU697031	USA	NorthAmerica	2015	2b
KX510057	USA	NorthAmerica	2016	2b
KJ679446	Germany	Europe	2012	2b
KX169298	China	Asia	2015	2d
KX169329	China	Asia	2015	2d
MF679586	China	Asia	2013	2d
EU521709	China	Asia	2008	2b
GQ995582	Brazil	SouthAmerica	2009	2b
GQ995581	Brazil	SouthAmerica	2009	2b
KJ680360	China	Asia	2012	2b
GQ995583	Brazil	SouthAmerica	2009	2b
KY806032	UnitedKingdom	Europe	2011	2b
LC004734	India	Asia	2013	2a
HQ378164	Serbia	Europe	2009	2a
KT867848	USA	NorthAmerica	2007	2a
KT867959	USA	NorthAmerica	2007	2a
KT868102	USA	NorthAmerica	2007	2a
HQ378165	Serbia	Europe	2009	2a
HQ378166	Serbia	Europe	2010	2a
MF314202	Thailand	Asia	2010	2a
MF314203	Thailand	Asia	2010	2a

MF314196	Thailand	Asia	2009	2a
MF314227	Thailand	Asia	2012	2a
KT868403	USA	NorthAmerica	2012	2a
KT868408	USA	NorthAmerica	2012	2a
KT868409	USA	NorthAmerica	2012	2a
KT868405	USA	NorthAmerica	2012	2a
KX169328	China	Asia	2015	2a
KX169330	China	Asia	2015	2a
KX169332	China	Asia	2015	2a
KX169333	China	Asia	2015	2a
MF679601	China	Asia	2017	2a
MF169677	Taiwan	Asia	2016	2a
MF679549	China	Asia	2017	2a
JN133305	Slovakia	Europe	2009	2a
KM191054	USA	NorthAmerica	2013	2a
KX929000	China	Asia	2015	2a
KX929002	China	Asia	2015	2a
KX929003	China	Asia	2015	2a
KX929019	China	Asia	2015	2a
KX929017	China	Asia	2015	2a
KM191069	USA	NorthAmerica	2013	2a
KT867860	USA	NorthAmerica	2013	2a
KT867869	USA	NorthAmerica	2013	2a
KU697176	USA	NorthAmerica	2015	2a
KU697290	USA	NorthAmerica	2015	2a
KX510071	USA	NorthAmerica	2016	2a
KX510075	USA	NorthAmerica	2016	2a
KX510076	USA	NorthAmerica	2016	2a
KT867903	USA	NorthAmerica	2013	2a
KT867862	USA	NorthAmerica	2013	2a
KT868452	USA	NorthAmerica	2008	2a
KM191123	USA	NorthAmerica	2013	2a
KT868069	USA	NorthAmerica	2007	2a
LC310725	Japan	Asia	2015	2a
LC310729	Japan	Asia	2015	2a
LC310740	Japan	Asia	2017	2a
KM191039	USA	NorthAmerica	2011	2a
KM191040	USA	NorthAmerica	2011	2a
KM191041	USA	NorthAmerica	2011	2a
EU747125	SouthKorea	Asia	2007	2a
KT868176	USA	NorthAmerica	2007	2a
JF683398	Taiwan	Asia	2007	2a
JF683403	Taiwan	Asia	2007	2a
KT868464	USA	NorthAmerica	2007	2a
KM190998	USA	NorthAmerica	2012	2a
KM191109	USA	NorthAmerica	2013	2a

KM191122	USA	NorthAmerica	2013	2a
KT867998	USA	NorthAmerica	2012	2a
KT868000	USA	NorthAmerica	2012	2a
KT868373	USA	NorthAmerica	2012	2a
KT868377	USA	NorthAmerica	2012	2a
KT868385	USA	NorthAmerica	2012	2a
KT868388	USA	NorthAmerica	2012	2a
KT868390	USA	NorthAmerica	2012	2a
KT868392	USA	NorthAmerica	2012	2a
KT868396	USA	NorthAmerica	2012	2a
KT868398	USA	NorthAmerica	2012	2a
KT868401	USA	NorthAmerica	2012	2a
KT868402	USA	NorthAmerica	2012	2a
KT868410	USA	NorthAmerica	2012	2a
KT868411	USA	NorthAmerica	2012	2a
KT868435	USA	NorthAmerica	2012	2a
KT868440	USA	NorthAmerica	2012	2a
KC699529	USA	NorthAmerica	2012	2a
KC702786	USA	NorthAmerica	2012	2a
KT868054	USA	NorthAmerica	2007	2a
KT868059	USA	NorthAmerica	2007	2a
KT868063	USA	NorthAmerica	2007	2a
KT868484	USA	NorthAmerica	2007	2a
KU697071	USA	NorthAmerica	2015	2a
KU697198	USA	NorthAmerica	2015	2a
KU697212	USA	NorthAmerica	2015	2a
KU697222	USA	NorthAmerica	2015	2a
KX098734	USA	NorthAmerica	2015	2a
KM191038	USA	NorthAmerica	2011	2a
KT868369	USA	NorthAmerica	2013	2a
KT868393	USA	NorthAmerica	2012	2a
KT868394	USA	NorthAmerica	2012	2a
KT868395	USA	NorthAmerica	2012	2a
KT868397	USA	NorthAmerica	2012	2a
KT868399	USA	NorthAmerica	2012	2a
KT868400	USA	NorthAmerica	2012	2a
KT868381	USA	NorthAmerica	2012	2a
KT868384	USA	NorthAmerica	2012	2a
KT868412	USA	NorthAmerica	2012	2a
KT868413	USA	NorthAmerica	2012	2a
KC702785	USA	NorthAmerica	2012	2a
KT868138	USA	NorthAmerica	2007	2a
KX510074	USA	NorthAmerica	2016	2a
KT868436	USA	NorthAmerica	2013	2a
KT868285	USA	NorthAmerica	2009	2a
KM191118	USA	NorthAmerica	2013	2a

KT868029	USA	NorthAmerica	2011	2a
KT868034	USA	NorthAmerica	2011	2a
KT868049	USA	NorthAmerica	2012	2a
KT868111	USA	NorthAmerica	2007	2a
KT868114	USA	NorthAmerica	2007	2a
KT868113	USA	NorthAmerica	2007	2a
KT868404	USA	NorthAmerica	2012	2a
KT868406	USA	NorthAmerica	2012	2a
KT868407	USA	NorthAmerica	2012	2a
KM191127	Mexico	SouthAmerica	2011	2a
KM191128	Mexico	SouthAmerica	2011	2a
KT868491	USA	NorthAmerica	2008	2a
KX510085	USA	NorthAmerica	2016	2a
KT868146	USA	NorthAmerica	2007	2a
KT867992	USA	NorthAmerica	2012	2a
KT867995	USA	NorthAmerica	2012	2a
KT867997	USA	NorthAmerica	2012	2a
KT867999	USA	NorthAmerica	2012	2a
LC310732	Japan	Asia	2015	2a
KT868482	USA	NorthAmerica	2008	2a
KT867994	USA	NorthAmerica	2007	2a
KT868467	USA	NorthAmerica	2007	2a
KT868321	USA	NorthAmerica	2007	2a
KT868323	USA	NorthAmerica	2007	2a
KT868380	USA	NorthAmerica	2007	2a
KT868004	USA	NorthAmerica	2007	2a
KT868368	USA	NorthAmerica	2007	2a
KT867990	USA	NorthAmerica	2007	2a
KT868080	USA	NorthAmerica	2007	2a
MF314204	Thailand	Asia	2010	2a
MF314206	Thailand	Asia	2010	2a
MF314205	Thailand	Asia	2010	2a
KT867923	USA	NorthAmerica	2013	2a
KT867924	USA	NorthAmerica	2013	2a
KT867925	USA	NorthAmerica	2013	2a
KT867926	USA	NorthAmerica	2013	2a
KT867927	USA	NorthAmerica	2013	2a
KT867928	USA	NorthAmerica	2013	2a
KT867929	USA	NorthAmerica	2013	2a
KT867930	USA	NorthAmerica	2013	2a
KT867931	USA	NorthAmerica	2013	2a
KT867932	USA	NorthAmerica	2013	2a
KT867933	USA	NorthAmerica	2013	2a
KT867934	USA	NorthAmerica	2013	2a
KT868463	USA	NorthAmerica	2007	2a
KT868317	USA	NorthAmerica	2007	2a

KT868418	USA	NorthAmerica	2009	2a
KT868347	USA	NorthAmerica	2007	2a
KT868170	USA	NorthAmerica	2007	2a
KT867952	USA	NorthAmerica	2013	2a
KT868479	USA	NorthAmerica	2008	2a
KT868001	USA	NorthAmerica	2012	2a
KT868365	USA	NorthAmerica	2007	2a
KT868160	USA	NorthAmerica	2007	2a
KT868372	USA	NorthAmerica	2007	2a
KT868120	USA	NorthAmerica	2007	2a
KT868122	USA	NorthAmerica	2007	2a
KT868092	USA	NorthAmerica	2007	2a
KT868313	USA	NorthAmerica	2007	2a
KX510064	USA	NorthAmerica	2016	2a
KT868097	USA	NorthAmerica	2007	2a
MF679547	China	Asia	2017	2a
LC310726	Japan	Asia	2015	2a
LC310730	Japan	Asia	2015	2a
LC310728	Japan	Asia	2015	2a
KY940527	China	Asia	2014	2a
KY940529	China	Asia	2014	2a
KY940532	China	Asia	2013	2a
KX929001	China	Asia	2015	2b
KJ094599	Brazil	SouthAmerica	2010	2c
KP824717	China	Asia	2014	2d
KT795287	Mexico	NorthAmerica	2014	2e
KT795290	USA	NorthAmerica	2015	2e
KT795289	USA	NorthAmerica	2015	2e
KT870146	USA	NorthAmerica	2015	2e
MF589524	China	Asia	2017	2e
MF589523	China	Asia	2017	2e
KT870147	USA	NorthAmerica	2015	2e
KT795288	USA	NorthAmerica	2015	2e
KT867795	USA	NorthAmerica	2013	2e
KT867796	USA	NorthAmerica	2013	2e
KT867798	USA	NorthAmerica	2012	2e
KT867800	USA	NorthAmerica	2012	2e
KT867803	USA	NorthAmerica	2015	2e
KX098754	USA	NorthAmerica	2016	2e
KX510062	USA	NorthAmerica	2016	2e
KX510081	USA	NorthAmerica	2016	2e
KT867802	USA	NorthAmerica	2015	2e
KT867801	USA	NorthAmerica	2012	2e
KX510067	USA	NorthAmerica	2016	2e
KT867794	USA	NorthAmerica	2013	2e
KY940535	China	Asia	2015	2a

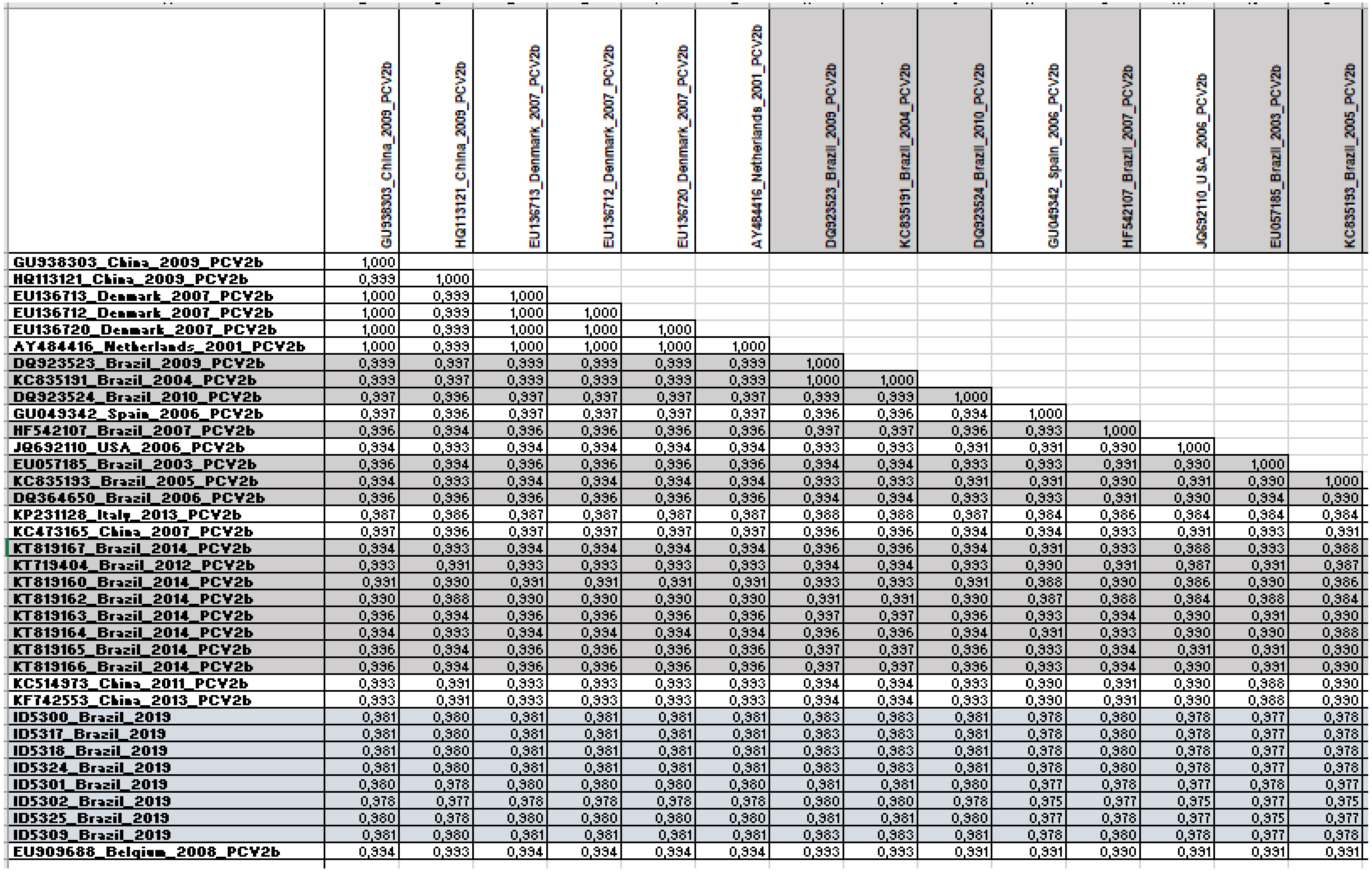
KY940520	China	Asia	2013	2b
KY940521	China	Asia	2013	2b
KY940523	China	Asia	2013	2b
KY940525	China	Asia	2014	2b
KY940531	China	Asia	2013	2d
KY940542	China	Asia	2014	2d
ID4346	Brasil	SouthAmerica	2019	2d
ID4347	Brazil	SouthAmerica	2019	2d
ID5084	Brazil	SouthAmerica	2019	2d
ID5298	Brazil	SouthAmerica	2019	2d
ID5299	Brazil	SouthAmerica	2019	2d
ID5311	Brazil	SouthAmerica	2019	2d
ID5313	Brazil	SouthAmerica	2019	2d
ID5316	Brazil	SouthAmerica	2019	2d
ID5086	Brazil	SouthAmerica	2019	2d
ID5093	Brazil	SouthAmerica	2019	2d
ID5094	Brazil	SouthAmerica	2019	2d
ID5320	Brazil	SouthAmerica	2019	2d
ID5305	Brazil	SouthAmerica	2019	2d
ID5315	Brazil	SouthAmerica	2019	2d
ID5097	Brazil	SouthAmerica	2019	2d
ID5300	Brazil	SouthAmerica	2019	2b
ID5317	Brazil	SouthAmerica	2019	2b
ID5318	Brazil	SouthAmerica	2019	2b
ID5324	Brazil	SouthAmerica	2019	2b
ID5301	Brazil	SouthAmerica	2019	2b
ID5302	Brazil	SouthAmerica	2019	2b
ID5325	Brazil	SouthAmerica	2019	2b
ID5309	Brazil	SouthAmerica	2019	2b
ID5329	Brazil	SouthAmerica	2017	2b
JN006445	Romania	Europe	2010	2d
JN006448	Romania	Europe	2010	2d
KC620504	SouthKorea	Asia	2011	2d
KC620510	SouthKorea	Asia	2011	2d
KC620508	SouthKorea	Asia	2012	2d
KR559709	Italy	Europe	2011	2d
KR559711	Italy	Europe	2011	2d
KR559712	Italy	Europe	2011	2d
KR559724	Italy	Europe	2011	2d
KP420187	Ukraine	Europe	2011	2d
KC261600	Brazil	SouthAmerica	2008	2b
KC261601	Brazil	SouthAmerica	2008	2b
KP420196	Ukraine	Europe	2011	2b
KP420195	Ukraine	Europe	2011	2b
KP420201	Ukraine	Europe	2012	2b
KP420188	Ukraine	Europe	2010	2b

KP420193	Ukraine	Europe	2011	2b
KP420198	Ukraine	Europe	2010	2b
KP420192	Ukraine	Europe	2011	2b
KT216672	Brazil	SouthAmerica	2012	2b
KT216673	Brazil	SouthAmerica	2012	2b
KT216675	Brazil	SouthAmerica	2012	2b
KT216676	Brazil	SouthAmerica	2012	2b
KT216674	Brazil	SouthAmerica	2012	2b
KP420200	Ukraine	Europe	2012	2b
KT216677	Brazil	SouthAmerica	2012	2b
KP420190	Ukraine	Europe	2011	2b
KP420181	Ukraine	Europe	2011	2b
KP420183	Ukraine	Europe	2011	2b
KP420184	Ukraine	Europe	2011	2b
KP420185	Ukraine	Europe	2011	2b
KP420182	Ukraine	Europe	2011	2b
KP420189	Ukraine	Europe	2010	2b
KP420191	Ukraine	Europe	2011	2b
KP420199	Ukraine	Europe	2012	2a
KP420203	Ukraine	Europe	2012	2a
KP420194	Ukraine	Europe	2011	2a
KP420202	Ukraine	Europe	2012	2a
KP420186	Ukraine	Europe	2011	2a
HQ591381	Croatia	Europe	2009	2a
JN006443	Romania	Europe	2008	2d
JN006444	Romania	Europe	2009	2d
JN006447	Romania	Europe	2009	2d
JN006449	Romania	Europe	2008	2d
JN382158	Romania	Europe	2011	2d
JN006450	Romania	Europe	2010	2d
JN006446	Romania	Europe	2010	2d
JN382179	Romania	Europe	2011	2d
JN382183	Romania	Europe	2011	2d
KP420197	Ukraine	Europe	2010	2g
JN382163	Romania	Europe	2011	2d
JN382170	Romania	Europe	2011	2d
JN006451	Romania	Europe	2008	2b
JN006452	Romania	Europe	2008	2b
JN006458	Romania	Europe	2008	2b
JN382166	Romania	Europe	2015	2b
JN382172	Romania	Europe	2011	2b
JN382173	Romania	Europe	2011	2b
JN382174	Romania	Europe	2011	2b
JN382180	Romania	Europe	2011	2b
KP768470	Slovakia	Europe	2012	2b
KP768475	Slovakia	Europe	2012	2a

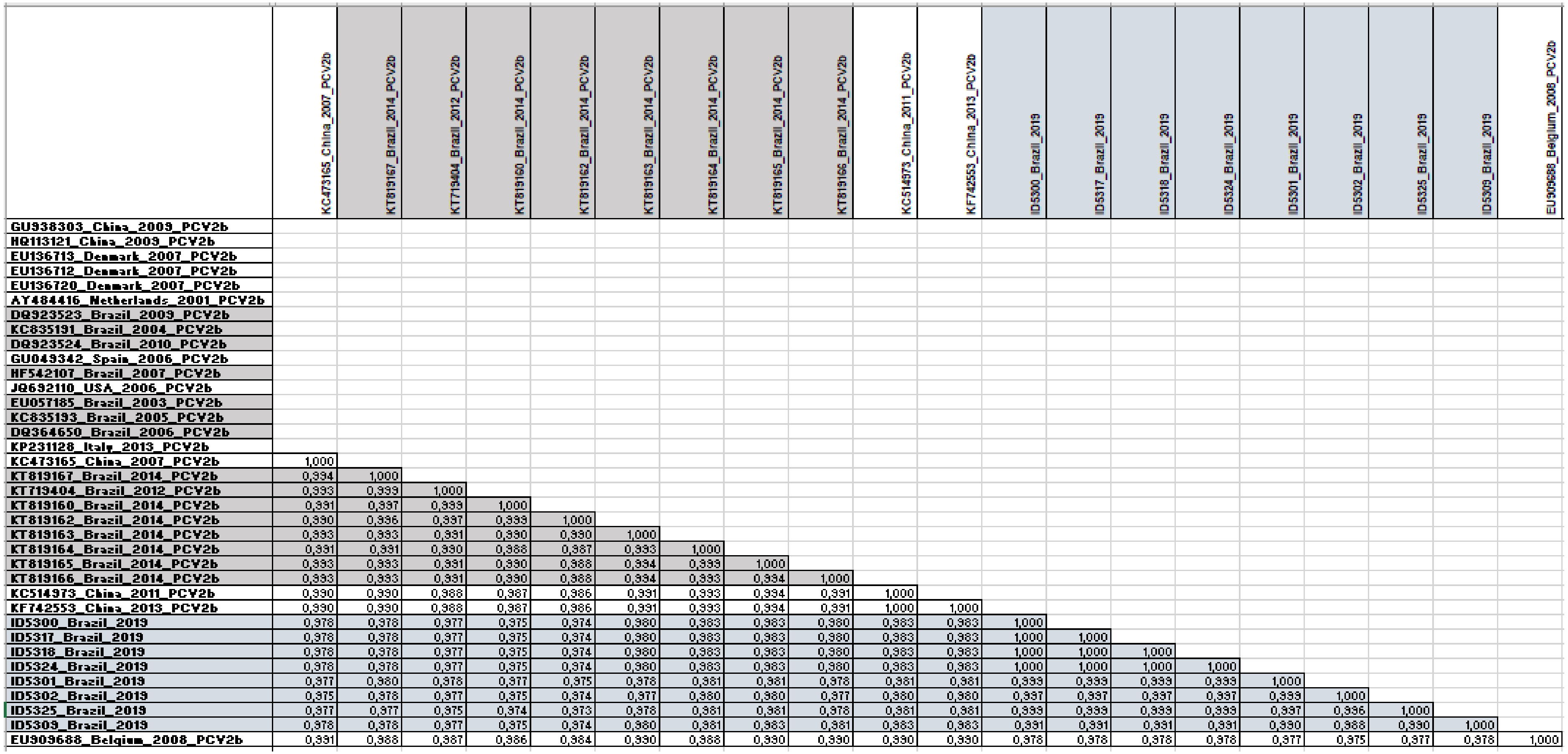
KP768486	Slovakia	Europe	2012	2b
JN006462	Romania	Europe	2010	2b
KP768468	Slovakia	Europe	2012	2b
KP768471	Slovakia	Europe	2012	2b
JN006461	Romania	Europe	2010	2b
KR559701	Italy	Europe	2011	2b
KP768469	Slovakia	Europe	2012	2b
KR559722	Italy	Europe	2011	2b
KC620503	SouthKorea	Asia	2011	2b
KC620507	SouthKorea	Asia	2011	2b
KC620512	SouthKorea	Asia	2012	2b
KC620520	SouthKorea	Asia	2011	2b
KR559723	Italy	Europe	2011	2b
KR559704	Italy	Europe	2010	2b
KR559720	Italy	Europe	2011	2b
JN382165	Romania	Europe	2011	2b
KR559715	Italy	Europe	2011	2b
KR559725	Italy	Europe	2011	2b
JN006463	Romania	Europe	2010	2b
KC620513	SouthKorea	Asia	2012	2b
KC620515	SouthKorea	Asia	2012	2b
KC620514	SouthKorea	Asia	2010	2b
KR559717	Italy	Europe	2011	2b
KR559718	Italy	Europe	2011	2b
KR559719	Italy	Europe	2011	2b
KC620516	SouthKorea	Asia	2011	2b
KC620517	SouthKorea	Asia	2011	2b
KP768485	Slovakia	Europe	2012	2b
KR559698	Italy	Europe	2009	2b
KR559707	Italy	Europe	2011	2b
KR559721	Italy	Europe	2011	2b
KR559708	Italy	Europe	2011	2b
KR559714	Italy	Europe	2011	2b
KP768481	Slovakia	Europe	2012	2b
KR559702	Italy	Europe	2010	2b
KR559703	Italy	Europe	2010	2b
KR559705	Italy	Europe	2010	2b
JN006455	Romania	Europe	2008	2b
JN006456	Romania	Europe	2008	2b
KP768484	Slovakia	Europe	2012	2b
JN382176	Romania	Europe	2011	2b
KP768473	Slovakia	Europe	2012	2b
JN006459	Romania	Europe	2010	2b
JN006460	Romania	Europe	2010	2b
KC620506	SouthKorea	Asia	2011	2b
KP768476	Slovakia	Europe	2012	2b

JN006453	Romania	Europe	2008	2b
JN006454	Romania	Europe	2008	2b
JN382171	Romania	Europe	2011	2b
JN006464	Romania	Europe	2010	2b
KP768482	Slovakia	Europe	2012	2b
JN382181	Romania	Europe	2011	2b
JN382182	Romania	Europe	2011	2b
KR559699	Italy	Europe	2009	2b
KR559700	Italy	Europe	2009	2b
KP768479	Slovakia	Europe	2012	2b
KP768483	Slovakia	Europe	2012	2b
KR559713	Italy	Europe	2011	2b
KP768478	Slovakia	Europe	2012	2b
KC620505	SouthKorea	Asia	2012	2b
KC620518	SouthKorea	Asia	2012	2b
KR559706	Italy	Europe	2012	2b
KR559716	Italy	Europe	2011	2b
KC620519	SouthKorea	Asia	2011	2b
KP768477	Slovakia	Europe	2012	2b
KP768472	Slovakia	Europe	2012	2b
KC620502	SouthKorea	Asia	2011	2b
JN382167	Romania	Europe	2011	2b
JN382184	Romania	Europe	2011	2b
KC620509	SouthKorea	Asia	2010	2b
JN006457	Romania	Europe	2008	2b
JN382168	Romania	Europe	2011	2b
JN382169	Romania	Europe	2011	2b
KC620511	SouthKorea	Asia	2010	2b
KR559710	Italy	Europe	2011	2b
JN382164	Romania	Europe	2011	2b
JN382159	Romania	Europe	2011	2b
JN382175	Romania	Europe	2011	2b
KP768480	Slovakia	Europe	2012	2a
KP768467	Slovakia	Europe	2012	2a
KP768474	Slovakia	Europe	2012	2a
JN006465	Romania	Europe	2010	2a
JN382161	Romania	Europe	2011	2a
JN382162	Romania	Europe	2011	2a
JN382177	Romania	Europe	2011	2a
JN382157	Romania	Europe	2011	2a
JN382160	Romania	Europe	2011	2a
JN382178	Romania	Europe	2011	2a

Supplementary Table 3: Estimates of Evolutionary Divergence between PCV2b Sequences. The number of base differences per site from between sequences are shown. This analysis involved 36 nucleotide sequences. Codon positions included were 1st+2nd+3rd+Noncoding. All ambiguous positions were removed for each sequence pair (pairwise deletion option). There were a total of 693 positions in the final dataset. Evolutionary analyses were conducted in MEGA X (KUMAR et al., 2018)

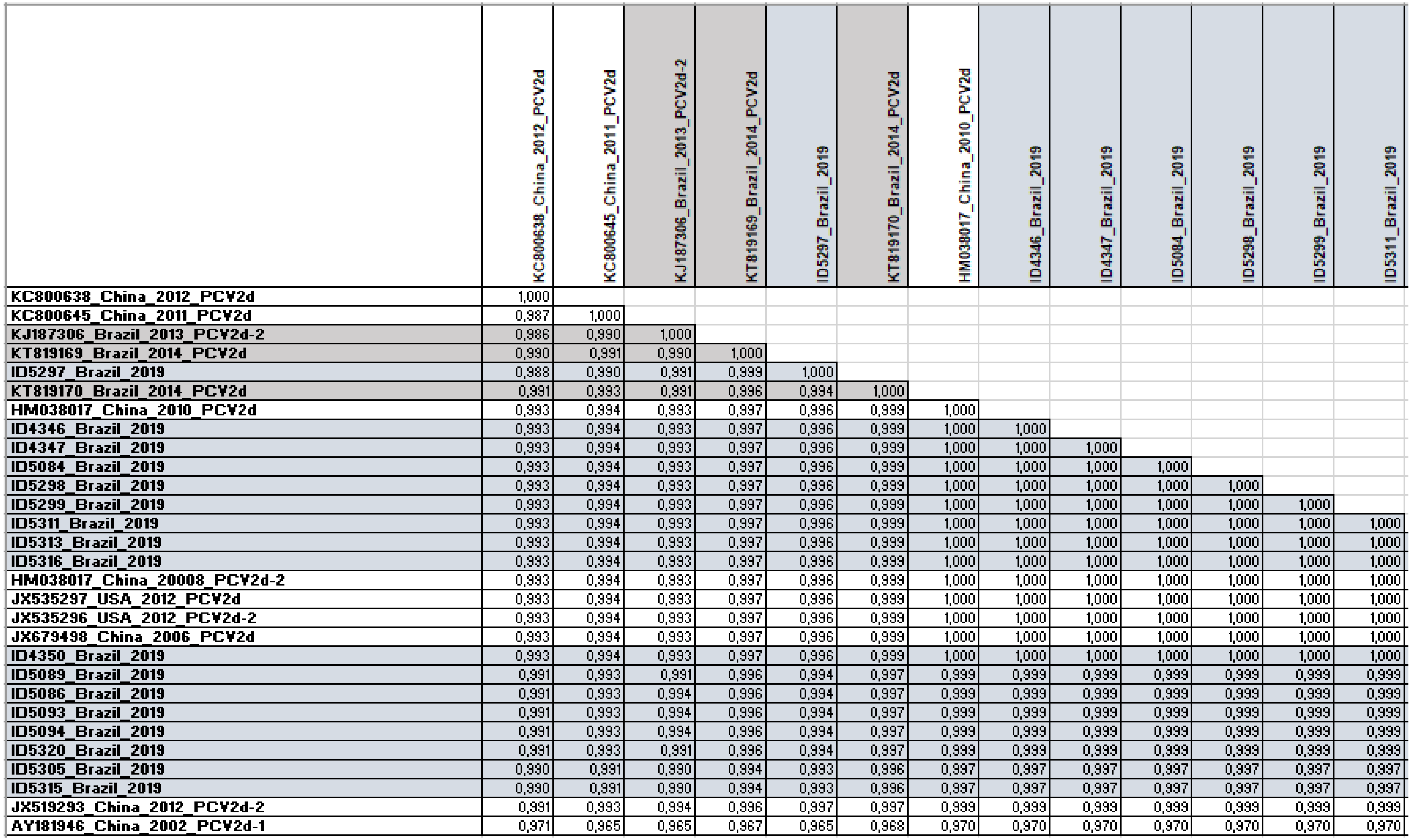


	GU938303_China_2009_PCV2b	HQ113121_China_2009_PCV2b	EU136713_Denmark_2007_PCV2b	EU136712_Denmark_2007_PCV2b	EU136720_Denmark_2007_PCV2b	AY484416_Netherlands_2001_PCV2b	DQ923523_Brazil_2009_PCV2b	KC835191_Brazil_2004_PCV2b	DQ923524_Brazil_2010_PCV2b	GU049342_Spain_2006_PCV2b	HF542107_Brazil_2007_PCV2b	JQ692110_USA_2006_PCV2b	EU057185_Brazil_2003_PCV2b	KC835193_Brazil_2005_PCV2b
GU938303_China_2009_PCV2b	1,000													
HQ113121_China_2009_PCV2b	0,999	1,000												
EU136713_Denmark_2007_PCV2b	1,000	0,999	1,000											
EU136712_Denmark_2007_PCV2b	1,000	0,999	1,000	1,000										
EU136720_Denmark_2007_PCV2b	1,000	0,999	1,000	1,000	1,000									
AY484416_Netherlands_2001_PCV2b	1,000	0,999	1,000	1,000	1,000	1,000								
DQ923523_Brazil_2009_PCV2b	0,999	0,997	0,999	0,999	0,999	0,999	1,000							
KC835191_Brazil_2004_PCV2b	0,999	0,997	0,999	0,999	0,999	0,999	1,000	1,000						
DQ923524_Brazil_2010_PCV2b	0,997	0,996	0,997	0,997	0,997	0,997	0,999	0,999	1,000					
GU049342_Spain_2006_PCV2b	0,997	0,996	0,997	0,997	0,997	0,997	0,996	0,996	0,994	1,000				
HF542107_Brazil_2007_PCV2b	0,996	0,994	0,996	0,996	0,996	0,996	0,997	0,997	0,996	0,993	1,000			
JQ692110_USA_2006_PCV2b	0,994	0,993	0,994	0,994	0,994	0,994	0,993	0,993	0,991	0,991	0,990	1,000		
EU057185_Brazil_2003_PCV2b	0,996	0,994	0,996	0,996	0,996	0,996	0,994	0,994	0,993	0,993	0,991	0,990	1,000	
KC835193_Brazil_2005_PCV2b	0,994	0,993	0,994	0,994	0,994	0,994	0,993	0,993	0,991	0,991	0,990	0,991	0,990	1,000
DQ364650_Brazil_2006_PCV2b	0,996	0,996	0,996	0,996	0,996	0,996	0,994	0,994	0,993	0,993	0,991	0,990	0,994	0,990
KP231128_Italy_2013_PCV2b	0,987	0,986	0,987	0,987	0,987	0,987	0,988	0,988	0,987	0,984	0,986	0,984	0,984	0,984
KC473165_China_2007_PCV2b	0,997	0,996	0,997	0,997	0,997	0,997	0,996	0,996	0,994	0,994	0,993	0,991	0,993	0,991
KT819167_Brazil_2014_PCV2b	0,994	0,993	0,994	0,994	0,994	0,994	0,996	0,996	0,994	0,991	0,993	0,988	0,993	0,988
KT719404_Brazil_2012_PCV2b	0,993	0,991	0,993	0,993	0,993	0,993	0,994	0,994	0,993	0,990	0,991	0,987	0,991	0,987
KT819160_Brazil_2014_PCV2b	0,991	0,990	0,991	0,991	0,991	0,991	0,993	0,993	0,991	0,988	0,990	0,986	0,990	0,986
KT819162_Brazil_2014_PCV2b	0,990	0,988	0,990	0,990	0,990	0,990	0,991	0,991	0,990	0,987	0,988	0,984	0,988	0,984
KT819163_Brazil_2014_PCV2b	0,996	0,994	0,996	0,996	0,996	0,996	0,997	0,997	0,996	0,993	0,994	0,990	0,991	0,990
KT819164_Brazil_2014_PCV2b	0,994	0,993	0,994	0,994	0,994	0,994	0,996	0,996	0,994	0,991	0,993	0,990	0,990	0,988
KT819165_Brazil_2014_PCV2b	0,996	0,994	0,996	0,996	0,996	0,996	0,997	0,997	0,996	0,993	0,994	0,991	0,991	0,990
KT819166_Brazil_2014_PCV2b	0,996	0,994	0,996	0,996	0,996	0,996	0,997	0,997	0,996	0,993	0,994	0,990	0,991	0,990
KC514973_China_2011_PCV2b	0,993	0,991	0,993	0,993	0,993	0,993	0,994	0,994	0,993	0,990	0,991	0,990	0,988	0,990
KF742553_China_2013_PCV2b	0,993	0,991	0,993	0,993	0,993	0,993	0,994	0,994	0,993	0,990	0,991	0,990	0,988	0,990
ID5300_Brazil_2019	0,981	0,980	0,981	0,981	0,981	0,981	0,983	0,983	0,981	0,978	0,980	0,978	0,977	0,978
ID5317_Brazil_2019	0,981	0,980	0,981	0,981	0,981	0,981	0,983	0,983	0,981	0,978	0,980	0,978	0,977	0,978
ID5318_Brazil_2019	0,981	0,980	0,981	0,981	0,981	0,981	0,983	0,983	0,981	0,978	0,980	0,978	0,977	0,978
ID5324_Brazil_2019	0,981	0,980	0,981	0,981	0,981	0,981	0,983	0,983	0,981	0,978	0,980	0,978	0,977	0,978
ID5301_Brazil_2019	0,980	0,978	0,980	0,980	0,980	0,980	0,981	0,981	0,980	0,977	0,978	0,977	0,978	0,977
ID5302_Brazil_2019	0,978	0,977	0,978	0,978	0,978	0,978	0,980	0,980	0,978	0,975	0,977	0,975	0,977	0,975
ID5325_Brazil_2019	0,980	0,978	0,980	0,980	0,980	0,980	0,981	0,981	0,980	0,977	0,978	0,977	0,975	0,977
ID5309_Brazil_2019	0,981	0,980	0,981	0,981	0,981	0,981	0,983	0,983	0,981	0,978	0,980	0,978	0,977	0,978
EU909688_Belgium_2008_PCV2b	0,994	0,993	0,994	0,994	0,994	0,994	0,993	0,993	0,991	0,991	0,990	0,991	0,991	0,991



	KC473165_China_2007_PCV2b	KT819167_Brazil_2014_PCV2b	KT719404_Brazil_2012_PCV2b	KT819160_Brazil_2014_PCV2b	KT819162_Brazil_2014_PCV2b	KT819163_Brazil_2014_PCV2b	KT819164_Brazil_2014_PCV2b	KT819165_Brazil_2014_PCV2b	KT819166_Brazil_2014_PCV2b	KC514973_China_2011_PCV2b	KF742553_China_2013_PCV2b	ID5300_Brazil_2019	ID5317_Brazil_2019	ID5318_Brazil_2019	ID5324_Brazil_2019	ID5301_Brazil_2019	ID5302_Brazil_2019	ID5325_Brazil_2019	ID5309_Brazil_2019	EU909688_Belgium_2008_PCV2b
GU938303_China_2009_PCV2b																				
HQ113121_China_2009_PCV2b																				
EU136713_Denmark_2007_PCV2b																				
EU136712_Denmark_2007_PCV2b																				
EU136720_Denmark_2007_PCV2b																				
AY484416_Netherlands_2001_PCV2b																				
DQ923523_Brazil_2003_PCV2b																				
KC835191_Brazil_2004_PCV2b																				
DQ923524_Brazil_2010_PCV2b																				
GU049342_Spain_2006_PCV2b																				
HF542107_Brazil_2007_PCV2b																				
JQ692110_USA_2006_PCV2b																				
EU057185_Brazil_2003_PCV2b																				
KC835193_Brazil_2005_PCV2b																				
DQ364650_Brazil_2006_PCV2b																				
KP231128_Italy_2013_PCV2b																				
KC473165_China_2007_PCV2b	1,000																			
KT819167_Brazil_2014_PCV2b	0,994	1,000																		
KT719404_Brazil_2012_PCV2b	0,993	0,999	1,000																	
KT819160_Brazil_2014_PCV2b	0,991	0,997	0,999	1,000																
KT819162_Brazil_2014_PCV2b	0,990	0,996	0,997	0,999	1,000															
KT819163_Brazil_2014_PCV2b	0,993	0,993	0,991	0,990	0,990	1,000														
KT819164_Brazil_2014_PCV2b	0,991	0,991	0,990	0,988	0,987	0,993	1,000													
KT819165_Brazil_2014_PCV2b	0,993	0,993	0,991	0,990	0,988	0,994	0,999	1,000												
KT819166_Brazil_2014_PCV2b	0,993	0,993	0,991	0,990	0,988	0,994	0,993	0,994	1,000											
KC514973_China_2011_PCV2b	0,990	0,990	0,988	0,987	0,986	0,991	0,993	0,994	0,991	1,000										
KF742553_China_2013_PCV2b	0,990	0,990	0,988	0,987	0,986	0,991	0,993	0,994	0,991	1,000	1,000									
ID5300_Brazil_2019	0,978	0,978	0,977	0,975	0,974	0,980	0,983	0,983	0,980	0,983	0,983	1,000								
ID5317_Brazil_2019	0,978	0,978	0,977	0,975	0,974	0,980	0,983	0,983	0,980	0,983	0,983	1,000	1,000							
ID5318_Brazil_2019	0,978	0,978	0,977	0,975	0,974	0,980	0,983	0,983	0,980	0,983	0,983	1,000	1,000	1,000						
ID5324_Brazil_2019	0,978	0,978	0,977	0,975	0,974	0,980	0,983	0,983	0,980	0,983	0,983	1,000	1,000	1,000	1,000					
ID5301_Brazil_2019	0,977	0,980	0,978	0,977	0,975	0,978	0,981	0,981	0,978	0,981	0,981	0,999	0,999	0,999	0,999	1,000				
ID5302_Brazil_2019	0,975	0,978	0,977	0,975	0,974	0,977	0,980	0,980	0,977	0,980	0,980	0,997	0,997	0,997	0,997	0,999	1,000			
ID5325_Brazil_2019	0,977	0,977	0,975	0,974	0,973	0,978	0,981	0,981	0,978	0,981	0,981	0,999	0,999	0,999	0,999	0,997	0,996	1,000		
ID5309_Brazil_2019	0,978	0,978	0,977	0,975	0,974	0,980	0,981	0,983	0,981	0,983	0,983	0,991	0,991	0,991	0,991	0,990	0,988	0,990	1,000	
EU909688_Belgium_2008_PCV2b	0,991	0,988	0,987	0,986	0,984	0,990	0,988	0,990	0,990	0,990	0,990	0,978	0,978	0,978	0,978	0,977	0,975	0,977	0,978	1,000

Supplementary Table 4: Estimates of Evolutionary Divergence between PCV2d Sequences. The number of base differences per site from between sequences are shown. This analysis involved 29 nucleotide sequences. Codon positions included were 1st+2nd+3rd+Noncoding. All ambiguous positions were removed for each sequence pair (pairwise deletion option). There were a total of 693 positions in the final dataset. Evolutionary analyses were conducted in MEGA X (KUMAR et al., 2018)



	KC800638_China_2012_PCV2d	KC800645_China_2011_PCV2d	KJ187306_Brazil_2013_PCV2d-2	KT819169_Brazil_2014_PCV2d	ID5297_Brazil_2019	KT819170_Brazil_2014_PCV2d	HM038017_China_2010_PCV2d	ID4346_Brazil_2019	ID4347_Brazil_2019	ID5084_Brazil_2019	ID5298_Brazil_2019	ID5299_Brazil_2019	ID5311_Brazil_2019
KC800638_China_2012_PCV2d	1,000												
KC800645_China_2011_PCV2d	0,987	1,000											
KJ187306_Brazil_2013_PCV2d-2	0,986	0,990	1,000										
KT819169_Brazil_2014_PCV2d	0,990	0,991	0,990	1,000									
ID5297_Brazil_2019	0,988	0,990	0,991	0,999	1,000								
KT819170_Brazil_2014_PCV2d	0,991	0,993	0,991	0,996	0,994	1,000							
HM038017_China_2010_PCV2d	0,993	0,994	0,993	0,997	0,996	0,999	1,000						
ID4346_Brazil_2019	0,993	0,994	0,993	0,997	0,996	0,999	1,000	1,000					
ID4347_Brazil_2019	0,993	0,994	0,993	0,997	0,996	0,999	1,000	1,000	1,000				
ID5084_Brazil_2019	0,993	0,994	0,993	0,997	0,996	0,999	1,000	1,000	1,000	1,000			
ID5298_Brazil_2019	0,993	0,994	0,993	0,997	0,996	0,999	1,000	1,000	1,000	1,000	1,000		
ID5299_Brazil_2019	0,993	0,994	0,993	0,997	0,996	0,999	1,000	1,000	1,000	1,000	1,000	1,000	
ID5311_Brazil_2019	0,993	0,994	0,993	0,997	0,996	0,999	1,000	1,000	1,000	1,000	1,000	1,000	1,000
ID5313_Brazil_2019	0,993	0,994	0,993	0,997	0,996	0,999	1,000	1,000	1,000	1,000	1,000	1,000	1,000
ID5316_Brazil_2019	0,993	0,994	0,993	0,997	0,996	0,999	1,000	1,000	1,000	1,000	1,000	1,000	1,000
HM038017_China_20008_PCV2d-2	0,993	0,994	0,993	0,997	0,996	0,999	1,000	1,000	1,000	1,000	1,000	1,000	1,000
JX535297_USA_2012_PCV2d	0,993	0,994	0,993	0,997	0,996	0,999	1,000	1,000	1,000	1,000	1,000	1,000	1,000
JX535296_USA_2012_PCV2d-2	0,993	0,994	0,993	0,997	0,996	0,999	1,000	1,000	1,000	1,000	1,000	1,000	1,000
JX679498_China_2006_PCV2d	0,993	0,994	0,993	0,997	0,996	0,999	1,000	1,000	1,000	1,000	1,000	1,000	1,000
ID4350_Brazil_2019	0,993	0,994	0,993	0,997	0,996	0,999	1,000	1,000	1,000	1,000	1,000	1,000	1,000
ID5089_Brazil_2019	0,991	0,993	0,991	0,996	0,994	0,997	0,999	0,999	0,999	0,999	0,999	0,999	0,999
ID5086_Brazil_2019	0,991	0,993	0,994	0,996	0,994	0,997	0,999	0,999	0,999	0,999	0,999	0,999	0,999
ID5093_Brazil_2019	0,991	0,993	0,994	0,996	0,994	0,997	0,999	0,999	0,999	0,999	0,999	0,999	0,999
ID5094_Brazil_2019	0,991	0,993	0,994	0,996	0,994	0,997	0,999	0,999	0,999	0,999	0,999	0,999	0,999
ID5320_Brazil_2019	0,991	0,993	0,991	0,996	0,994	0,997	0,999	0,999	0,999	0,999	0,999	0,999	0,999
ID5305_Brazil_2019	0,990	0,991	0,990	0,994	0,993	0,996	0,997	0,997	0,997	0,997	0,997	0,997	0,997
ID5315_Brazil_2019	0,990	0,991	0,990	0,994	0,993	0,996	0,997	0,997	0,997	0,997	0,997	0,997	0,997
JX519293_China_2012_PCV2d-2	0,991	0,993	0,994	0,996	0,997	0,997	0,999	0,999	0,999	0,999	0,999	0,999	0,999
AY181946_China_2002_PCV2d-1	0,971	0,965	0,965	0,967	0,965	0,968	0,970	0,970	0,970	0,970	0,970	0,970	0,970

	ID5313_Brazil_2019	ID5316_Brazil_2019	HM038017_China_20008_PCV2d-2	JX535297_USA_2012_PCV2d	JX535296_USA_2012_PCV2d-2	JX679498_China_2006_PCV2d	ID4350_Brazil_2019	ID5089_Brazil_2019	ID5086_Brazil_2019	ID5093_Brazil_2019	ID5094_Brazil_2019	ID5320_Brazil_2019	ID5305_Brazil_2019	ID5315_Brazil_2019	JX519293_China_2012_PCV2d-2	AY181946_China_2002_PCV2d-1
KC800638_China_2012_PCV2d																
KC800645_China_2011_PCV2d																
KJ187306_Brazil_2013_PCV2d-2																
KT819169_Brazil_2014_PCV2d																
ID5297_Brazil_2019																
KT819170_Brazil_2014_PCV2d																
HM038017_China_2010_PCV2d																
ID4346_Brazil_2019																
ID4347_Brazil_2019																
ID5084_Brazil_2019																
ID5298_Brazil_2019																
ID5299_Brazil_2019																
ID5311_Brazil_2019																
ID5313_Brazil_2019	1,000															
ID5316_Brazil_2019	1,000	1,000														
HM038017_China_20008_PCV2d-2	1,000	1,000	1,000													
JX535297_USA_2012_PCV2d	1,000	1,000	1,000	1,000												
JX535296_USA_2012_PCV2d-2	1,000	1,000	1,000	1,000	1,000											
JX679498_China_2006_PCV2d	1,000	1,000	1,000	1,000	1,000	1,000										
ID4350_Brazil_2019	1,000	1,000	1,000	1,000	1,000	1,000	1,000									
ID5089_Brazil_2019	0,999	0,999	0,999	0,999	0,999	0,999	0,999	1,000								
ID5086_Brazil_2019	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,997	1,000							
ID5093_Brazil_2019	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,997	1,000	1,000						
ID5094_Brazil_2019	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,997	1,000	1,000	1,000					
ID5320_Brazil_2019	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,997	0,997	0,997	0,997	1,000				
ID5305_Brazil_2019	0,997	0,997	0,997	0,997	0,997	0,997	0,997	0,996	0,996	0,996	0,996	0,996	1,000			
ID5315_Brazil_2019	0,997	0,997	0,997	0,997	0,997	0,997	0,997	0,996	0,996	0,996	0,996	0,996	0,994	1,000		
JX519293_China_2012_PCV2d-2	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,997	0,997	0,997	0,997	0,997	0,996	0,996	1,000	
AY181946_China_2002_PCV2d-1	0,970	0,970	0,970	0,970	0,970	0,970	0,970	0,968	0,971	0,971	0,971	0,968	0,967	0,967	0,968	1,000