SZENT ISTVÁN UNIVERSITY
FACULTY OF VETERINARY SCIENCE, BUDAPEST

Porcine parvoviruses

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Family	***Parvoviridae***	
Subfam.	***Parvovirinae***	
Genus	Parvovirus (Protoparvovirus)	*Chicken parvovirus (Galliform aveparvovirus 1)*
		Feline panleukopenia virus (Carnivore protoparvovirus 1)
		Feline panleukopenia virus
		Canine parvovirus 2
		Mink enteritis virus
		Racoon parvovirus
		Porcine parvovirus (Ungulate protoparvovirus 1)
		Etc
	Erythrovirus (Erythroparvovirus)	*Human parvovirus B19 (Primate erythroparvovirus 1)*
		Bovine parvovirus type 3 (Ungulate erythroparvovirus 1)
	Dependovirus (Dependoparvovirus)	*Adeno associated virus (Adeno-associated dependoparvovirus)*
		Goose parvovirus (Anseriform dependoparvovirus 1)
		Duck parvovirus (Anseriform dependoparvovirus 1)
	Amdovirus (Amdoparvovirus)	*Aleutian mink disease virus (Carnivore amdoparvovirus 1)*
	Bocavirus (Bocaparvovirus)	*Bovine parvovirus (Ungulate bocaparvovirus 1)*
		Human bocaviruses (Primate bocaparvovirus 1, 2)
		Canine minute virus (Carnivore bocaparvovirus 1)
		Porcine bocaviruses (Ungulate bocaparvovirus 2-5)
Subfam	***Densovirinae***	
Genus	Densovirus	
	Iteravirus	
	Brevidensovirus	
	Pefudensovirus	

PORCINE PARVOVIRUS DISEASE

Porcine parvovirus 1 (PPV1)

History:

1965: Dunne, **SMEDI** (Stillbirth, Mummification, Embryonic Death, Infertility)
1967: not enterovirus but parvovirus

Prevalence:

Everywhere, wherever pigs are present
Less frequent in Australia and New Zealand

Epidemiology:

Infected pig: feces and saliva
fomites, wind, can survive more than 4 months
Boars (and infected sperm)

Pathogenesis:

P.os

Lymphoid tissues around throat — **Small intestine**

Viraemia
transient, symptomless

Pigs — Pregnant sow

Lymphoid organs — **Fetus** (2 weeks after the infection)

http://allategeszsegugy.pfizer.hu/images2/pig_parvovirus_okozta_szaporo_2.jpg

Immune suppression

Co-infection with PCV2: more frequent and severe postweaning multisystemic wasting syndrome, PMWS

Rarely respiratory and vesicular disease in adults, systemic disease of neonates.

Embryo and fetus:

to 30 days	death, resorption
30-70 days	death of fetus, mummification
	calcification of bones after 35 days, cannot be resorbed
from day 70	weak and mummified fetus
	active immunity initiated after day 70

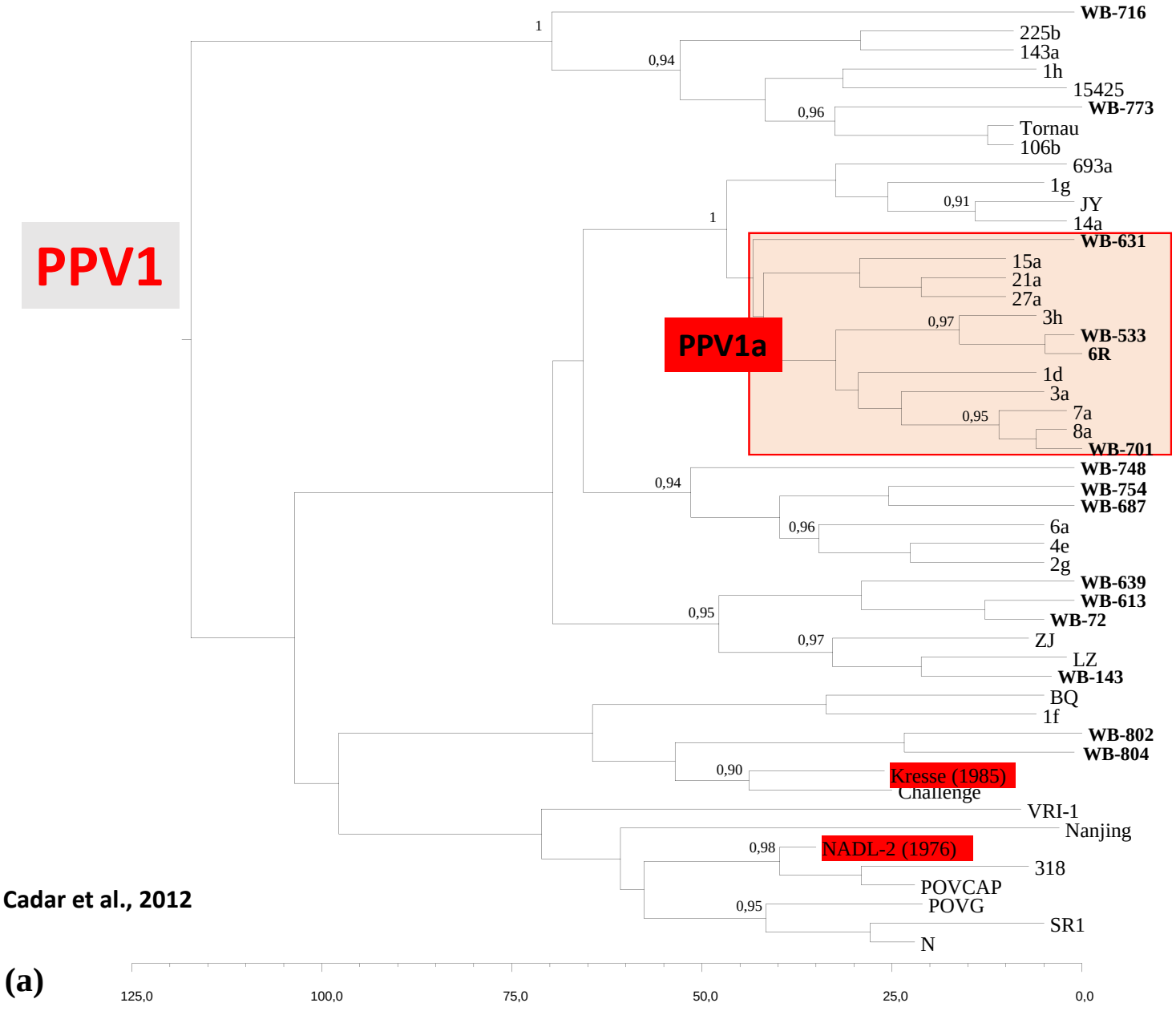
Pregnant sows:
return to estrus (3-8 weeks after breeding)
abortus, smaller than normal litters
(PPV unlikely if at least 8 live pigs)

New antigenic variant of PPV1: PPV-27a

Originally 1 serotype (**PPV1**): SMEDI, vaccines (NADL-2 and IDT strains)
2001-**PPV1a** (PPV-27a): Germany, limited cross-protection with vaccine strains

ZEEUW, E.J., LEINECKER, N., HERWIG, V., SELBITZ, H.J., TRUYEN, U., 2007. Study of the virulence and cross-neutralization capability of recent porcine parvovirus field isolates and vaccine viruses in experimentally infected pregnant gilts. J. Gen. Virol. 88, 420–427.:

„Cross-neutralization of the sera raised against the vaccine viruses PPV-NADL-2 and PPV-IDT (MSV) against the field isolates PPV-143a and PPV-27a as well as against PPV-Challenge (Engl.) revealed low neutralization activity (0.5–0.69) against PPV-27a, indicating incomplete protection. Neutralizing antibodies are known to play a prominent role in protection against parvovirus infection. Therefore, if PPV-27a is representative for current PPV-isolates in the population, this indicates that vaccines, which have been used for 30 years, may no longer be fully protective.
Beside the evidence for distinct antigenic types of PPV, another interesting phenomenon became obvious in this study. Interestingly, all sera raised against the field isolate PPV-27a neutralized all heterologous PPV isolates with high efficiency (2.99–3.99), but homologous neutralization was much less efficient (0.69–1.19). This was seen for all three pigs inoculated as well as with the sera of both rabbits immunized with PPV-27a."



Cadar et al., 2012

(a)

PPV1 HUN

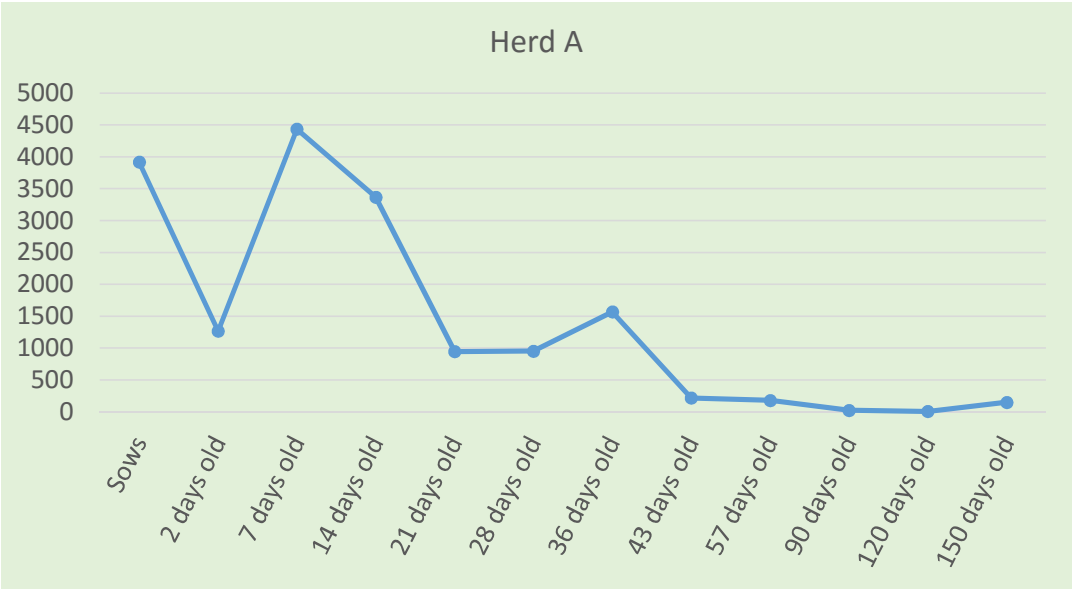
- ❖ PPV1 HUN strain is genetically, antigenetically highly similar to PPV-27a.
- ❖ PPV1 HUN strain was isolated from a newborn piglet, originate from a Hungarian swine herd.
- ❖ In this swine herd, piglets had weak viability (poorly developed piglets, poor resistance, increased mortality).
- ❖ Gilts and sows were vaccinated against porcine parvovirus.

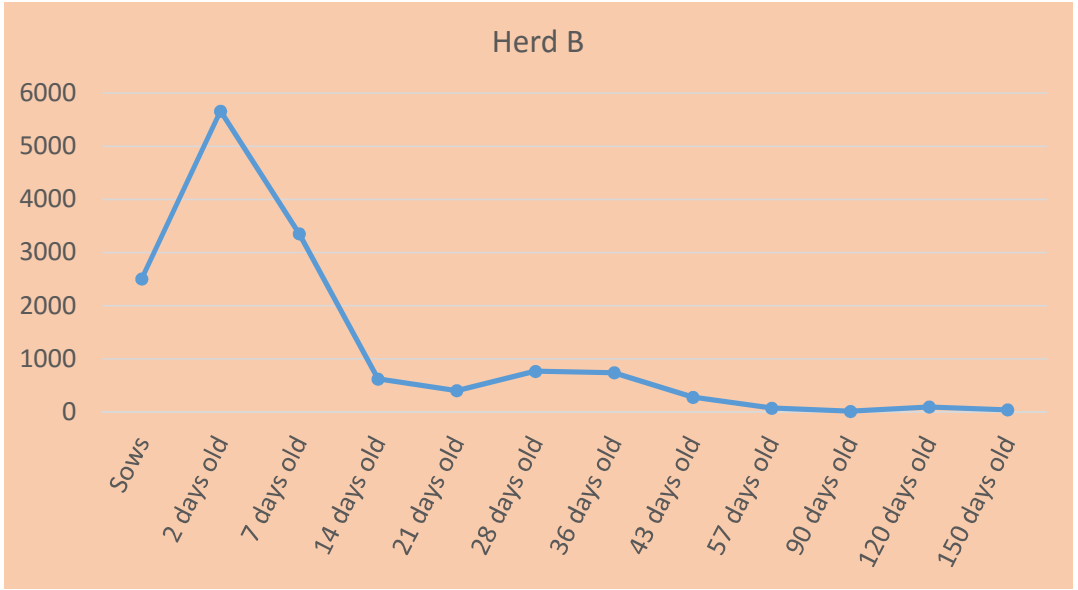
- PPV1 HUN strain was isolated on Swine testicular cell line (STC).
- PPV1 HUN strain can replicate up to 10^8 tissue culture infective dose 50% ($TCID_{50}$).
- PPV1 HUN strain is under patenting process.

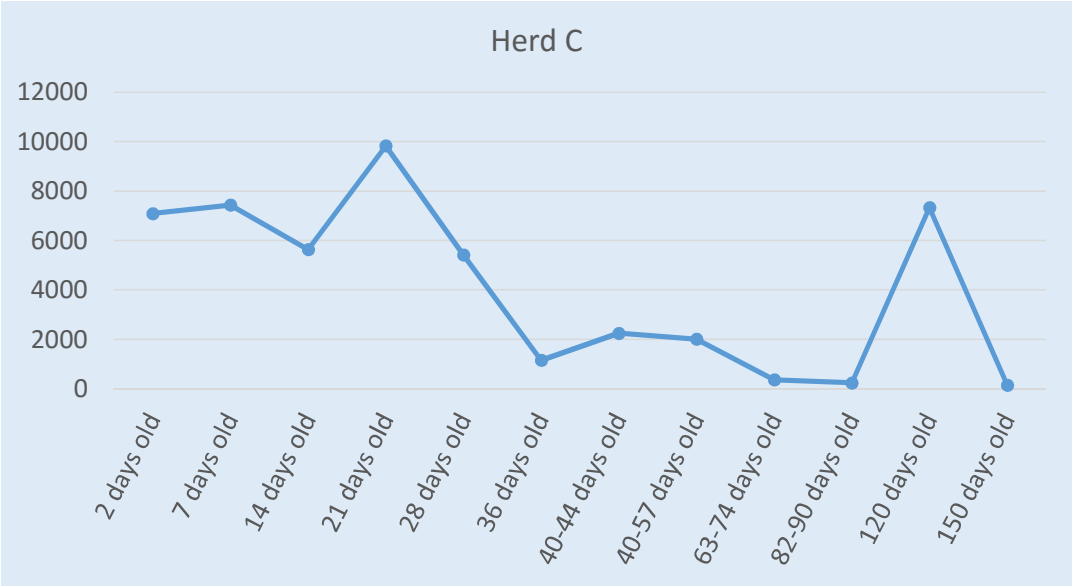
Examination of the PPV1 serological profile of infected swine herds

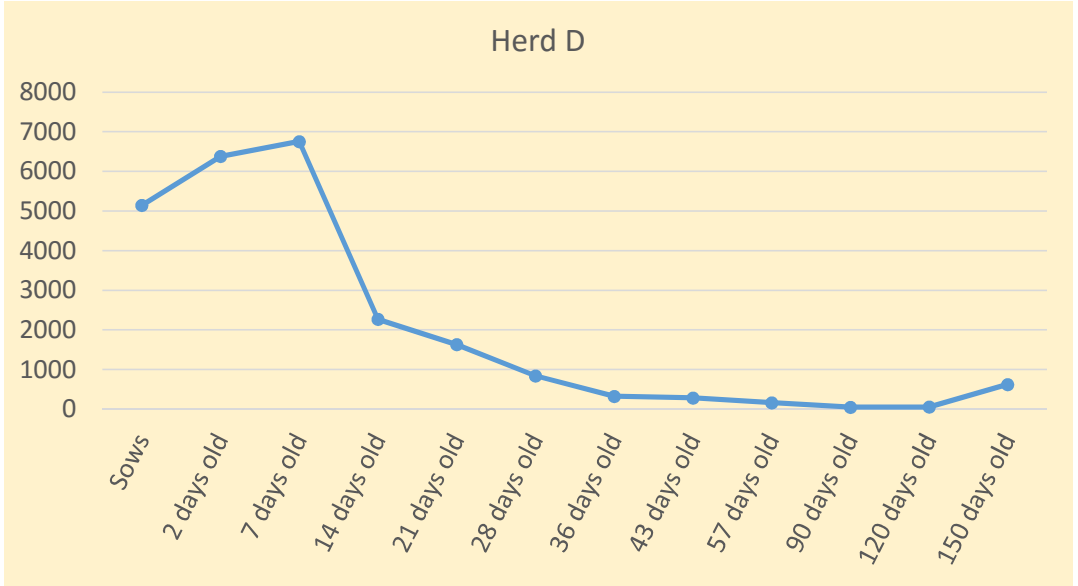
15-15 serum samples were collected from:

- **2, 7, 14 and 21 days old piglets (60 samples) and their sows (20 samples),**
- **and 15-15 samples from 28, 36, 43, 57, 90, 120 and 150 days old growing and finishing pigs.**


Herd A
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Sows
2 days old
7 days old
14 days old
21 days old
28 days old
36 days old
43 days old
57 days old
90 days old
120 days old
150 days old


Herd B
6000
5000
4000
3000
2000
1000
0
Sows
2 days old
7 days old
14 days old
21 days old
28 days old
36 days old
43 days old
57 days old
90 days old
120 days old
150 days old


Herd C
12000
10000
8000
6000
4000
2000
0
2 days old
7 days old
14 days old
21 days old
28 days old
36 days old
40-44 days old
40-57 days old
63-74 days old
82-90 days old
120 days old
150 days old


Herd D
8000
7000
6000
5000
4000
3000
2000
1000
0
Sows
2 days old
7 days old
14 days old
21 days old
28 days old
36 days old
43 days old
57 days old
90 days old
120 days old
150 days old

Conclusions

- The PPV1 infection causes severe economic losses, so an appropriate and effective protection against PPV1 is highly important.

- The maternal antibodies are already absent around 1-2 months of age, but because of infection induced specific humoral immune response, high PPV1 specific antibody level was detected in some individuals of older age groups.

- The swine herds, in terms of protection against PPV1, are heterogeneous (which is also true for sows!), which favors the survival and spreading of the virus within the herds.

- Vaccines against PPV1 are routinely used in most swine herds. Usually the recommended vaccination time is around the age of 6 months. Our results suggest that the modification of PPV1 vaccination protocol (for example vaccination at 6-8 weeks of age) could be necessary to establish homogeneous immune status of the animals in order to have a more effective defense.

Emerging porcine parvoviruses

PPV2 *(Ungulate tetraparvovirus 3):*
2001: single positive case (Myanmar)
2010: Very high number of cases, China
2011: 6,4% Europe

PPV3 *(Ungulate tetraparvovirus 2):*
HoKovirus, respiratory signs (human Parv4 and 5)
2008-: 3-35% Hong Kong,
Great Brittan, Transylvania, Hungary

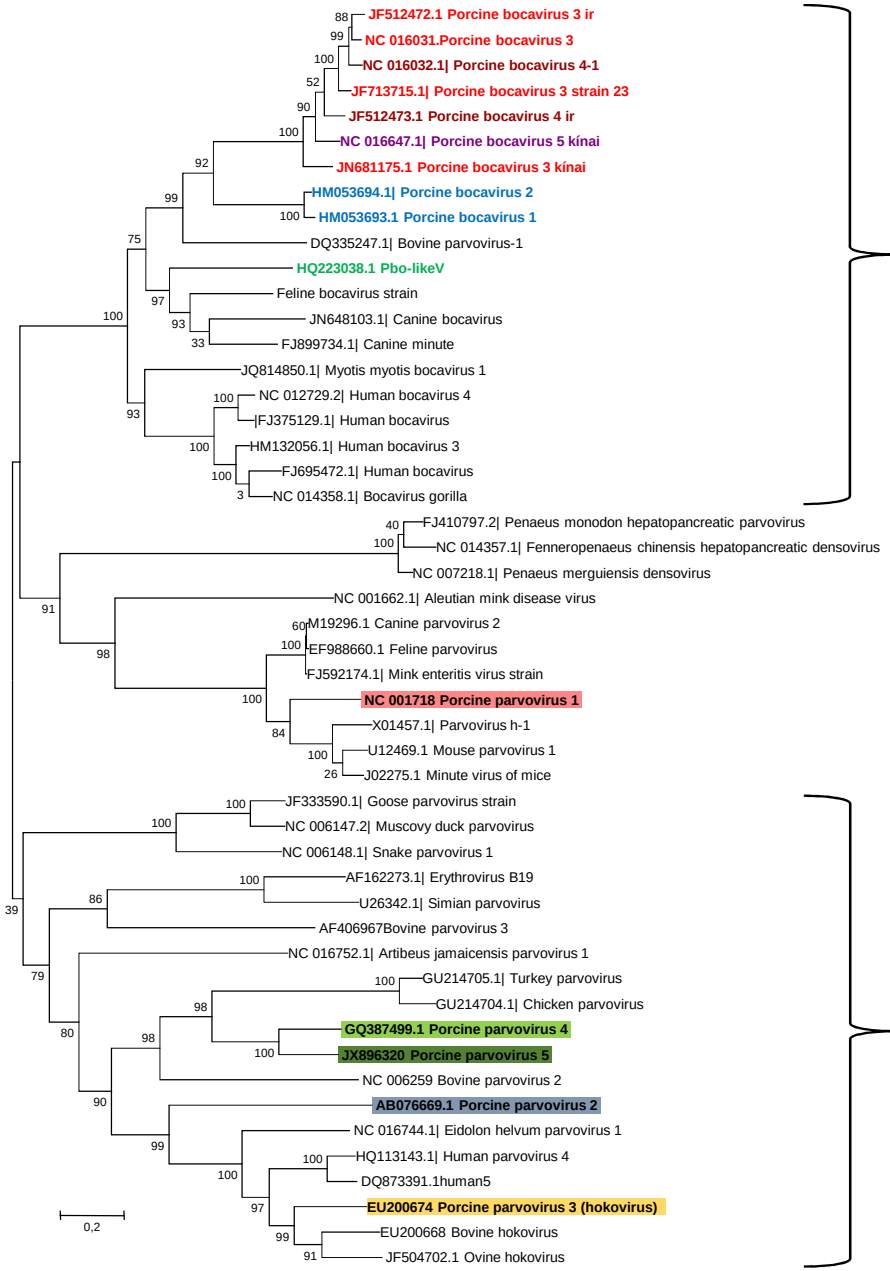
PPV4 *(Ungulate copiparvovirus 2)*:
Reproductive disorders
2005-: low prevalence but up to 50 within herd
2011: 6,4% Hungary (Europe)

Bocaviruses *(Ungulate bocaparvovirus 2-5)*:

PBoV-like:
respiratory in piglets
2009: 0,1% Sweden
2010-: 1,5% Hungary / Europe

Since 2010: PBoV-1, PBoV-2, PBoV-3, PBoV-4, 6V, 7V

Parvoviruses



Boca viruses

PPV1, other well known canine, feline, mink parvoviruses

Newly described

PPV2 specific antibody profile with Myanmar-type and Cnvirus-type antigens.