

Hepatitis E virus infection dynamics in endemically infected pig farms

Results from longitudinal and genetic data



Background Hepatitis E virus (HEV)

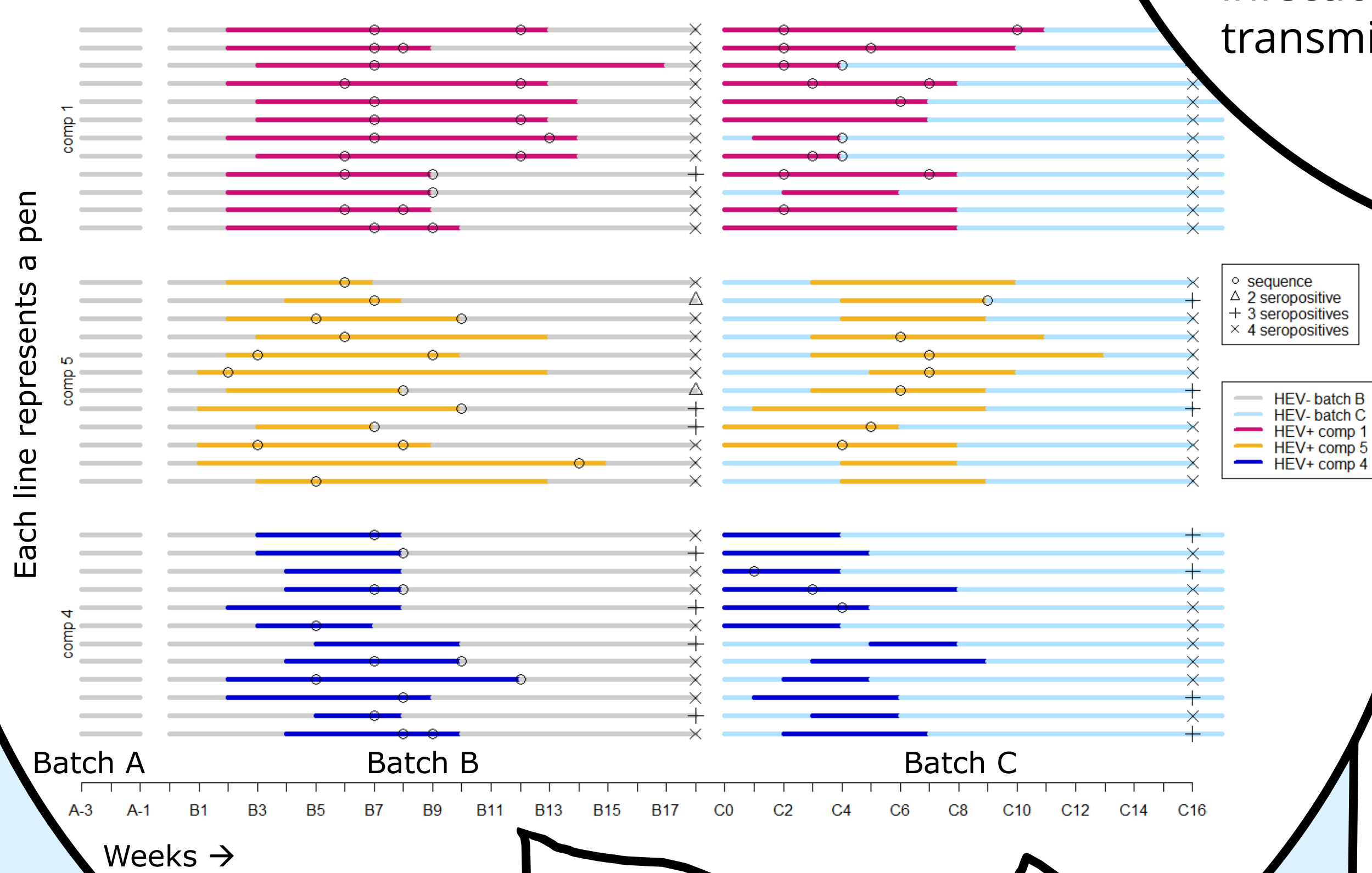
- Single-stranded RNA virus with 7200 bases
- Liver infection in humans
- Transmission pigs to humans via raw pork liver consumption or contact pig feces
- Endemic in pig farms across the world
- HEV RNA in livers of slaughter pigs (NL) 11%
- How to reduce HEV prevalence in slaughter pigs?
- First step is to better understand the infection dynamics and routes of transmission of HEV within pig farms!

M. Meester^{1*}, T.J. Tobias^{1,2}, M. Bouwknegt³, R.W. Hakze-van der Honing⁴, W.H.M. van der Poel⁴, C. Valenzuela Agüí^{5,6}, C. Guinat^{7,8}, T. Stadler^{5,6}, J.A. Stegeman¹

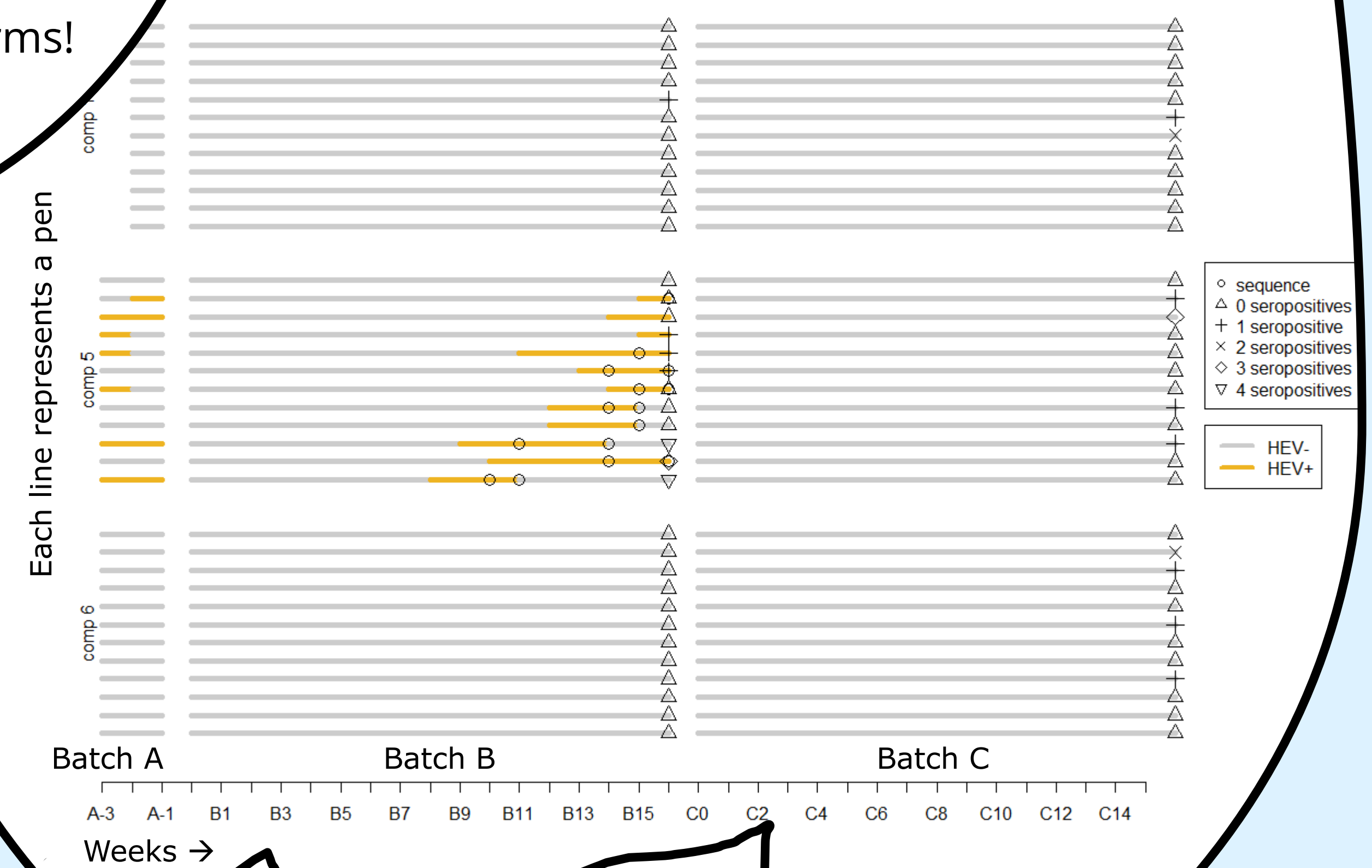
1: Utrecht University, faculty of Veterinary Medicine Utrecht;
2: Royal GD Deventer;
3: Vion Food Group Boxtel;
4: Wageningen Bioveterinary Research Lelystad;
5: ETH Zürich, Department of Biosystems Science & Engineering Basel;
6: SIB Swiss Institute of Bioinformatics Lausanne;
7: École Nationale Vétérinaire de Toulouse;
8: INRAE, UMR Interactions Hôtes-Agents Pathogènes, Toulouse

* e-mail: m.meester@uu.nl

Results Farm 1: High seroprevalence



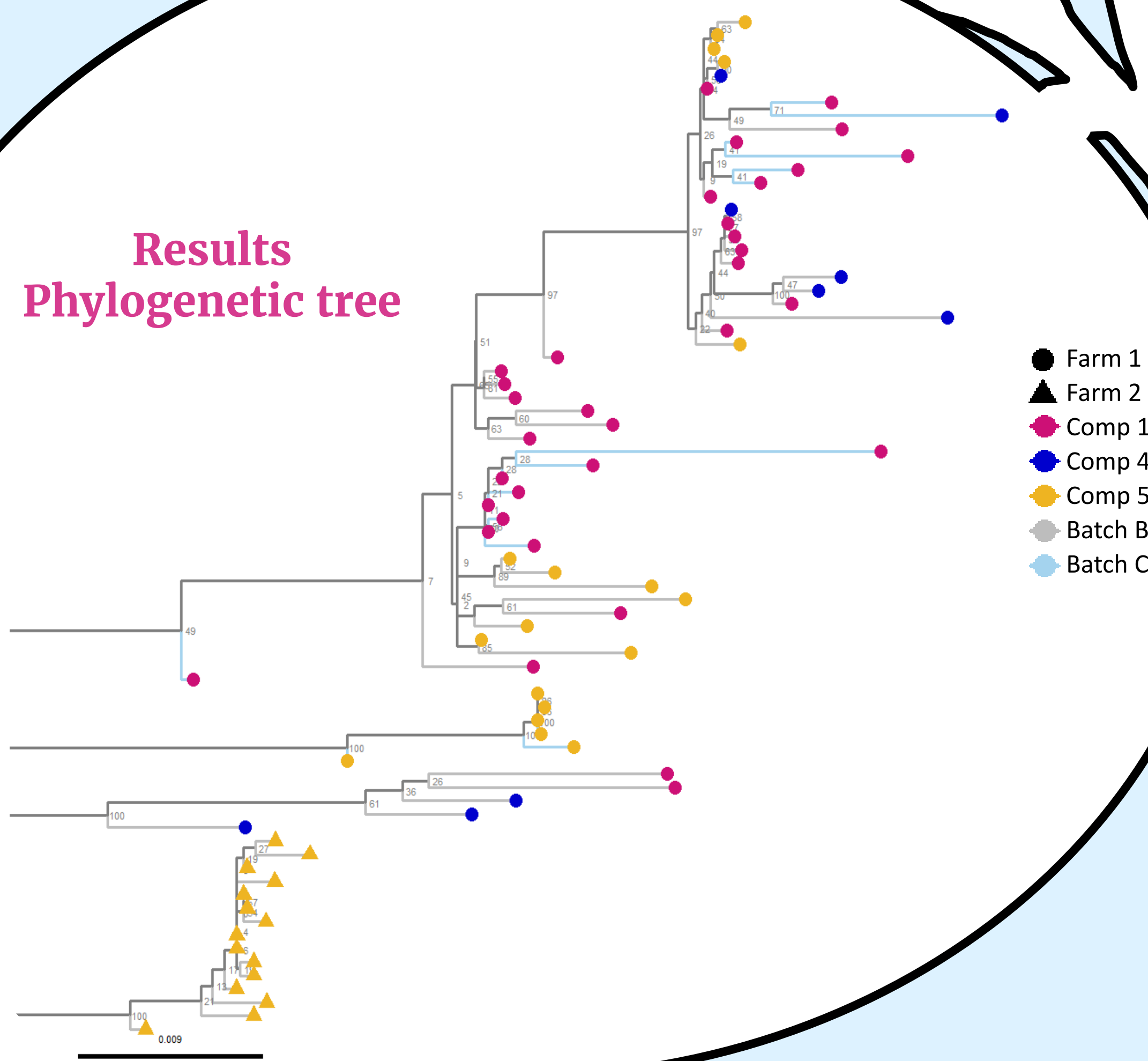
Results Farm 2: Low seroprevalence



Discussion

- Farm 1:
- HEV infection early in fattening phase
 - Multiple introductions (3 subclades in tree)
 - Spread between compartments
- Farm 2:
- HEV contained in compartment 5
 - Biosecurity is 'by the book'
- Both farms:
- Between batch transmission via environment likely

Results Phylogenetic tree



Results Farm biosecurity

| | Farm 1 Another farm, same farmer | Farm 2 Another farm, different farmer |
|---------------------------|--|---|
| Origin of pigs | Another farm, same farmer | Another farm, different farmer |
| Mixing | Yes: farrow - weaning and weaning - fattening | Yes: farrow - weaning and weaning - fattening |
| Cleaning and disinfection | Only cleaning with cold water at high pressure | Soaking- soap - high pressure cleaning - disinfection |
| Cleaning boards corridors | Once a year | Once a week |
| Boots | Never cleaned | Cleaned after every entrance of a pen |
| Overalls | Washed daily | Washed daily |
| Order during check-ups | From front to back of the barn | From young to old |

Conclusion

Improved biosecurity may reduce within-farm transmission → reduce exposure of people to HEV

Future research

Phyldynamic model to estimate R0 and transmission rates

Aim: Compare infection dynamics of HEV in fattening pig farms with a high vs. low seroprevalence of HEV

Methods

Farms

- Farm 1: Seroprevalence slaughter pigs 75%
- Farm 2: Seroprevalence slaughter pigs 40%
- 3 fattening compartments
- 36 pens (8-12 pigs/pen)
- Pens as unit of observation
- Last weeks batch A, and batch B and C followed: ~38 weeks

Sampling and lab analysis

- Weekly fecal sampling (1 pool/pen)
- Twice blood sampling (4/pen)
- RT-PCR on feces & antibody ELISA on serum
- Illumina sequencing - each batch: 2/pen

Analyses

- Alignment to reference (HEV3, human, 2017)
- Sequences with max. 5% gaps
- Phylogenetic tree (RAxML-NG)
 - Maximum likelihood
 - Substitutions GTR+Γ
 - 1000 bootstraps
- Visualizations: R (longCatEDA, ggTree)