Co-evolution of house mouse and an intracellular parasite, Eimeria spp.

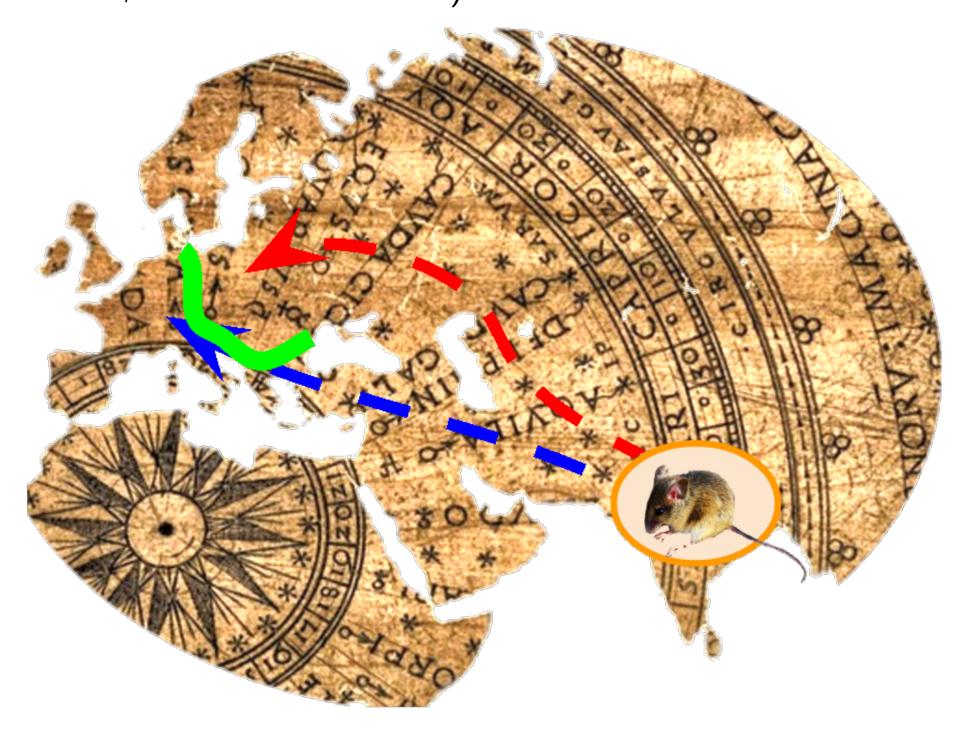
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Context

• House Mouse Hybrid Zone, 20km wide, formed by hybrids of *Mus musculus domesticus* and *Mus musculus musculus*. After 500,000 years in isolation, secondary contact 5000 years ago (Macholán *et al.* 2012; Boursot *et al.* 1993)

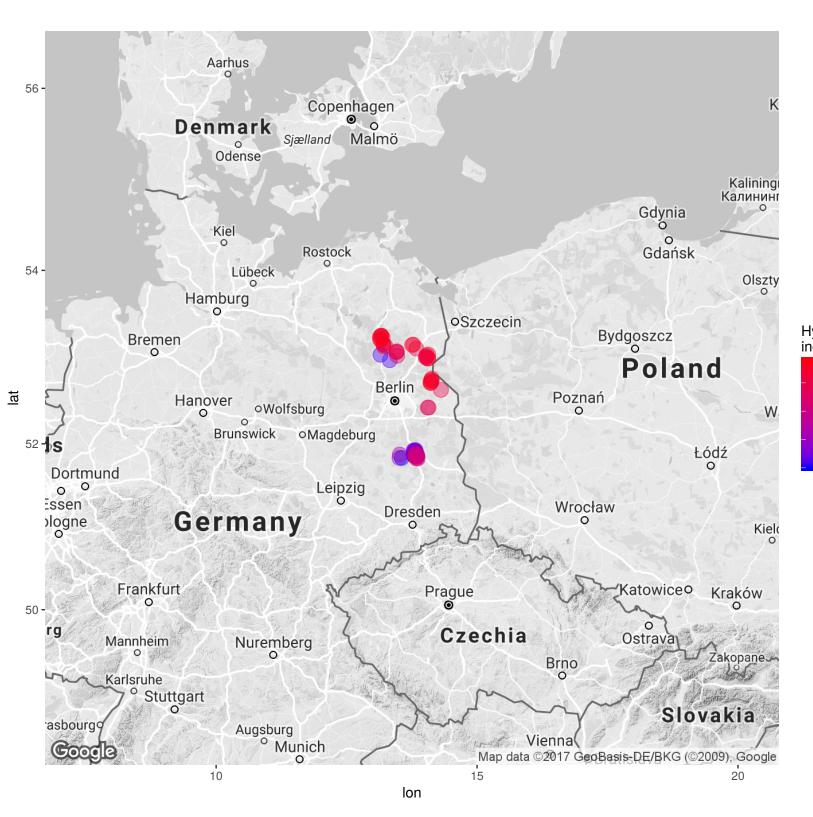


• Eimeria spp., obligate intracellular apicomplexan parasite. **Two major clades (A & B)** of *Eimeria* spp. identified (3 markers) in the mice of the hybrid zone (Jost 2016)

Aims of the study

- 1. Investigating the **vigor/resistance of hybrids of house mouse** to their parasite *Eimeria* spp. using prevalence and intensity data for parasite strains throughout the House Mouse Hybrid Zone.
- 2. Looking for evidence of **local adaptation** between the murine host and its Eimerian parasite

Material & Methods: Field study



- Annual sampling every September
 N1 mice from 2015
 N2 mice in 2016
 Brandenburg area (Germany)
- Oocyst counted in mice feces
 All parasite strains genotyped using
 3 markers, then assigned to an haplotype
- Adaptation of the method of Stuart J.E. Baird (Baird *et al.* 2012): Maximum likelihood analysis explicitly linking parasite abundance to a gradient along the hybrid index (as a proxy of host heterozygosity), generalized linear model with negative binomial distribution

 $Parasite\ load \sim mouse\ heterozygosity\ level*parasite\ strain$

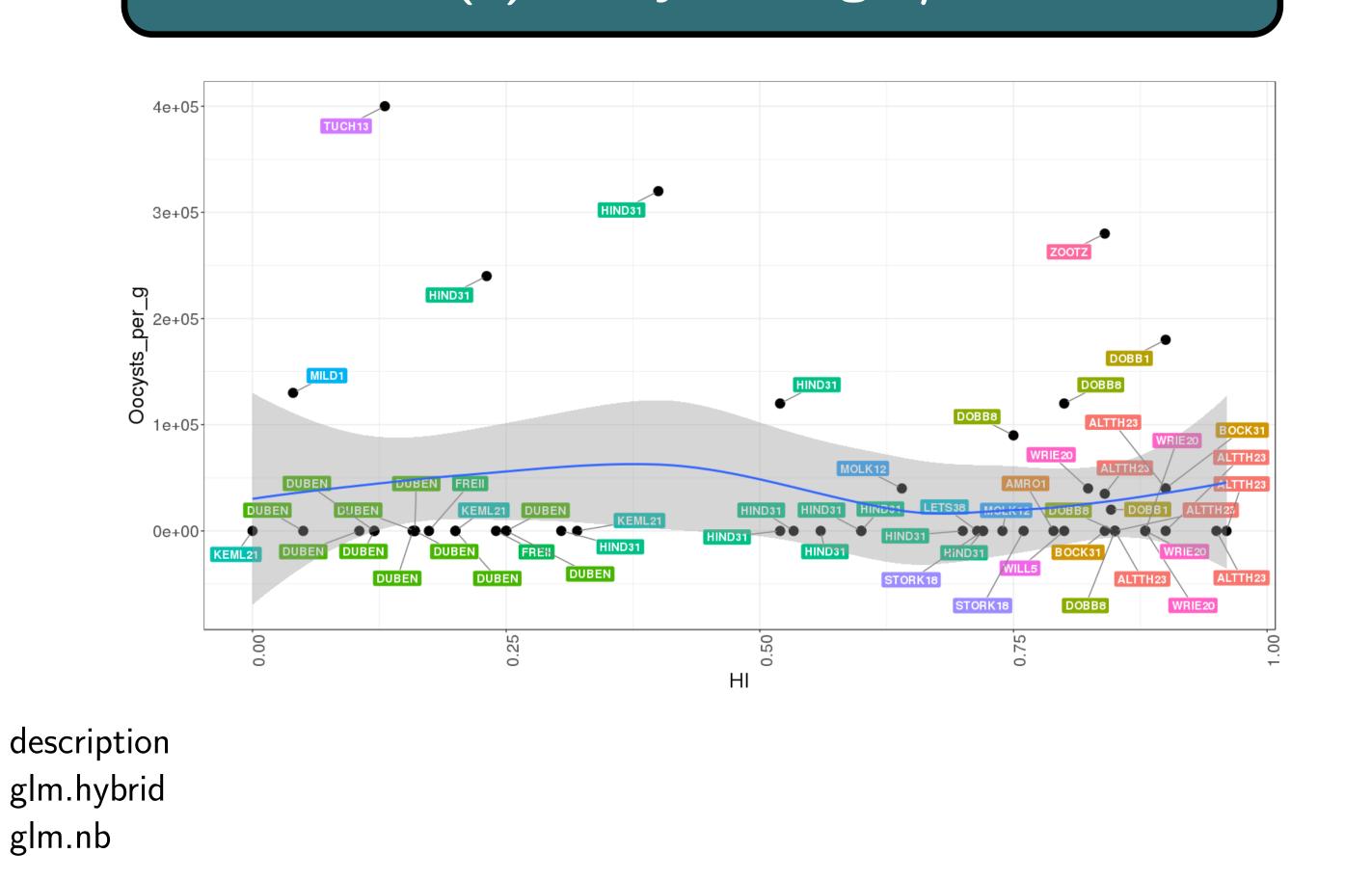
• R package: https://github.com/alicebalard/Parasite_Load

Material & Methods: Cross infection

Pilote experiment

- Parasite strains :
- 1. **Eimeria** haplotype A laboratory strain *Eimeria falciformis* REEEFF
- 2. *Eimeria* haplotype B strain isolated in the wild
- Host strains :
- 1. **WSB** Wild-derived inbred strain. Isolated from wild *Mus musculus domesticus* Region of capture: Eastern Shore, Maryland
- 2. **PWD** Wild-derived inbred strain. Isolated from wild *Mus musculus musculus* Region of capture: near Prague, Czech Republic
- 3. **WP** Hybrids between the 2 previous commercial strains

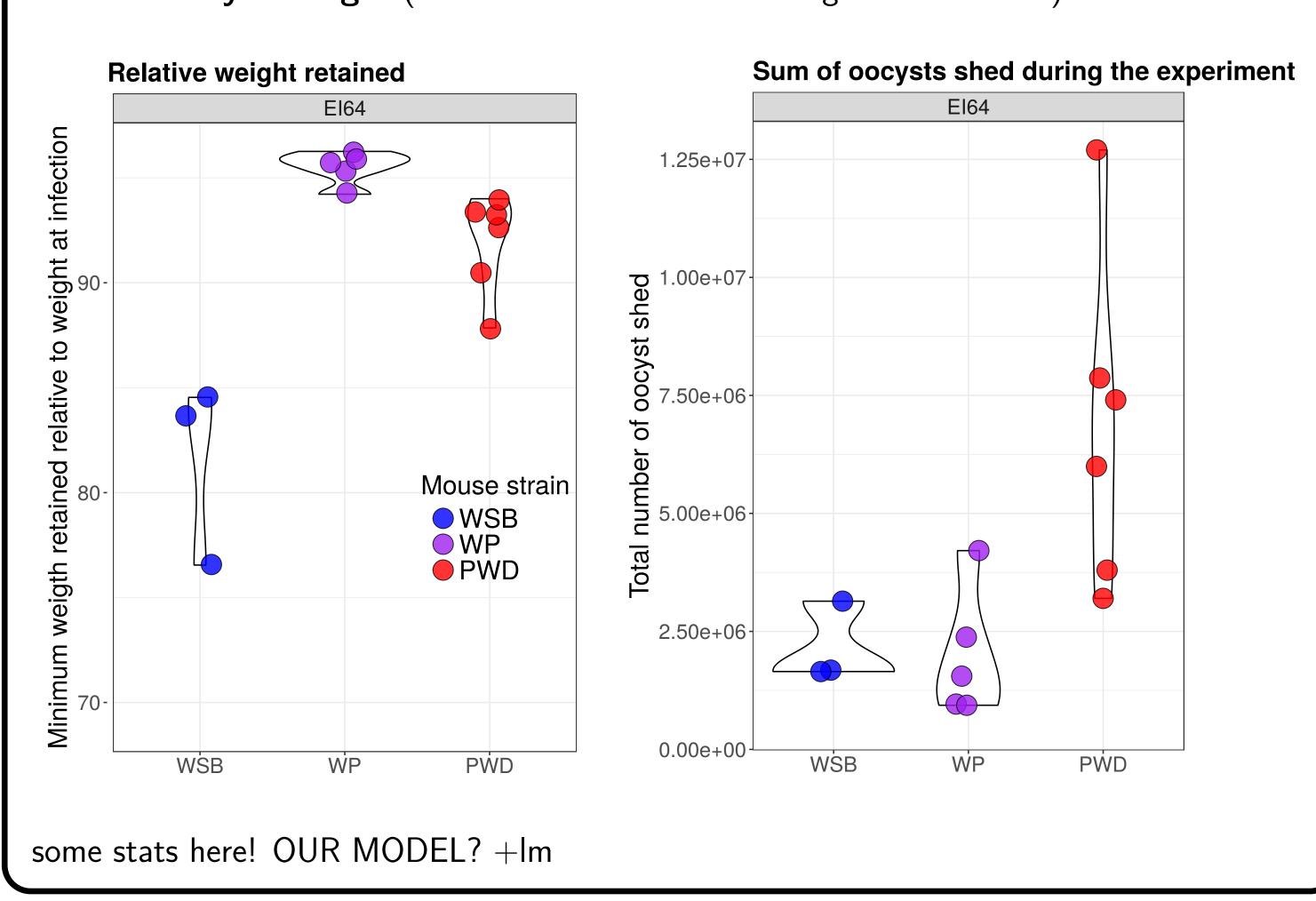
Evidence (?) of hybrid vigor/resistance



Evidence of local adaptation

Results of the infection experiment :

- *Eimeria* strain haplotype B has **lowest parasite shedding** in mice strains WSB compared to PWD, for a **highest relative weight loss**: indication of **local adaptation**
- Mice hybrids lost less weight and were less infected than the pure strains **Possible hybrid vigor** (limitation : unknow effect of general heterosis)



Perspective

- Next cross infection experiment: verify our hypotheses (hybrid vigor, local adaptation), measure the effect of heterosis (within subspecies heterosis vs between subspecies)
- Assess local adaptation in other parasite strains
- Analyse of divergence scenarios for *Eimeria* spp. based on whole genomes and comparison of models of coalescence and cospeciations with their murine hosts (beyond the house mouse).
- Investigation of loci of coevolution, identifying parasite genes under divergent selection in the two house mouse subspecies. The coevolving loci corresponding on the host side will be investigated.

References

Baird et al. (2012) Where Are the Wormy Mice? A Reexamination of Hybrid Parasitism in the European House Mouse Hybrid Zone Evolution 66 (9): 2757–72

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