

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

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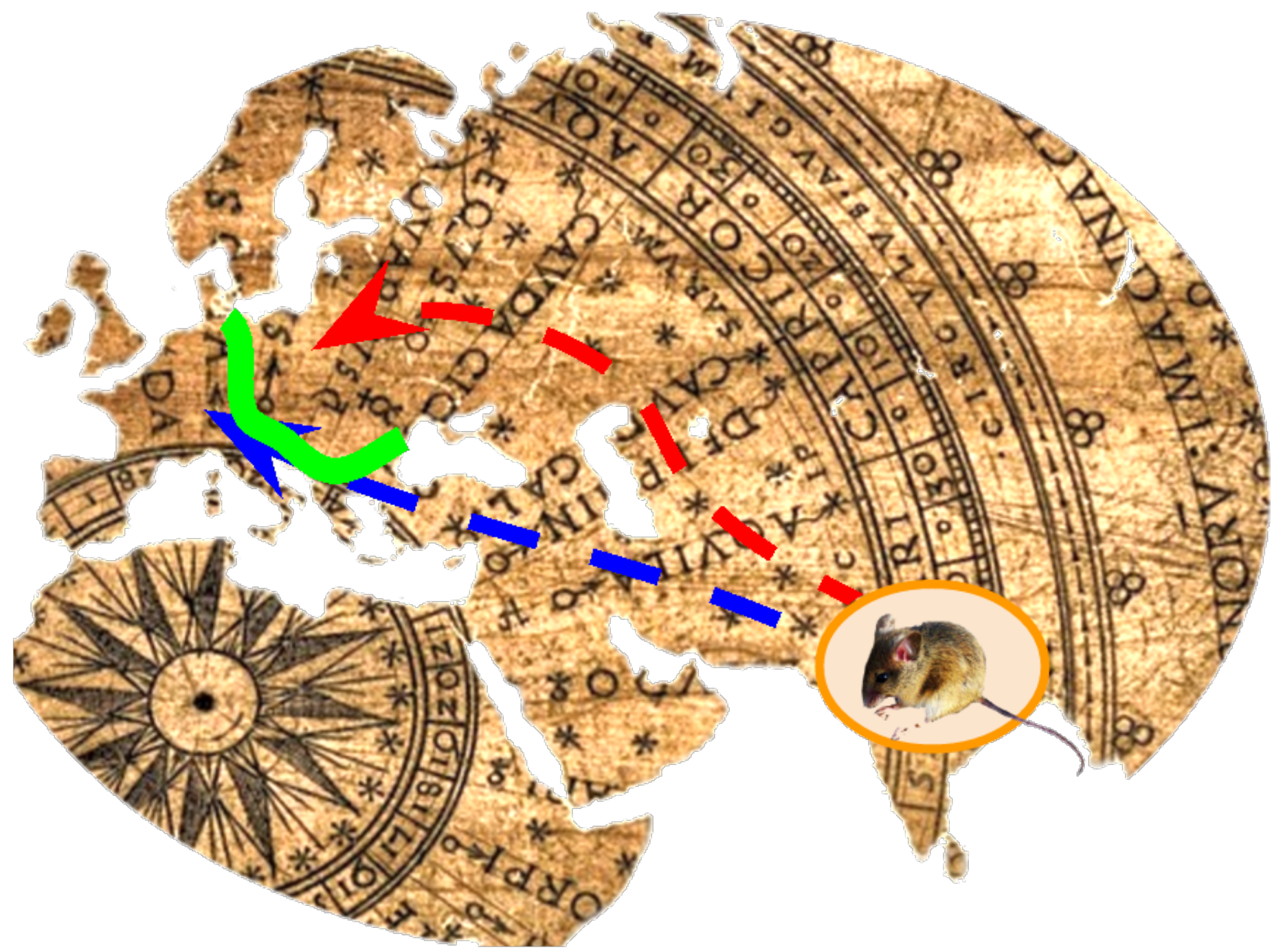
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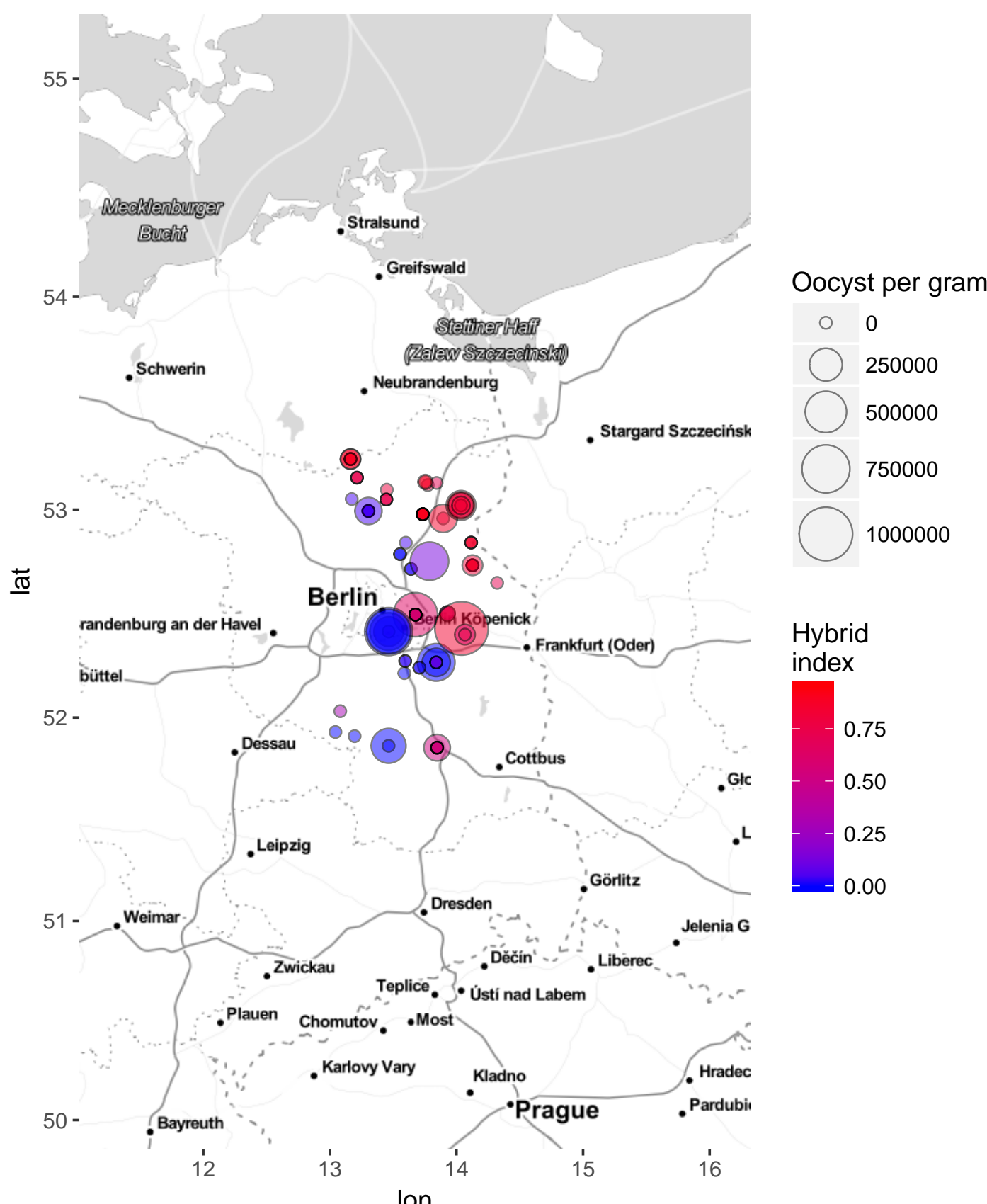
Context

- 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)



- 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)

Preliminary results : exploring hybrid vigor/resistance in the wild



- Prevalence :
19% infected farms in 2015
2016 : pending analysis...
2017 : upcoming sampling

- Hybrid index assigned to all mice
0 = *Mus musculus domesticus*
1 = *Mus musculus musculus*
in between = hybrids

Goal : using our glm.hybrid model to assess the existence of hybrid vigor/resistance, taking into account the parasite strains

Aims of the study

- 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.
- Looking for evidence of **local adaptation** between the murine host and its Eimerian parasite

Material & Methods : Field study

- Annual sampling every September
104 mice in 2015 from 48 localities
165 mice in 2016 from 45 localities
upcoming sampling in 2017
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

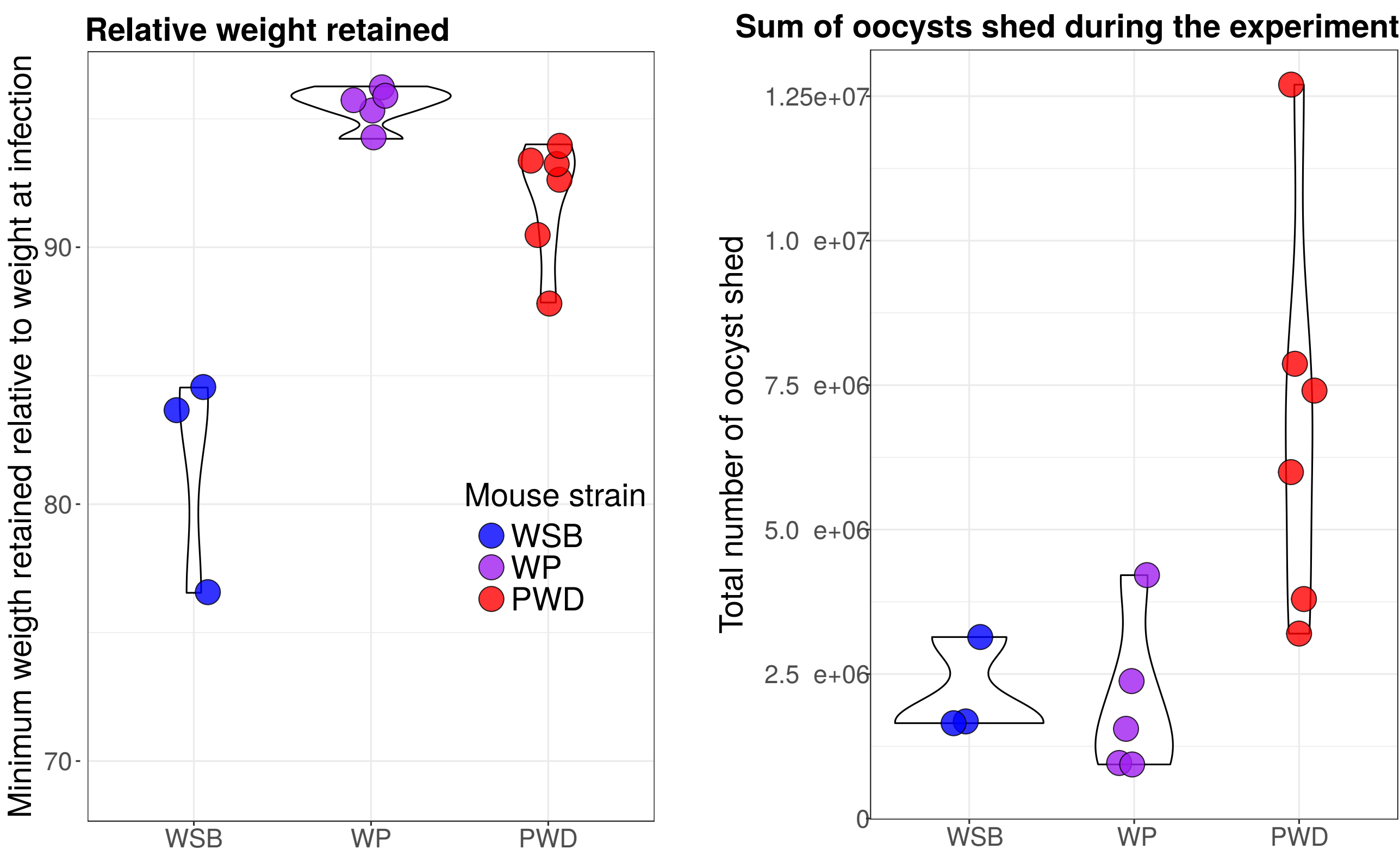
$$\text{Parasite load} \sim \text{mouse heterozygosity level} * \text{parasite strain}$$

- R package under development : https://github.com/alicebalard/Parasite_Load

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 : unknown effect of general heterosis)



Material & Methods : Cross infection

Pilote experiment

- Parasite strains :
 - Eimeria* haplotype A** laboratory strain *Eimeria falciformis* (Heitlinger *et al.* 2014)
 - Eimeria* haplotype B** strain isolated in the wild
- Host strains :
 - WSB** Wild-derived inbred strain. Isolated from wild *Mus musculus domesticus* Region of capture : Eastern Shore, Maryland
 - PWD** Wild-derived inbred strain. Isolated from wild *Mus musculus musculus* Region of capture : near Prague, Czech Republic
 - WP** Hybrids between the 2 previous commercial strains

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

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