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

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Context

- Parasite model: *Eimeria* spp., obligate intracellular parasite (Apicomplexa: Coccidia). **Two major clades (A & B)** of *Eimeria* spp. identified (3 markers) in the mice of the hybrid zone
- Host model: Mus musculus domesticus Mus musculus musculus. and hybrids

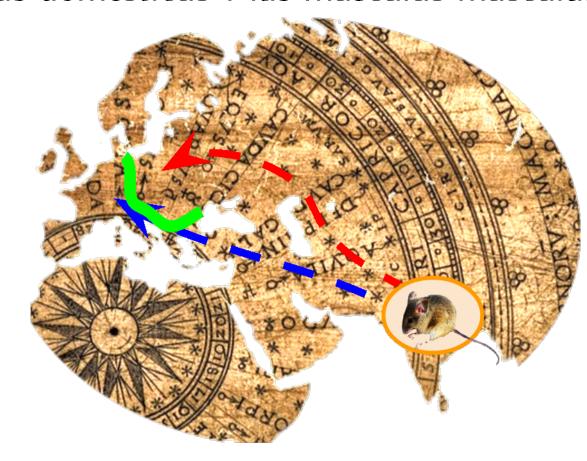


Fig. 1: The House Mouse Hybrid Zone (about 20km wide) is formed by hybrids of two sub-species of *Mus musculus*. After isolation for 500,000 years, secondary contact was established during the Bronze Age (Macholán *et al.* 2012)

Aims of the study

- 1. Investigate **hybrid vigor/resistance** of house mice to their parasite *Eimeria* spp. using prevalence and intensity data for parasite strains throughout the House Mouse Hybrid Zone
- 2. Test **local adaptation** between the host and its parasite

Material & Methods: Field study

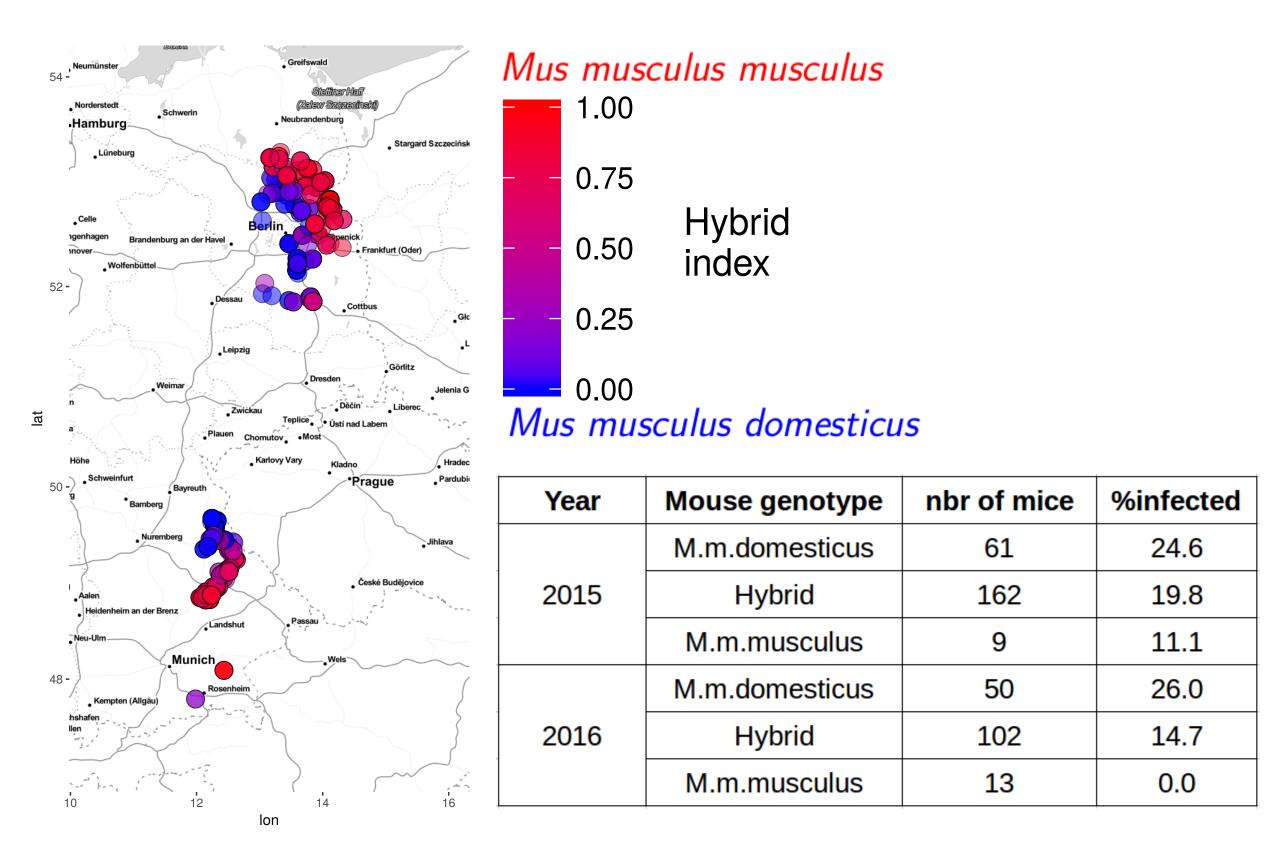


Fig. 2: Annual sampling every September. Oocyst counted in mice feces. Mice assigned to a hybrid index based on M.m.domesticus/M.m.musculus alleles ratio (Macholán et al. (2011))

Material & Methods: Cross infection

- Parasite strains:
- Eimeria strain (clade B) isolated in the wild from Mus musculus musculus
- Host strains:
- 1. **WSB** Wild-derived inbred strain. Derived from wild *Mus musculus domesticus* Region of capture: Eastern Shore, Maryland
- 2. **PWD** Wild-derived inbred strain. Derived from wild *Mus musculus musculus* Region of capture: near Prague, Czech Republic
- 3. **WP** Hybrids between the two previous strains

Funding: This research has received funding from the DFG, and is part of a IZW/HU project





Exploring hybrid vigor/resistance in the wild

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

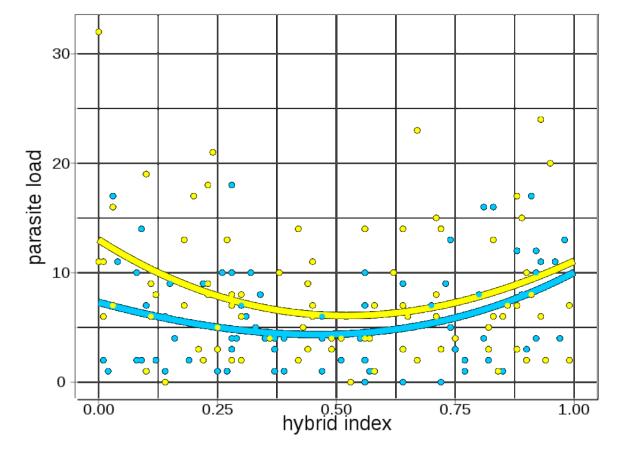


Fig. 3: Generalized linear model with negative binomial distribution: **glm.hybrid** applied to simulated data, two groups both presenting a hybrid vigor

R package under development: https://github.com/alicebalard/Parasite_Load
Goal: assessement of hybrid vigor/resistance, taking into account parasite strains

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

Results of the infection experiment

- Less pathology (weight lost) but better parasite reproduction (oocyst shed) in PWD compared to WSD
- Less pathology in mice hybrids compared to both pure strains, and lower parasite reproduction in mice hybrids than in PWD

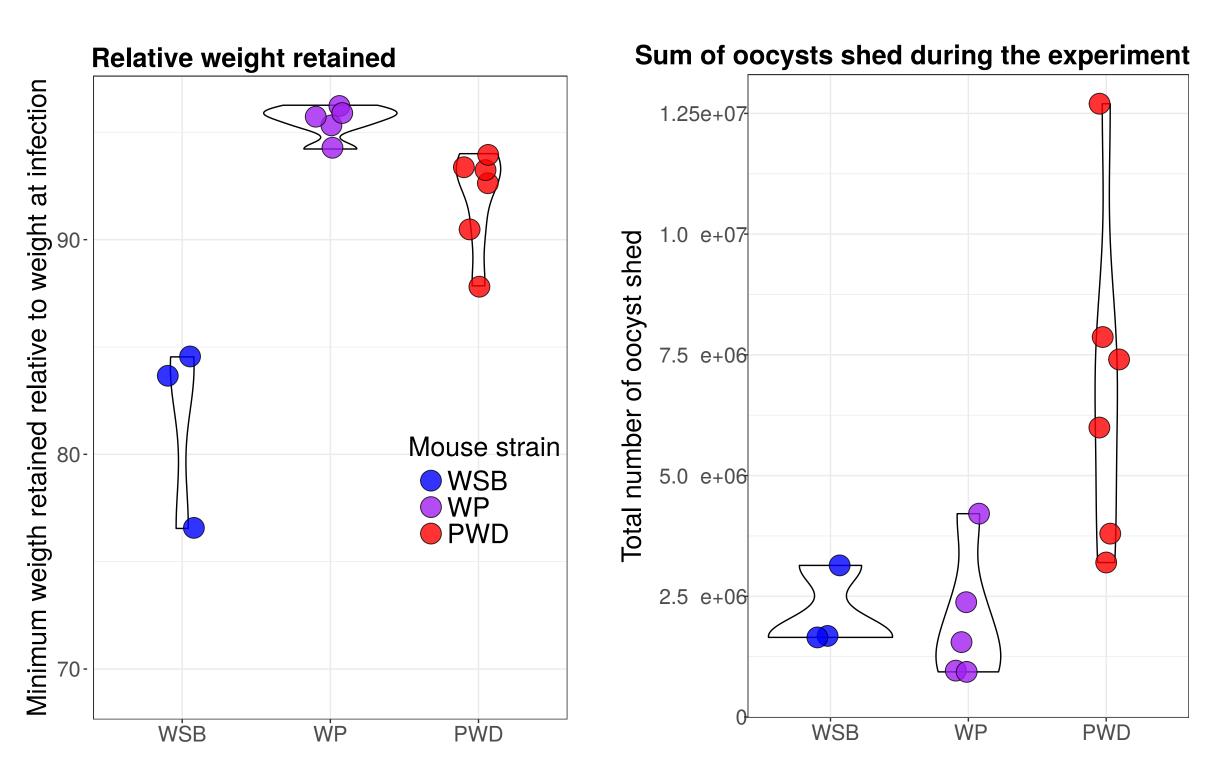


Fig. 4: First indications of **local adaptation** and **hybrid vigor**

Perspective

Next cross infection experiment:

- Test our hypothesis of hybrid vigor (within subspecies heterosis vs between subspecies)
- Assess local adaptation in other parasite strains

Field data:

• Obtain enough data (Sept. 2017) to test our hypotheses of hybrid vigor and local adaptation in the wild

References

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