

Blackgrass vs. Blotch: Discovering Natural Defences Against Wheat's Biggest Threat

Project ID: 263

Supervisory team

Rothamsted supervisor: Dr Jason Rudd (Rothamsted Research)

Academic supervisor: Dr Helen Fones (Eyles) (University of Exeter)

Other supervisors: Dr Dana MacGregor (Rothamsted Research), Dr Michael Deeks (University of Exeter)

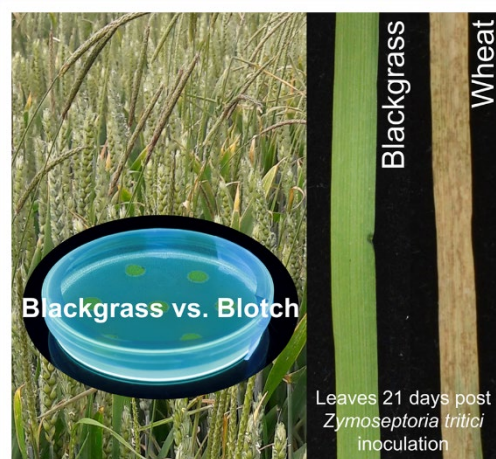
Host institution: Rothamsted Research (Harpenden)

Project description: This PhD offers a unique opportunity to study two major challenges to UK cereal production: *Alopecurus myosuroides* (blackgrass) and *Zymoseptoria tritici* (Zt). Blackgrass is Western Europe's most problematic and costly weed, while Zt causes Septoria tritici blotch (STB), a disease capable of inflicting severe yield losses in wheat. Despite growing side-by-side with wheat, blackgrass does not develop STB, even when intentionally exposed to Zt in the lab - suggesting blackgrass has natural resistance mechanism(s) that wheat lacks. This project aims to understand why blackgrass is unaffected by Zt and to assess whether insights from this non-host interaction can inform novel strategies for enhancing wheat protection. By revealing natural resistance pathways, this work supports more sustainable and resilient cereal production.

Key Research Activities:- Confirm resistance – Systematically demonstrate blackgrass's non-host status and document fungal development using advanced bioimaging.- Pathogen screening – Leverage diverse Zt isolate collections, including fluorescently tagged and UV-mutagenized strains, to identify variants that might breach blackgrass defences.- Weed diversity analysis – Use an extensive panel of field-derived blackgrass germplasm to uncover natural variation in resistance.- Real-world data – Collect samples from Rothamsted's 800-ha farm to validate lab findings under field conditions.- Molecular and genomic tools – Integrate cell biology, physiology, and genomics to identify and validate candidate resistance mechanisms.

Training & Environment Supervised jointly by Rothamsted Research (Dr Dana MacGregor, Dr Jason Rudd) and the University of Exeter (Dr Helen Fones, Dr Michael Deeks), you can work in both host institutions. You will develop a wide array of skills: from confocal microscopy and quantitative bioimaging to pathogen screening, genomics, statistics, and bioinformatics. You'll work across lab, glasshouse, and field settings, and be supported with dedicated training in experimental design, coding, data analysis, and communication through the structured SWBio DTP programme.

Person specification We welcome applicants from any background in plant pathology, molecular biology, weed science, or related disciplines. You should value interdisciplinary and collaborative research, be motivated by solving real-world agricultural challenges, and keen to help develop new ways to protect crop yields sustainably. This project will not only advance scientific understanding of non-host resistance in a major weed species but also bridge that knowledge to crop protection, helping shape a more resilient future for cereal agriculture.



Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.