

Population Genomics and Evolution of Wheat Take-all Under Diverse Agronomic and Seed Treatment Practices for Integrated Pathogen Management

Project ID: 3571

Supervisory team

Rothamsted supervisor: Dr Kim Hammond-Kosack (Rothamsted Research)

Academic supervisor: Dr Neil Brown (University of Bath)

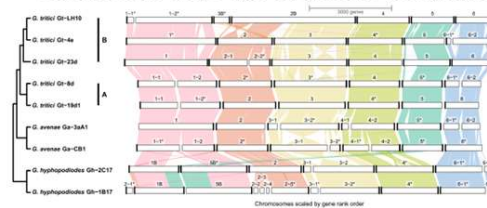
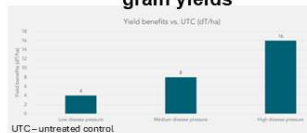
Non-academic (CASE) supervisor: Dr Raphaël Biezunski (Certis Belchim)

Other supervisors: Dr Nida Ghorri (Rothamsted Research), Dr Daniel Henk (University of Bath), Dr Mark McMullan (Earlham Institute) & Dr Rowena Hill (Earlham Institute)

Host institution: Rothamsted Research (Registered at University of Bath)

CASE partner: Certis Belchim

Project description: Wheat is one of the most important cereal crops in Europe, North America and elsewhere. Take-all (TA) disease, caused by the fungus *Gaeumannomyces tritici*, is the most important root disease of wheat globally, limiting water/nutrient uptake and reducing grain yield and quality. Current disease control options are based around crop rotations, deploying specific agronomic practices and seed dressings. In TA fungal populations considerable phenotypic variation exists, including high and low virulence isolate types and differing sensitivity to the chemical fungicide Silthiofam. This PhD project to be done in collaboration with the company CertisBelchim has two broad aims. The first is to explore and understand the factors driving TA population dynamics and genome evolution across Europe. This will involve fieldwork to obtain and analyse TA isolates recovered from diseased wheat crops and ongoing wheat trials in North, South, East and West Europe each differing in climate and managed under different agronomic practices and seed dressing treatments. The second aim is to use carefully designed field experiments, to be done at Rothamsted and other European locations, to explore the disease control effectiveness and changes in TA population dynamics and genome evolution. These field trials will investigate the effects of different break crop species, e.g. oats, rye, field beans, and seed treatments, i.e. Silthiofam, Toltek, a new biological, or a combination of the two. Collectively, this research aims to better understand TA impact on farmer and food productivity and support the development of integrated management for TA. The student will learn a range of key skills. These include field trial design and management, aseptic techniques for fungal isolation/culturing, phenotyping and genotyping, bioinformatics, population genomics, evolutionary analyses, statistical analyses and big data analyses benefitting from many years of field trials and satellite images. The detailed genome/pangenome and evolutionary analyses will be done in collaboration with the Earlham Institute, Norwich as part of ongoing UK and global studies. The student will undertake an initial rotation research project and skills training at Bath University for 5 months, before transferring to Rothamsted. In addition, specific training periods will take place in the company's laboratories in Belgium and France. The student will have access to world class research facilities throughout and will receive outstanding interdisciplinary training. The student will also receive training in how to give oral/poster presentations at laboratory meetings, workshops, national/international conferences, write a scientific paper for peer review and will take part in outreach events. Continued on next page.....



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.