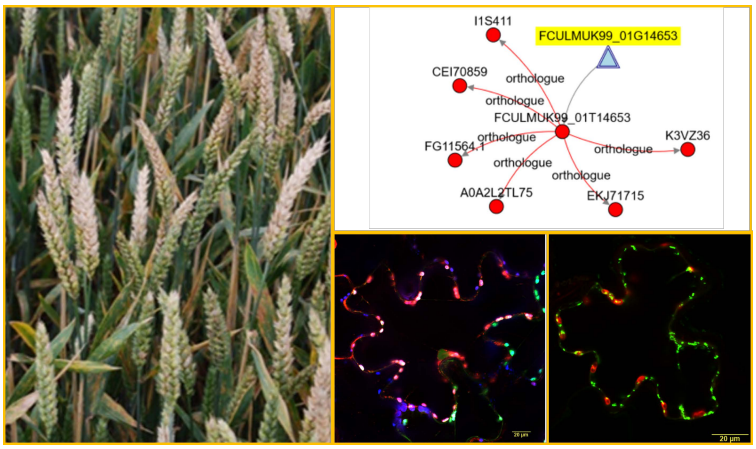
Investigating fungal pathogen effector localisation within plant cells

Supervisory team:
Rothamsted supervisor: Prof Kim Hammond-Kosack (Rothamsted Research)
Academic supervisor: Dr Hans-Wilhelm Nuetzmann (University of Bath)
Dr Martin Urban (Rothamsted Research), Dr Neil Brown (University of Bath), Dr Martin Darino (Rothamsted Research), Dr Dan Smith (Rothamsted Research)

Collaborators: Dr Jana Sperschneider (CSIRO, Australia)

Host institution: Rothamsted Research (Harpenden)
Submit applications for this project to University of Bath

Project description:



Ensuring global food security for the ever-growing world's population is a major concern. Fungal pathogens destroy a substantial amount of all food crops each year (~15%). Cereal head blight diseases of wheat caused by various Fusarium fungi are particularly serious (Dean et al., 2012). These pathogens secrete effector proteins that manipulate the host to promote infection. Some effectors were predicted to enter host organelles using software tools that search for sequence signatures associated with subcellular targeting. However, these prediction might not be accurate as only for a few fungal effectors has their subcellular localisation been validated. Robust predictions are required to identify virulence changes in the pathogen population associated with differences in effector host subcellular localisation.

We will use multiple software tools to perform an in-silico meta-analytic prediction of the secretome of multiple Fusarium graminearum strains and identify effectors likely to have host subcellular localisation before validating these predictions in the laboratory using in planta expression and confocal microscopy. Validated localisation data will be used to improve the accuracy of prediction tools. Then the plant protein targets from some effectors will be identified by co-immunoprecipitation or proximity labelling followed by mass spectrometry. Plant targets identification will allow the elucidation of effector function(s). This new knowledge will permit the student and the advisory team to devise new F. graminearum control strategies.

The project is multidisciplinary with strong mathematical, computational biology and imaging components. The student will spend the first six months at Rothamsted Research (RRes) undertaking initial research training in bioinformatics, cloning techniques, bioimaging and specific taught courses. Subsequently, the student will transfer to the University for a further research training period, before returning to RRes for the remainder of the PhD project. The University of Bath will be involved and will provide training in genomic approaches and analyses. The advisory team includes Drs Nützmann (lead University supervisor) and Brown (2nd University supervisor) and at RRes Drs Darino, Smith and Urban and Prof. Hammond-Kosack (main supervisor). The student will have access to world class research facilities and will receive outstanding interdisciplinary training from their advisory team. 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 suitable public outreach events, for example The British Festival of Science.

Sperschneider (2017) Scientific Reports 7: 1-14. Dean (2012) Molecular Plant Pathology 13: 414-430.

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.