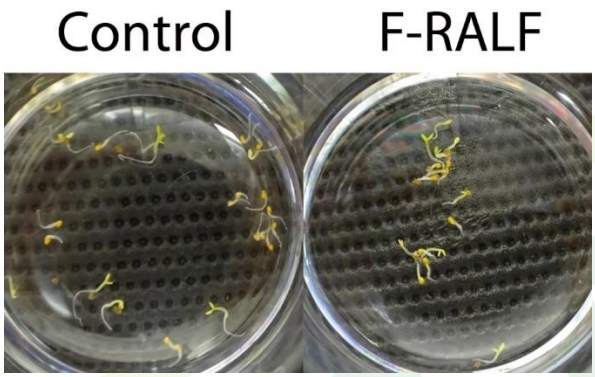
Plant defence strategies to *Fusarium oxysporum*

Throughout my summer studentship, I have worked alongside Dr Estrella Luna-Diez at the Arthur Willis Environmental Centre at the University of Sheffield, investigating the immune response of plants to *Fusarium oxysporum*. My project focused on *Arabidopsis thaliana*, with an aim for this research to be transferred to *Solanum lycopersicum* (tomato) plants. The project looked into a main aspect of food security where pathogens continuously affect our attempts to increase food production.

F. oxysporum is a multihost pathogen, commonly found in agricultural soils. It is a devastating vascular fungus. Its obscure infection strategy through the root system makes it hard to identify and control. Fungicides are an effective control, yet there is strict legislation upon using these chemicals, therefore alternative methods must be found. One alternative is to enhance the defence capacity of plants. In order to achieve this, we need to understand how *F. oxysporum* infects roots and alters how the plant combats the attack. The infection process could be seen as an arms-race, as both pathogen and host are constantly developing new mechanisms of attack and defence. Amongst different strategies, in plants, the activation of hormone-dependent signalling pathways act towards protecting against infection. The fungus produces a peptide homologous to the plant Rapid Alkalinisation Factor (RALF); Fusarium RALFs (F-RALFs) have been demonstrated to enhance fungal disease through increasing pH. Importantly, deletion of the F-RALF encoding gene in the fungus leads to enhanced activation of plant defences, indicating that F-RALF suppresses host immunity during fungal infection. During this project, I studied the role of F-RALF in impacting hormone-dependent signalling pathways. For this, I have investigated the phenotype triggered by F-RALFs in shortening root length in mutants impaired in the activation of hormone-dependent defence mechanisms. This work has led me to identify potential pathways in plants that are important for F-RALF-induced virulence.

For the experiments, I grew Arabidopsis seedlings in solid and liquid growth media to observe differences in root growth (pictured below). Moreover, I have optimised the method using tomato seedlings. During my project I have learnt a range of laboratory skills, including sterilisation of seeds, making growth media and using general lab equipment. Importantly, I have also learnt valuable transferable skills in photographic analysis and statistics. Additionally, I have assisted Dr Luna-Diez in her own project, working in the P3 centre at Sheffield. This extra experience allowed me to work with different accessions of tomato, learn to perform different pathoassays, as well as isolating virulent strains of *Phytophthora infestans* and *Botrytis cinerea*.



I would like to thank Dr Estrella Luna-Diez for her constant help and encouragement, as well as allowing me to work alongside her on her own exciting projects. She has provided me with invaluable knowledge and skills, all of which will help me in my future work. I look forward to hopefully continuing my experiment with her to complete our investigation! I would also like to thank Prof Antonio Di Pietro (University of Cordoba, Spain) for his advice during the project. Thanks also, to the BSPP for funding my project and giving me the chance to gain research experience in such a current topic.

Jemma P Upton

University of Sheffield