Feeling the heat: understanding plant-pathogen interactions in a changing climate

Supervisory team:
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Submit applications to this project to University of Exeter

Project description:
Crops growing in the field are continually faced with challenges or stresses. Two major current and future threats to crop production are diseases and climate change, in particular global warming and associated "heat stress". Understanding the response of a plant to a combined stress is traditionally more difficult than studying each in isolation. Pathogens themselves must also adapt to the stresses imposed by temperatures as well as plant defence responses. Studies on combined stress are often underrepresented yet this work is crucial to sustain crop productivity. Right now, we do not understand how a heat stressed plant might respond to pathogen attack or indeed if the capacity of the pathogen to infect the plant is altered by increased temperatures. This PhD project is designed to address these gaps in our understanding.

We are proposing a new programme of research to understand if future elevated temperatures associated with climate change will contribute to further wheat yield loss caused by fungal diseases. We will use a new model system involving a key global pathogen of wheat, Zymoseptoria tritici which causes Septoria tritici blotch disease. It has long been established that lipid remodelling – the rearrangement of membrane lipid composition – is a critical part of temperature sensing and mitigation in all kingdoms of life. In plants, defence-associated signal transduction is multifaceted and involves phospholipid-based signalling and membrane trafficking. Similar processes are known for non-pathogenic yeasts, but have not yet been studied in any filamentous fungal plant pathogens such as Z. tritici. We have developed methods to identify and quantify the total set of lipids present in plants and fungi, so called Lipidomics. The emergence of Lipidomics as a technique, combined with our large genetic resources and techniques to manipulate both wheat and Z. tritici isolates, places us in a unique position to investigate combined stress responses in a globally important crop production setting. The project represents a unique venture bringing together disparate disciplines, and will offer unique training in lipidomics, plant pathology, abiotic stress tolerance, molecular biology, and functional genomics. The development of resilient crops that require less inputs e.g., irrigation and pesticides will support the reconfiguration of agriculture into sustainable food systems urgently requires this type of investigation.

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.