Climate change impacts on Fusarium Head Blight disease and mycotoxin risk in wheat production

Supervisory team:
Main supervisor: Prof Daniel Bebber (University of Exeter)
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Host institution: University of Exeter (Streatham)

Project description:
Mycotoxins are toxins produced by fungi on many different food plants, posing a serious risk to human health. This project will investigate how climate change is affecting mycotoxin production in wheat and barley, caused by the fungal disease Fusarium Head Blight (FHB). A recent estimate of the economic cost of mycotoxins in European wheat alone at EUR 3 Billion between 2010 and 2019. This studentship will develop a wide range of laboratory and data science skills, focussing on an issue of major importance to UK and European agriculture. Weather conditions exert a strong influence upon the risk of infection by FHB-causing fungi, and on the production of mycotoxins. The various fungal species associated with FHB respond differently to temperature and moisture, and production of different mycotoxins is dependent upon both microclimate and atmospheric carbon dioxide concentrations. Thus, climate change is likely to alter mycotoxin risk in complex ways with largely unknown implications for cereal production in coming decades.

Existing predictive models for fungal infection, FHB development and mycotoxin production have poor predictive ability or have been developed for climates unlike the UK, so our understanding of how and why risk might change in future is limited. While several FHB predictive models have been developed, UK-specific analysis is lacking. This project will generate new data on the epidemiology of FHB-causing fungi in relation to environmental conditions, using the University of Exeter's state-of-the-art Global Weather Simulator facility. The project will involve infection and disease development experiments under a range of simulated weather and atmospheric conditions with a sample of FHB-associated fungal pathogens (Fusarium, Michrodium), under the supervision of Dr. Helen Fones (University of Exeter). Quantification of mycotoxin production under these varying conditions will be supervised by Dr Neil Brown (University of Bath). Data arising from these experiments will be used to develop and parameterize predictive models of disease and mycotoxin production and identify optimal timing of fungicide applications, under the supervision of Prof. Dan Bebber (University of Exeter). Climate change projections from published FHB-mycotoxin models will be compared to the newly-parameterized model. FHB is a major burden to global wheat production, and understanding how weather and climate affect mycotoxin production is an important step in directing research to reduce risk.