# Zymoseptoria tritici-wheat: the metabolic interface of a crop pathogen and its host plant

**Supervisory team:**
**Main supervisor:** Dr Helen Fones (Eyles) (University of Exeter)
**Second supervisor:** Prof Nick Smirnoff (University of Exeter)
Prof David Studholme (University of Exeter)

**Collaborators:** Dr Gary Barker (University of Bristol)

**Host institution:** University of Exeter (Streatham)

**Project description:**

Zymoseptoria tritici, the causal agent of Septoria Triciti Blotch (STB), is Europe's most important pathogen of wheat, costing the UK economy alone around £300M per annum in lost yields and spending on fungicides. There is a great need to better understand how this fungus interacts with the wheat plant and with other microbes on the leaf surface, in order to find new ways to control STB: at present, we are reliant on fungicides to which the fungus is beginning to develop resistance. One area in which little is currently known is how the fungus obtains nutrients in early infection.

Work in the Fones' lab has recently shown that this fungus can remain on the leaf surface (epiphytic) for at least ten days before entering and infecting the leaf, and that it does not simply survive there but grows and even reproduces. Currently, we do not know how the fungus obtains nutrients during this phase. Zymoseptoria tritici isolates differ in the duration and extent of this surface growth and reproduction. In this PhD project, you will sample an array of Zymoseptoria tritici isolates from the field and use microscopy, molecular biology and plant pathology to determine their epiphytic growth phenotypes. You will carry out a Genome-Wide Association Study (GWAS) to identify the genetic differences which underpin variation in surface growth characteristics, with a particular interest in genes involved in nutrient acquisition and usage. You will use then use metabolomic techniques to determine what nutrients are present on the leaf surface and to what extent different Z. tritici isolates use particular energy sources. You will relate genomic and metabolomic data to the virulence of Zymoseptoria tritici isolates on chosen wheat cultivars. Finally, you will investigate possible links between fungal nutrient usage and plant defence signalling.

This project will allow us to develop a clear picture of how different Z. tritici isolates interact with resistant and susceptible wheat cultivars. You will show whether a particular isolate can colonise the leaf surface, and whether it can the subsequently enter the leaf. You genomic work will show what genes control this and whether they are they linked to nutrient uptake. You will also show what nutrients the fungus uses when it is on the leaf surface, how this relates to plant nutrition, and whether this may affect plant defences. Together, these findings will present new possibilities for control of this critical crop pathogen.