

Linking plant nutritional ecology with insect chemical ecology to promote regenerative agriculture

Supervisory team:

Lead supervisors: Dr Jozsef Vuts (Rothamsted Research), Dr Pete Maxfield (University of the West of England) Dr Vanessa Nessner-Kavamura-Noguchi (Rothamsted Research), Prof Neil Willey (University of the West of England), Prof Martin Broadley (Rothamsted Research), Dr Tim Mauchline (Rothamsted Research), Dr Ian Clark (Rothamsted Research), Dr Stephan Haefele (Rothamsted Research)

Host institution: Rothamsted Research (Harpenden)

Submit applications for this project to *University of the West of England*

Project description:

Insect herbivores can select more nutritious plant tissues over less nutritious to feed and lay their eggs on the host plant. How do they do this? We aim to answer this question under laboratory and field conditions using crop plants and their insect pests. You will first link plant nutritional composition with distinct plant volatile profiles, acquiring analytical chemistry skills during the process. As volatiles help herbivores locate their host, you will then test the hypothesis that herbivores can indeed use plant volatiles to distinguish the tissues most suitable for their actual physiological needs from less rewarding ones. With these skills, you enter the multi-disciplinary field of chemical ecology providing you with practical knowledge of insect behavioural ecology and electrophysiological science.

A key aspect of the project is to understand the role of the rhizosphere microbiome in plant nutrient acquisition. You will use a novel substrate system to experimentally manipulate which macro- and micronutrients are available for the plant to take up and how this is influenced by soil microbial activity. This will give you the chance to develop a deep understanding about microbiology and plant nutritional ecology.

Rothamsted Research has various field trial platforms, amongst them the world's longest-running agricultural field experiment, which will give you the opportunity to travel and test your lab findings in real life. This is the field ecology part of the project, in which you will map the distribution of pest insects on crop plants growing in plots that receive defined nutrient treatments. This will link spatial ecological patterns of nutrients, herbivores and soil microbes to the mechanistic understanding of plant-microbe-herbivore nutrient and volatile interactions from the lab.

You will have, or soon expect to obtain, an undergraduate degree in biology, chemistry or environmental science. A master's-level degree and substantive laboratory experience is desirable, but not essential. The supervisory team at Rothamsted and The University of the West of England consists of experienced chemical and nutritional ecologists, analytical chemists, microbiologists, and soil and field ecologists. By joining this team, you will have a unique chance to influence future fertiliser practices to reduce the negative impact of pest insects on crop health, including supporting regenerative agricultural practices.

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.