

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

Supervisory team:

Lead supervisors: Dr Jozsef Vuts (Rothamsted Research) and Dr Pete Maxfield (University of the West of England; UWE)

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Host institution: Rothamsted Research (Harpenden) / University of the West of England; UWE

Submit applications for this project to UWE

Project description:

Insect herbivores can select more nutritious plant tissues over less nutritious to feed and lay their eggs on their host plant. How do they do this? We aim to answer this question under laboratory and field conditions using crop plants and their pest insects.

You will experimentally test the following hypotheses using aphids as above- and wireworms as belowground herbivores:

- Plant nutritional composition is linked with distinct volatile profiles both in the aerial and the soil environments.
- Herbivores assess plant nutritional status using volatiles.
- The physiological status and developmental stage of herbivores dictate their preference for plant tissues of particular nutritional compositions.
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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 hosts, 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. Equipped with these skills, you enter the multi-disciplinary field of chemical ecology providing you with practical knowledge of insect behavioural ecology and electrophysiological science. The data you generate here will link insect behaviour with plant nutrition and particular volatile molecules.

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 and herbivores to the mechanistic understanding of plant-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 Masters-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, and soil and field ecologists. By joining this team, you will learn skills around hypothesis formulation and testing, critical thinking, experimental design, working in a laboratory environment and dissemination of science to the academic community. You will also have a unique chance to influence future fertiliser optimisation practices to reduce the negative impact of pests on crop health, including supporting regenerative agricultural systems.

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.