PhD Project Advertisement

Project No/title: FBS2026 09 Bosch ar / *Flower Power: Petal and pistil adaptations for climate resilience*
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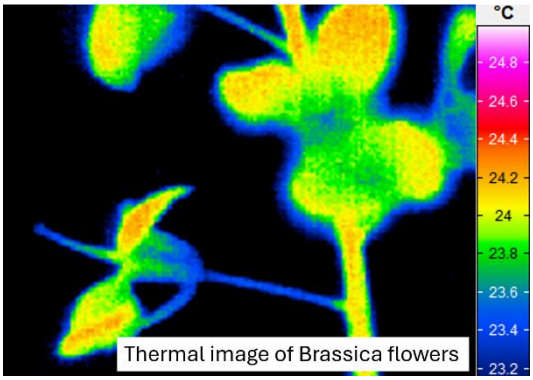
Co-supervisors:
Prof John Hammond, University of Reading
Prof John Doonan, Aberystwyth University

Project Details

High temperatures can reduce plant fertility and lower seed yield, posing a major challenge for food production in a warming climate. Flowers are especially sensitive to heat, but some structures may help protect their reproductive organs. Preliminary data in Brassica napus suggests that pistils are cooler than the surrounding petals, indicating that petals may help create a protective microclimate. We also identified stomata along the style of the pistil, which may allow the plant to cool this tissue through transpiration.



Thermal image of Brassica flowers

Little is known about how flower structures help manage heat, and this project will investigate this overlooked dimension of floral physiology. By exploring how petals and pistils regulate temperature, the study will shed light on natural processes that plants may use to safeguard reproduction under heat stress. Understanding these thermo-regulatory traits could help improve crop resilience as global temperatures rise, offering new opportunities for climate-smart crop improvement.

Research aims: To investigate how petals and pistils work together to regulate temperature under heat stress, and to determine how these cooling processes support reproductive success. The project will reveal the physiological, structural, and potentially genetic traits that help flowers protect sensitive reproductive tissues in challenging environmental conditions, with wider implications for improving heat tolerance in crops.

What you will do: The student will use thermal imaging to measure temperature differences between petals and pistils under a range of heat stress conditions. Comparisons will include wild-type Brassica napus and apetalous mutants to assess the influence of petals. They will also carry out transcriptional analyses to identify temperature-responsive pathways associated with cooling effects or heat stress responses. To investigate how stomata on the style contribute to cooling, the student will work with Arabidopsis stomatal mutants. Thermal imaging, gas-exchange measurements, and molecular analysis will be used to link transpiration to pistil temperature regulation. Heat-stress experiments will then examine how these thermo-regulatory processes affect pollen tube growth and seed production. Finally, comparative studies in different species (e.g., Brassica and Solanum) will explore how floral cooling varies across plants adapted to different climates.

References:

1. Dahake A, Coates C, Obregon D, Chai J, Nunes-Silva P, Kevan PG, Raguso RA. The effects of floral microclimate on pollen viability and visitor behavior. Current Biology. 2025;35(19):4765-81. https://doi.org/10.1016/j.cub.2025.08.039
2. Kourani M, Anastasiadi M, Hammond JP, Mohareb F. Prolonged heat stress in Brassica napus during flowering negatively impacts yield and alters glucosinolate and sugars metabolism. Frontiers in Plant Science. 2025;16:1507338. https://doi.org/10.3389/fpls.2025.1507338
3. Kourani M, Mohareb F, Rezwan FI, Anastasiadi M, Hammond JP. Genetic and physiological responses to heat stress in Brassica napus. Frontiers in Plant Science. 2022;13:832147. https://doi.org/10.3389/fpls.2022.832147

Student profile

Essential for project: A background in one or more of the following: plant biology, cell biology, physiology, molecular biology, or a related subject, and an interest in either plant reproduction, heat stress, or crop resilience.
Desirable for project: Experience with microscopy or imaging, plant growth, physiology, or molecular techniques, or quantitative data analysis is desirable but not required. Training will be provided to support candidates new to these methods.
Minimum requirements for all FoodBioSystems applicants: An upper 2nd class degree (or equivalent) in a subject relevant to the project. Candidates with a lower class of Bachelors degree, but merit or above at Masters level will also be considered**.** Demonstrable skills in problem-solving, team-working, communication and time management.

Training

Project specific training opportunities: The student will receive multi-disciplinary training across plant reproductive biology, physiology, genetics, and imaging. They will learn thermal imaging, microscopy, gas-exchange methods, molecular biology, and transcriptional profiling, with opportunities to develop skills in quantitative image analysis, data handling and modelling. Working with Maurice Bosch (Aberystwyth University), the student will develop skills in flower biology and molecular cell biology. John Doonan, director of the National Plant Phenomics Centre, will provide expertise in plant phenotyping and image-based analysis, including handling and interpreting complex imaging datasets. John Hammond (University of Reading) will offer training in crop genetics, physiology, and Brassica systems, including opportunities to develop skills in transcriptional analysis and trait characterisation during visits to Reading. A placement with a crop research or agri-tech organisation will support experience in applying research skills beyond academia and broaden career development.

FoodBioSystems training opportunities: Throughout their studentship, all FoodBioSystems doctoral researchers participate in cohort training that covers four key themes: food systems, big data (data analytics and modelling), business, and research fundamentals. All doctoral researchers complete a placement: either project-related with a non-academic (CASE) partner, or unrelated to the project and outside the academic environment (PIPS). Details of training are available on the DTP website: https://research.reading.ac.uk/foodbiosystems/training/.

Project supervision style

The supervision plan for this project will ensure robust support for the student's research and development. Maurice Bosch at IBERS, Aberystwyth University, will act as the lead supervisor, with weekly 1:1 meetings to provide consistent guidance. The student will also participate in weekly lab group meetings for broader scientific discussions. Importantly, at the start of the project, the student will have virtual meetings every other week with the supervisory team that includes John Hammond from the University of Reading, an expert in Brassicas and other crops, and John Doonan, director of the National Plant Phenomics Centre. These meetings may shift to a monthly schedule as the project progresses. We will also organize at least one annual in-person meeting with the supervisory team. Feedback on drafts and reports will be provided within two weeks, ensuring timely and effective progression.

Stipend (Salary)

FoodBioSystems DTP students receive an annual tax-free stipend (salary) that is paid in instalments throughout the year. For 2025/26 this is £20,780 and it will increase slightly each year at rate set by UKRI.

Equity Diversity and Inclusion

The FoodBioSystems DTP is committed to equity, diversity and inclusion (EDI), to building a doctoral researcher (DR) and staff body that reflects the diversity of society, and to encourage applications from under-represented and disadvantaged groups. Our actions to promote diversity and inclusion are detailed on the FoodBioSystems DTP website and include:

- Offering reasonable adjustments at interview for shortlisted candidates who have disclosed a disability or specific learning difference.
- Guaranteed interview and applicant mentoring schemes for applicants, with UK home fees status, from eligible under-represented ethnic groups who also meet academic eligibility criteria and the student profile essential for the project.

These are opt-in processes**.**

Our studentships can be offered to home students on a part-time basis, and studentship end date and stipend payments will be amended to reflect the part-time registration. The minimum registration for DTP funded part-time students is 0.5 FTE (studying an average of 20 hours per week over 8 years). We regret that part time registration is not available to international students due to complexities of visa restrictions.

Funding note

We welcome applications from candidates with Home/ROI fees and international fees status. This studentship is funded by UKRI and covers stipend, fees at Home/ROI rate, and research costs. The host university will not charge UKRI funded international students the difference between Home/ROI fees and international fees.
Costs that must be found from other sources or met by the individual student include: visa fees, healthcare surcharge, relocation costs and guarantor services.

For up to date information on funding eligibility, studentship rates and part-time registration, please visit the FoodBioSystems website.