

# PhD Opportunity

Developing synthetic microbial communities for the control of pea downy mildew

## Supervisory team

Professor Mahmut Tör, Professor Yiguo Hong, Dr Tom Wood

## Director of Studies

Professor Mahmut Tör, Molecular Plant and Microbial Biosciences Research Unit (MPMB-RU) School of Science and the Environment, University of Worcester

## Supervisors

Professor Yiguo Hong, Molecular Plant and Microbial Biosciences Research Unit (MPMB-RU) School of Science and the Environment, University of Worcester

## Research Group

[Molecular Plant and Microbial Biosciences Research Unit \(MPMB-RU\)](#)

## The PhD Opportunity

Demand for food production is increasing due to growing global population, reduced land availability for agriculture, concern over the effects of the environment on agriculture, and decreasing yield reliability because of climate change. We need to rise to this challenge and provide solutions to grow enough food in a sustainable way. Legumes including peas and broad beans and other protein crops have gone through a revival and demand has been increasing steadily.

However, these pulse crops suffer heavily from the downy mildew pathogen *Peronospora viciae* f.sp. *pisi* (*PVP*). Next Generation Sequencing (NGS) approaches on soil and phyllosphere microbes have led to an explosion of information regarding plant associated microbiomes. Although this type of work has been predominantly sequence-based and often descriptive in nature, increasingly it is moving towards microbiome functionality. The synthetic microbial communities (SynCom) approach is an emerging technique that involves co-culturing multiple taxa under well-defined conditions to mimic the structure and function of a microbiome.

## Our aim and objectives are:

We aim to reduce downy mildew disease with artificially constructed beneficial microbial communities. Specifically, we will identify microbial communities on the phyllosphere part of pea plants, determine if the microbial community enhances yield and quality of the crop, examine if synthetic fungicides can be replaced by beneficial microorganisms and develop a beneficial microbial mixture specific to pea plants. In the short term (2-3 years), commercial pea growers, breeders and pea seed producers will be able to benefit from the outcome of the research proposed here.

1. Identify microbiomes in phyllosphere of pea and investigate how *PVP* interacts with the microbial community using shotgun 16 s and ITS metagenomics/whole genome sequencing approaches.
2. Determine whether phyllosphere microbiomes enhance crop performance in terms of differences in disease symptoms in the absence and presence of infective pathogen.
3. Examine the interaction between synthetic fungicide and addition of 'beneficial microorganism' to phyllosphere and *PVP*.
4. Develop a pea specific novel beneficial microbial mixture.

We anticipate through this work, microbial communities on pea plants will be identified before and after pesticide application; interaction between *PVP* and other microbial community identified; effect of fungicides on pathogenic, commensal and beneficiary microbes determined; role and performance of microbiomes in phyllosphere of pea determined; and a method that will help to identify crop specific mixture of beneficial microbes established.

Student will have research training in: Molecular biology, plant pathology, bioinformatics. Student will have opportunity to work with different groups and laboratories. Supervisors have extensive experience in supervising students and collaborated and published joint papers before. Results obtained from this work will be published in internationally peer-reviewed journals and will be presented at national and international scientific meetings.

### **Application Process**

To begin the application process please go to

<https://www.worc.ac.uk/research/research-degrees/applying-for-a-phd/>.

### **The Interview**

All successful applicants will be offered an interview with the proposed Supervisory Team. You will be contacted by a member of the Doctoral School Team to find a suitable date. Interviews can be conducted in person or over Microsoft Teams.

### **Funding your PhD**

For information about Doctoral Loans please visit: <https://www.worc.ac.uk/study/fees-and-finance/doctoral-loans.aspx>

During your PhD you can access the Research Conference Support Scheme to support the costs of presenting your research at an external conference.

### **Research at the University of Worcester**

Research is central to the University's mission to make a difference in everything that we do. We are committed to delivering excellent research which extends the boundaries of human knowledge but which also improves people's lives by enabling better health outcomes, improving food security, developing environmentally sustainable solutions for crop production and socially sustainable solutions to our ageing population, enhancing public knowledge and understanding of the past and present.

The University hence focuses its research around five high-level challenges facing society, locally, nationally and globally:

- [Human Health and Wellbeing](#)
- [Sustainable Futures](#)
- [Digital Innovation](#)
- [Culture, Identity and Social Exclusion](#)
- [Professional Education](#)

The success of our research is reflected in our continuous improvement in external research assessment processes. In the most recent Research Excellence Framework, REF 2021, the University saw a near 50% increase in the scale of its research and 12% increase in quality, building on its performance in REF 2014 when it was the UK's most improved university in terms of Research Power, a combination of scale and quality.

### **Research Degrees at Worcester**

Our research students are central to our overall mission for research. They are working at the cutting edge of their disciplines and driving forward the quality of our research whilst enriching our research culture. We are looking to increase our research student numbers as a strategic imperative.

Our commitment to our students is reflected in the results of the Postgraduate Research Experience Survey 2023 in which we ranked 3<sup>rd</sup> for overall research student satisfaction nationally. Key to our success in this area is the Doctoral School, a focal point for all our research students.

It provides:

- day-to-day support for our students, both administrative and practical, through our dedicated team.
- a Research Student Study Space with both PCs and laptop docking station.
- a comprehensive Researcher Development Programme for students and their supervisors.
- a programme of student-led conferences and seminars.

### **Research Group**

#### **Molecular Plant and Microbial Biosciences Research Unit**

We carry out both fundamental and translational research in the field of plant and microbial biosciences. We are interested in answering the following fundamental questions; how do obligate pathogens such as downy mildews coordinate their attack to overcome the plants' defence? What is the basis of their host specificity? Do they synchronize their physiological and metabolic activity with their hosts? Can we carry out reverse genetics to reveal the role of pathogenicity and developmental genes?

We aim to take the information gained to develop a potential disease control strategy against downy mildews on crop plants. Our further translational research includes genomic assisted plant breeding and genome editing for crop improvements.

### **Widening Participation**

As part of its mission statement the University is committed to widening participation for its higher degrees. Although most candidates will have an undergraduate and/or a Masters degree, the University is happy to accept applications from candidates with relevant professional qualifications and work related experience.

**For further information** or an informal discussion on this project, please contact Prof Mahmut Tor (Director of Studies) via email at [m.tor@worc.ac.uk](mailto:m.tor@worc.ac.uk)

