

PhD studentship
The Bio-Protection Research Centre, New Zealand

Understanding plant response to infection by *Plasmodiophora brassicae*

Applications close: Dec 24th, 2008

Reference number: CFRSB1

Supervisors: Dr Simon Bulman
Plant Pathology and Microbiology, Plant & Food Research, Lincoln, New Zealand.

Professor Richard Falloon
Plant Pathology and Microbiology, Plant & Food Research, Lincoln, New Zealand.

Professor Tony Conner
Plant and Food Biotechnology, Plant & Food Research, Lincoln, New Zealand.

Stipend: NZ\$24,500, plus University fees.

Location: Plant Pathology and Microbiology, Plant & Food Research, Lincoln, NZ.

Project Description

Clubroot is an ongoing disease problem for growers of brassica crops worldwide. It is caused by the biotrophic, soilborne protozoan pathogen, *Plasmodiophora brassicae*. Once soil is infested, clubroot becomes an intractable problem.

There are few chemical treatments available for control of diseases caused by plasmodiophorids. In large part, this is because of the evolutionary distance separating the plasmodiophorids from the true fungi and oomycetes. Most pesticides designed for plant pathogen control are fungicides, which have not proven successful for the control of plasmodiophorids. An alternative approach for pathogen control is through stimulation or priming of host plant defence systems. Elicitors of plant defence include the plant signalling molecules salicylic acid (SA) and methyl jasmonate (MeJA), and some rhizobacteria. Our poor understanding of plasmodiophorid diseases has been caused by a lack of systems for their manipulation; most experiments with clubroot continue to be made on soil-grown plants. For example, chitosan has been examined as a defence elicitor for protection against clubroot. However, when trying to understand the effects of chitosan on crop infection and yield, it has been difficult to distinguish between the influences of the elicitor or those of seasonal and soil variables. We have established a range of world-leading techniques for manipulating *P. brassicae* in the laboratory. In particular, we have phytohormone-free cultures of plant cells containing *P. brassicae* as well as *Arabidopsis* plants grown in sterile-sand that can be easily and reproducibly infected with clubroot.

The PhD student will use the cell lines and plant infection assays as a test system to examine the effects of stimulating plant defences on clubroot infection. Knowledge of the molecular response of host plants to successful *P. brassicae* infection is small, but it is known that plant defences are switched off. It is unclear if *P. brassicae* escapes detection by the plant or actively represses the plant defences. The PhD student will initially use bioinformatics tools to examine clubroot transcriptome data, particularly focusing on plant

defence gene transcription. Later, after applying elicitors such as SA or MeJA to the cells/plants, we will monitor changes in gene expression indicative of switching-on or priming of plant defences. Do these treatments result in gene expression changes, or does *P. brassicae* block these responses? If there are changes, does this drive *P. brassicae* out of the plant cell? Alternatively, is priming only successful if the plants are treated with the signalling molecules prior to initial infection with the pathogen?

These experiments will provide important new and reproducible information on the basic science of clubroot infection. They also offer the opportunity to examine the effects of commercial elicitor compounds such as benzothiadiazole (Bion® by Novartis), a plant activator used mainly for control of biotrophic fungi, and harpin (the broad-spectrum Messenger®, Eden Biosciences). We aim to identify new chemical or biological candidates for plant protection against plasmodiophorid diseases.

Project methodology

- 1). Genes transcribed in plasmodiophorid-infected plant cells will be identified.
- 2). Transcription profiles will be examined for evidence of plasmodiophorid manipulation of the plant immune system. Markers of immune system expression will be developed.
- 3). Plasmodiophorid cell lines will be exposed to elicitor compounds. Immune system gene transcription will be measured.
- 4). The ability of selected elicitors to affect plasmodiophorid infection will be tested in whole plant assays.
- 5). Thesis written and submitted.

Collaborators

The project is a collaboration between Plant & Food Research and the Bio-Protection Research Centre. The project will be overseen by Dr Simon Bulman, Professor Richard Falloon and Professor Tony Conner. The PhD studentship will ideally commence in either February or March 2009 and includes a NZ\$ 24,500 tax-free stipend and course fees for 3 years at Lincoln University. Funding is from the NZ Foundation for Research, Science & Technology and Horticulture New Zealand.

Eligibility

This PhD studentship is available to NZ and overseas students. Candidates should have or expect to obtain, a first or upper second class honours degree and preferably have a background in molecular biology and/or plant pathology. An ability to communicate well in English is an important criteria for entry to Lincoln University.

How to Apply

Applicants should submit a curriculum vitae with a covering letter indicating their interest in the project and the contact details of at least two referees to Dr Simon Bulman (bulmans@crop.cri.nz). The covering letter should quote the reference number CFRSB1.

Enquiries

For further information on this PhD studentship opportunity contact Dr Bulman (as above) at the Plant & Food Research.