

Postdoctoral Research Fellowship, Department of Plant Pathology, University of Stellenbosch

Project Title: Investigation of citrus soilborne pathogens and optimization of soilborne pathogen biocontrol

Scope of Research: In a recent study in South Africa, *Phytophthora nicotianae*, *P. citrophthora*, *Pythium* spp. and *Neocosmospora/Fusarium* spp. were all identified as being soilborne pathogens of citrus in South Africa. These organisms build up in the orchard soil over time and colonise newly planted trees. These pathogens often occur together in the soil where they interact. Previously, these pathogens were managed by MeBr fumigation. However, after being phased out, it was replaced by other soil fumigants. However, these have been shown to not provide the long-term control effect of soilborne diseases and nematodes. Concerns about resistance development by over-use of other fungicides such as metalaxyl (mefenoxam), have furthermore led to a reluctance to use these chemicals in management of soilborne pathogens. This has led to studies into the use of biocontrol agents for the management of these soilborne pathogens. These BCA's are furthermore attractive due to their different modes of action, including direct parasitism and competition while plant growth promoting characteristics are an added benefit. This makes them highly suitable to include in an integrated management system for soilborne pathogens, even if they need to be applied more than once.

Another recent study therefore focussed on finding potential BCA's from citrus tree roots. This led to two *Trichoderma harzianum*, one *Bacillus subtilis* and one *Pseudomonas fluorescens* isolate that showed potential *in vitro* to inhibit the different soilborne pathogens associated with citrus in South Africa. However, it was seen that the different BCA's varied in their efficacy against the different pathogens and even against different isolates of the pathogens. However, *in planta* evaluation of these identified BCA's indicated that, although they colonised the citrus seedling roots, they were not successful in reducing the levels of pathogen infection in the roots. In these evaluations the BCA's were applied multiple times. It was subsequently challenged by pathogen inoculations one week after the BCA applications. The short period between the last application and pathogen challenge might have been too short a time to allow the BCA's to colonise the seedling roots to such an extent as to optimally protect the seedlings against pathogen infestation. These results therefore pointed to some more questions that needs to be answered regarding the use of biological control agents, which this project aims to address. These were:

1. What is the tempo of colonization of citrus roots by the different biocontrol agents?
2. What mode of action do they employ against the soilborne pathogens?
3. The effect of the BCA's in activating defence responses within citrus against pathogen infestation.

Objectives

Optimisation of *Trichoderma*, *Bacillus subtilis* and *Pseudomonas fluorescens* biocontrol applications against citrus replant disease pathogens *in planta* under controlled conditions.

This objective will be addressed by studying the colonization of citrus roots by abovementioned BCA's along with the effect of BCA application on the expression of plant defense genes.

Host: The research will be done within the Citrus Research program under the leadership of Dr Jan van Niekerk within the Department of Plant Pathology, University of Stellenbosch, South Africa. The project will be part of an existing contractual agreement between Citrus Research International and the University of Stellenbosch. Funding is provided by the citrus industry through Citrus Research International and also carries a full grant-holder bursary for the successful applicant.

Requirement: PhD (obtained in the last 5 years)

- Advanced molecular skills relating to conventional PCR, qPCR and next generation sequencing (NGS)
- Experience in the study of plant pathogen related gene expression *in planta*
- Root microbiome studies
- Extensive experience in classical plant pathology research techniques and methodology.
- Computing literacy, with emphasis on Microsoft Office suite.

Please note that postdoctoral fellows are not appointed as employees and their fellowships are awarded tax free. They are therefore not eligible for employee benefits.

Commencement of duties: 1 April 2022

Closing date: 21 February 2022

Enquiries: Send a letter of application, accompanied by a comprehensive curriculum vitae, including list of publications and the names and contact details of at least two referees, to Dr Jan van Niekerk at E-mail: janvn@cri.co.za