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Control of sheath blight and other diseases in rice cropping systems using plant extracts

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Sheath blight caused by Rhizoctonia solani (teleomorph: Thanatophorus cucumeris) is one of the major problems in intensive rice production of the world, causing huge economic losses, especially under warm and humid conditions. No economically viable control methods have been developed. Chemical means of management are expensive and potentially harmful to the eco-system. In addition, no high levels of heritable resistance are available to control the disease.

Induced resistance is an eco-friendly and sustainable strategy to control diseases and is possible to activate in all plants (van Loon, 2000). Different kinds of inducers including chemicals, micro-organisms, and plant extracts can induce plant resistance (Walters et al., 2005). Induced resistance is often effective against several different pathogens (van Loon, 2000). Therefore, it has the potential to control R. solani, which is chosen as a model organism in our project, as well as other pathogens of rice.

Project objectives

1. Screening for plant extracts which can reduce infection of primarily R. solani
2. Elucidating the exact mechanisms behind the disease reduction

Work plan

1. Development of a screening system for plant extracts against R. solani
2. Basic studies of R. solani infection biology (histopathology) using microscopy
3. Studies of defence responses in plants with and without application of the selected plant extracts to verify whether induced resistance is involved in the disease reduction
   3.1. Test for direct antimicrobial effects of the selected plant extracts on the pathogen
   3.2. Studies of known induced resistance markers, e.g., H₂O₂, callose, lignin and lignin precursors using microscopy and specific staining techniques
   3.3. Studies of activities of the important defence-related enzymes such as chitinase, glucanase, etc.
   3.4. Gene expression studies using commercial Affymetrix GeneChips® and qRT-PCR to identify which genes are important in defence associated with induced resistance
4. Test of the selected plant extracts against other important rice pathogens including blast (Pyricularia grisea), brown spot (Bipolaris oryzae), and bacterial blight (Xanthomonas oryzae pv. oryzae) under greenhouse conditions
5. Evaluation of effectiveness of the selected plant extracts under field conditions

References