INDUCTION OF SYSTEMIC DEFENSE RESPONSES IN RICE AGAINST THE SHEATH BLIGHT PATHOGEN *RHIZOCTONIA SOLANI*, BY MEANS OF RIBOFLAVIN

Parissa TAHERI & Monica HÖFTE
Laboratory of Phytopathology, Faculty of Bioscience Engineering, Ghent University
Coupure Links 653, BE-9000 Gent, Belgium

Rice (*Oryza sativa* L.), the first cereal crop research model, plays an important role in the existence of human society for around 9000 years. It is the main staple food crop for almost half of the world's population, but can be affected by many diseases. Sheath blight, caused by the soil borne fungus *Rhizoctonia solani* Köhn (teleomorph: *Thanatephorus cucumeris* (A. B. Frank) Donk) is one of the most important rice diseases worldwide. Yield losses caused by sheath blight can reach over 50% when the infection is well distributed and severe in the field. Although partial genetic resistance to sheath blight in rice has been reported, no major gene responsible for resistance has been found untill now. Most traditional cultivars, planted on over 90% of the rice-growing areas are susceptible to this disease. Therefore, an intensive use of plant protecting chemicals is necessary to limit the damage in the fields. The toxicity and negative environmental effects of fungicides and appearance of fungicide-resistant pathogen strains has created interest in using alternative protection strategies. One of these strategies can be the application of natural or synthetic chemicals which are safe for the environment.

The role of riboflavin (vitamin B2) as an elicitor of systemic resistance and a plant defense activator in rice was demonstrated in the present study. We conducted studies of the mechanism of riboflavin-induced resistance and defense responses in rice against sheath blight. Following foliar application of riboflavin, rice plants developed systemic resistance to the pathogen. Riboflavin, at concentrations necessary for induction of resistance (0.1 to 1000 µM), did not cause any cell death in rice; also, it did not have any direct effect on the in vitro growth of the fungus. The necessity of a time interval between riboflavin application and inoculation of pathogen for reduction of disease progress clearly indicates that riboflavin protects rice against *R. solani* by induction of resistance. This case was further confirmed by investigating the expression of rice defense genes, including genes coding for rice cationic peroxidase (POC1), phenylalanine ammonia lyase (PAL), and lipoxygenase (LOX) using reverse transcription-polymerase chain reaction (RT-PCR). This method revealed significantly elevated levels of expression at 5 and 20 days after treatment with riboflavin, but not at 1 day after treatment compared to mock-treated plants as control. Riboflavin systemically induced expression of defense-related genes in treated rice plants especially after challenge inoculation with the pathogen, suggesting its ability for priming a signal transduction pathway, leading to induction of systemic resistance. Our findings demonstrate that using riboflavin as a plant defence activator can be a new, simple, and environmentally safe strategy to control the economically important sheath blight disease of rice.