RIBOFLAVIN INDUCES RESISTANCE IN RICE AGAINST RHIZOCTONIA SHEATH DISEASES BY ACTIVATING SIGNAL TRANSDUCTION PATHWAYS LEADING TO UPREGULATION OF RICE CATIONIC PEROXIDASE AND FORMATION OF LIGNIN AS A STRUCTURAL BARRIER

Parissa TAHERI and Monica HOFTE
Laboratory of Phytopathology, Faculty of Bioscience engineering, Ghent University, Coupure Links 653, B-9000 Ghent, Belgium

Plant defense responses against pathogen attack, which can be induced by several biological or chemical agents or after pathogen attack, usually include mobilizing a complex network of active defense mechanisms. In recent years, studies on application of various vitamins on plant, which are not only essential nutrients for human but also known as plant growth regulators, revealed interesting effects of these vitamins on activation of plant defense responses against different pathogens. The role of riboflavin (vitamin B_2) as a plant defense activator in rice against economically important sheath diseases caused by *Rhizoctonia* spp. was demonstrated in this study. Our findings revealed that riboflavin at concentrations necessary for induction of resistance in rice against *R. solani* was able to activate the expression of defense-related genes such as rice cationic peroxidase (PO-C1) and lipoxygenase (LOX). The possibility of involvement of PO-C1 in production of reactive oxygen species (ROS) was ruled out as upregulation of this gene was downstream of induction of H_2O_2 production in riboflavin-treated rice plants. Riboflavin-treatment of rice plants led to induction of resistance, and suppression of disease progress was linked with lignin formation at the infection sites, which was investigated using phloroglucinol/HCl test and thioglycolic-acid assay. Expression of a cationic rice peroxidase (PO-C1) was examined using reverse transcription-polymerase chain reaction (RT-PCR).Lignin formation, that can be another function of peroxidases, was detected in riboflavin-treated plants to be downstream of PO-C1 upregulation. This finding indicates that PO-C1 might be involved in lignin deposition in riboflavin-induced resistance (IR) in rice against *R. solani*. The weak effect of benzo (1, 2, 3)-thiadiazole-7-carbothionic acid-S-methyl ester (BTH) in protecting rice against *R. solani*, no clear effect of riboflavin treatment on the expression of phenylalanine ammonia lyase (PAL) gene, and the weak effect of the PAL inhibitor α-aminooxy-β-phenylpropionic acid (AOPP) alone on resistance of rice against *R. solani* ruled out the major involvement of the SA-signaling pathway in riboflavin-IR in our pathosystem. In contrast, the effect of JA in partially protecting rice against *R. solani*, the upregulation of LOX as a marker gene of jasmonic acid (JA) signaling pathway, and the strong suppression of resistance by the LOX inhibitor 5, 8, 11, 14-eicosatetraynoic acid (ETYA) support the involvement of JA signaling pathway in riboflavin-IR. In addition, our findings strongly suggest that riboflavin-IR requires protein kinase signaling mechanisms in the *Oryza sativa-R. solani* interaction.