Journal of Agricultural Biotechnology & Crop Improvement

Oral Presentation

Conference Abstract
Vol-1. No-1 | 2020

Engineering rice for resistance to blast and sheath blight diseases

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Abstract:

Rice is the source for more than half of the global population. The production of rice is subjected to various biotic and abiotic stresses. Among the biotic stresses, blast and sheath blight are the major threats for rice cultivation.Among the available approaches, deployment of resistance (R) and pathogenesis related (PR) genes, respectively are both eco-friendly and environmentally viable approaches. Using the biotechnological tools, we could identify the genes for these two diseases. Major resistance (R) gene Pi54of for blast resistance was identified and characterized from Oryza officinalis.Docking analysis found that Pi54of protein interacts with AVR-Pi54 through novel STI1 and RhoGEF domains, which are the components of rice defensome complex. Therefore, Pi54of has differential domain specificity in comparison to Pi54 and Pi54rh orthologs proteins during interaction with the AVR-Pi54 and is localized to cytoplasm and nuclei. Transformation in both indica and japonica rice with Pi54ofenhanced resistance for multiple M. oryzaestrains. Further, Pi54of was found to inherit stable resistance in the later generations as well. Indica rice cv. Tetep is known sources of resistance for sheath blight. A major QTL region (qSBR11-1) was characterized and a chitinase gene LOC_Os11g47510was cloned and characterized from this region using rice genetic engineering. Therefore, the novel genes identified here could be usedfor molecular breeding of rice for resistance to blast and sheath blight diseases.