Plant R genes and its application in defense

Suvanthini. S.

Department of Agricultural Biology, Faculty of Agriculture, University of Jaffna, Ariviyal Nagar, Kilinochchi

Abstract

Plant diseases can drastically decline the crop yields as the degree of disease outbreak is getting severe around the world. Therefore, plant disease management has always been one of the main objectives of any crop improvement program. Plant disease resistance (R) genes have the ability to detect a pathogen attack and facilitate a counter attack against the pathogen. Numerous plant R genes have been used with varying degree of success in crop improvement programs in the past and many of them are being continuously exploited. With the onset of recent genomic, bioinformatics and molecular biology techniques, it is quite possible to tame the R-genes for efficiently controlling the plant diseases caused by pathogens. This article summarizes importance of R genes and its applications.

The activation of plant defense to restrict pathogen invasion is often conferred by resistance (R) proteins. The most prevalent class of R proteins contains leucine-rich repeats (LRRs), a central nucleotide binding site and a variable amino terminal domain. Other classes possess an extracellular LRR domain, a transmembrane domain and sometimes an intracellular serine/threonine kinase domain. R proteins function in pathogen perception and/or the activation of conserved defense signaling networks. Upon infection, specific effectors produced by pathogens and presumed to promote growth in host tissue, are either directly recognized by different R proteins or are recognized by a targeted plant protein which is itself guarded by R proteins. Subsequently, various defense signaling networks are activated via R protein phosphorylation, oligomerization, degradation, conformational changes and by the shuttling of R proteins between the plant cell cytoplasm and the nucleus. The overall outcome is dramatic cellular reprogramming and the activation of coordinated defense responses both locally at the site of infection as well as systemically throughout the plant. For a century, plant breeders have genetically characterized and used R genes to reduce the impact of pathogens on crop production. More recently, various transgenic approaches have been tested to provide broader spectrum control and improved durability