DBT-NIPGR team studies Tomato leaf curl New Delhi virus infection in tomato

New Delhi, March 04: The reactive oxygen species (ROS) are involved in regulating growth, development, as well as response to biotic and abiotic stresses in plants. Regulation of stress adaptation and programmed cell death (PCD) by ROS-derived signals has been extensively studied. ROS in low levels induces protective mechanisms and acclimation responses to stresses, whereas a higher dose of ROS triggers PCD. Thus, the ROS levels should be tightly regulated within the cells, and ROS scavenging enzymes play a significant role in this regulation. As such, ROS scavenging enzymes have also been shown to have a potential role in providing tolerance to stresses; however, no attempt has been made to study the role of these enzymes during Tomato Leaf Curl New Delhi Virus (ToLCNDV) infection in tomato.

A team at DBT-National Institute for Plant Genome Research, New Delhi has studied the total repertoire of ROS detoxifying enzymes-encoding genes in tomato using advanced genomics approaches and showed that SlGR3 is a vital component of defense mechanism against ToLCNDV infection.

A total of 281 genes encoding for ROS detoxifying enzymes were identified in tomato. For the first time, we have identified six major classes of enzymatic antioxidants, namely superoxide dismutase (SOD), catalase (CAT), glutathione reductase (GR), Peroxidase (Prx) and glutathione S-transferase (GST), involved in ROS detoxification in tomato.

SlGR3, SlPrx25, SlPrx75, SlPrx95, SlGST44 and SlGST96 showed significant upregulation during virus infection.The expression patterns of identified genes were studied in tomato cultivars, contrastingly differing in their tolerance levels to ToLCNDV during virus infection and different hormone treatments. Significant upregulation of a few notable genes during virus infection in the tolerant cultivar suggests their possible involvement in conferring tolerance to virus infection.

Virus-induced gene silencing of SlGR3 turned tolerant cultivar to susceptible.Virus-induced gene silencing of SlGR3 in the tolerant cultivar conferred disease susceptibility to the knock-out line, and higher accumulation (~80%) of viral DNA was observed in the tolerant cultivar. This confirms the role of SlGR3 in the tolerance mechanism.

The team has been working on understanding the plant-virus interaction during ToLCNDV infection in tomato for more than a decade. This is the first attempt to delineate the tight interplay between ROS-induced hypersensitive response and ROS scavenging during virus infection. The study has opened new avenues for future research in this direction, and this will also enable the researchers to get access to the ROS scavenging genes repertoire from the paper. Though there is no immediate application to the public, the study serves as a foundation for further research towards engineering tomato plants tolerant to ToLCNDV.

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