ENHANCED FUSARIUM WILT RESISTANCE ASSOCIATED WITH LACINILENE PATHWAY INDUCTION IN COTTON

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Abstract

Terpenoid compounds derived from gossypol pathway and lacinilene pathway play an important defense role against herbaceous insects, animals and pathogens. The two pathways share common intermediates from □-cadinene to □-cadinen-2-one. Previously, we generated transgenic cotton plants in which the gossypol pathway was blocked by RNAi suppression of an early pathway biosynthetic enzyme CYP82D hydroxylase. Disease assay showed that the RNAi plants were more resistant to Fusarium wilt pathogens than that of the corresponding wild type sibling plants. Root terpenoids analyses revealed no overall increases in the gossypol pathway compounds in the roots infected by the wilt pathogen. In contrast, the lacinilene pathway was induced by the pathogen infection and the levels of lacinilenes were almost 20-fold higher in the RNAi plants than in wild type plants. Fungitoxicity testing of a lacinilene compound DHC at a concentration similar to those found in the infected RNAi plants showed growth inhibition of the fungal pathogen greater than 93%. Thus, the induction of lacinilene pathway in the RNAi plants may have contributed to enhanced resistance. Gossypol pathway was induced by phytohormone jasmonic acid treatments. However, jasmonic acid treatments failed to elicit production of lacinilene pathway terpenoids in roots of either RNAi or their wild type sibling plants. Therefore, the induction of the lacinilene pathway is not directly mediated by jasmonic acid signaling and requires other signaling upon perception of the pathogen. Genetic manipulation of these two major cotton chemical defense pathways may provide a new approach to increase host resistance to wilt pathogens in cotton.