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Genetic and transcriptomic analyses of disease response to Botrytis cinerea in Arabidopsis thaliana

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Transcriptional reprogramming forms a major part of a plant's response to environmental stress. We investigated the effects of combinations of biotic and abiotic stresses on the transcriptome level of Arabidopsis genome using comparative microarrays. We showed a unique program of gene expression was activated in response to each biotic and abiotic stress. In addition, abiotic stress-induced genes were commonly regulated with Botrytis cinerea infection. The Arabidopsis cell wall expansin-like A2 (EXLA2) gene was identified based on its down-regulation in response to infection by the necrotrophic pathogen B. cinerea, and on the reduced susceptibility of its mutants to the same pathogen. The exla2 mutants also enhanced tolerance to the phytoprostane-A1 (PPA1). Our results suggest that the absence or down-regulation of EXLA2 leads to increased resistance to B. cinerea in a COI1-dependent manner, and this down-regulation can be achieved by PPA1 treatment. The EXLA2 is significantly induced by salinity and cold, and exogenous application of abscisic acid (ABA). The exla2 mutant also showed hypersensitivity towards increased salt and cold, and this hypersensitivity required a functional ABA pathway. Overall, EXLA2 appears to be important in response to environmental stress, particularly in the pathogenesis of necrotrophic pathogens and tolerance to abiotic stress. Future directions to further analyze the functions of commonly expressed genes in response to environmental stress will increase our understanding of the plant stress response.

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