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Arabidopsis *RAP2.6* gene is involved in tolerance to multiple biotic and abiotic stresses

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Abstract

Transcription factors constitute complicated defense responses in plants to combat biotic and abiotic stresses. The APETALA2/Ethylene Responsive Factors (AP2/ERF) particularly the RAP2 subgroup, play crucial roles in diverse stress responses and developmental processes. We studied RAP2 genes in *A. thaliana, G. max, M. truncatula, V. radiata, V. angularis, O. sativa, Z. mays*, and *S. bicolor* to elucidate their prevalence, structural characteristics, and evolution. After basic characterization, we elucidated their detailed expression profiling through analysing gene expression data available on SRA-NCBI and GEO projects in *A. thaliana* against biotic (fungi and nematodes) and abiotic stress (abscisic acid (ABC), jasmonic acid (JA), salicylic acid (SA), ethylene, and salt). Finally, the expression of RAP2.6 was studied in detail through RT-PCR, creating promoter::GUS and T-DNA mutant lines. A total of 73 RAP2 genes were identified in the above mentioned economically important crops and they were grouped into two distinct groups: ERF and RAV (Group 1), and AP2 (Group 2). The expression of RAP2 genes revealed that RAP2.6 (except nematodes) and RAP2.7 were upregulated in all cases, while RAP2.10 and RAP2.11 were downregulated. This suggests that these genes may play a different role in different stress responses. The overexpression and mutant lines revealed that RAP2.6 was inducible by *P. syringae* but downregulated in *H. schachtii* induced syncytia from a very early time point on. GUS expression of RAP2.6 revealed its highest expression in ABA (12 h), Mannitol (12 h), NaCl, and wounding (0.5 h) treatments. While it was downregulated in cold, heat and desiccation treatments at all time points. Overexpression of RAP2.6 led to an elevated resistance against *H. schachtii*. These findings provide new insights into the role of RAP2 genes in plant stress response and development. More research is needed to confirm these findings and to identify the specific pathways that are regulated by these genes. However, the results suggest that RAP2 genes play an important role in plant adaptation to a variety of stresses.

Keywords:*; Arabidopsis; RAP2.6 overexpression; RAP2 genes; biotic stress; abiotic stress.*