Gene profiling studies of red-light-induced signal transduction in roots

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Red light, acting through the phytochromes, controls numerous aspects of plant development. Many of the signal transduction elements downstream to the phytochromes have been identified in aerial portions of the plant; however, very few elements in red-light signaling have been identified for roots. Here, we performed gene profiling studies using microarrays and quantitative real-time PCR to characterize gene expression changes in roots of *Arabidopsis* exposed to one h of red light. We identified several factors acting downstream of phytochromes in red light signaling in roots. Several genes founded to be differentially expressed in this study have already been characterized in the red-light signaling pathway for whole plants. *PHYTOCHROME KINASE 1* (*PKS1)* and *LONG HYPOCOTYL 5* (*HY5)* were significantly upregulated, and activation of *PHYB* signaling was implicated since *EARLY FLOWERING 4* (*ELF4*) and *GIGANTEA* (*GI*) were also upregulated. The upregulation of *SUPPRESSOR OF PHYTOCHROME A RESPONSES 1* (*SPA1)* and *CONSTITUTIVE PHOTOMORPHOGENIC 1-like* (*COP1-like)* suggests that the phyA signaling pathway was attenuated by red light. In addition, genes involved in lateral root and root hair formation, root plastid development, phenylpropanoid metabolism and hormone signaling were also differentially regulated upon exposure to red light. Interestingly, members of the *RPT2/NPH3* (*ROOT PHOTOTROPIC 2/NON PHOTOTROPIC HYPOCOTYL 3*) family, which mediate blue-light-induced phototropism, were differentially regulated by red light in roots. Taken as a whole, these results suggest that red and blue light pathways interact in roots and that many elements involved in regulating the responses of roots to red light are differentially expressed within one h.