Characterization of Arabidopsis thaliana Light Mutants Identified in lrb1 lrb2 Suppressor Genetic Screens

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Introduction

The ability to respond to the amount and quality of light is vital for plant growth and development. Red and far-red light are detected by the phytochrome (phy) photoreceptors which mediate plant behavior. We previously identified two genes in the model flowering plant Arabidopsis thaliana, LRB1 and LRB2 (Light-Response BTB1 and 2), as potent negative regulators of phy-mediated red light responses. LRB1 and LRB2 encode functionally redundant E3 ubiquitin-ligase target adapters that recent evidence has shown mediate ubiquitylation and degradation of phytochrome B and another component of the red light response pathway called PIF3.1-3 (Fig. 1). Arabidopsis plants with disruption of both the LRB1 and LRB2 genes display hypersensitivity to red light (Fig. 2), likely because of increased phytochrome levels in the plants.

The precise mechanisms by which the LRBs regulate PIF and phytochrome levels are still under investigation, and there may be additional components of the red light signaling pathway to be discovered. To further probe the red pathway, we conducted genetic screens in Arabidopsis to identify mutations which suppress the red light hypersensitive phenotype produced by disrupted LRB1 and 2 genes. These suppressing mutations would likely occur in genes that have roles in the red light response pathway. More than 100 putative suppressor mutants were identified in a screen of >30,000 M2 individuals. We have been working for several years to confirm and characterize these lines. Here we present our data from the work in the past year with these lines.

Suppressor Phenotype Analysis

Following initial identification of a putative suppressor mutant, we confirm a suppression phenotype by analyzing hypocotyl elongation responses to varying levels of red light (~660nm). This past year we analyzed seventeen putative suppressor lines in such manner. Based on our analyses, ten of the lines have true lrb1 lrb2 suppressing mutations. Data from two of the lines with strong suppression phenotypes, S8-12-3 and S9-14-1, is shown below (Fig. 4).

Conclusions and Future Work

• Our suppressor screen successfully identified mutations which reduce the red light hypersensitive phenotype caused by the lrb1-1 and lrb2-1 mutations.

• Complementation tests suggest that two of the suppressor lines have mutations in the phyB gene, which encodes the major red light photoreceptor in Arabidopsis.

• We are currently working to sequence the phyB gene in these mutant lines to understand the nature of these mutations.

References


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