The Role of Alternative Splicing During Photomorphogenesis

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Plants respond to light changes through a process known as photomorphogenesis by altering their growth and development. After germinating in darkness, etiolated seedlings are characterized by elongated stems and underdeveloped leaves where after a subsequent exposure to light significant transcriptional changes occur.

GUN1 has been characterized as a suppressor of photomorphogenesis and we previously showed that during early de-etiolation a negative GUN1-mediated retrograde signal restricts chloroplast development in darkness. Then, as the exposure to light progresses, it progressively stops inhibiting key TFs of photosynthesis establishment and chloroplast development and consequently downstream targets.

Alternative splicing (AS) plays a role in photomorphogenesis through the production of different protein isoforms in response to light that allows plants to respond during de-etiolation. Thus, AS of certain genes involved in light signalling can result in the production of different protein isoforms, allowing the plant to fine-tune its response.

Here, through the use of co-expression network and RNA-Seq analysis we identified new genes involved in photomorphogenesis and characterized at transcript level the changes involved in de-etiolation in wild type and *gun1* plants.

We herein show that splicing-related genes are down-regulated in *gun1* mutants, which led to changes in AS. We found in wild type plants 915 genes being affected by AS during de-etiolation and that AS landscape is affected in *gun1*. In addition, in darkness *gun1* plants showed AS alterations in 40 chloroplast related genes. We validated our results by qPCR and analyzed the functional consequences of AS changes using protein domains and structural analysis. Thus, our results characterize the transcriptome changes during de-etiolation and demonstrates that key genes for the establishment of photosynthesis are affected by AS during de-etiolation. Additionally, our findings show that GUN1 mutation affects AS during photomorphogenesis by an unknow mechanism and how this might influence the transcriptomics responses to light.