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Improvement of biomass and stress tolerance in crop plants using cyanobacteria Flavodiiron Proteins (FDPs)

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Environmental stresses and nutrient limitation are among the major causes for crop losses worldwide. Engineering strategies aimed at improving growth and stress tolerance have mostly focused on overexpression of plant-endogenous genes belonging to molecular networks for stress perception or stress responses. A new alternative approach has recently been applied with considerable success to model plants. It is based on the replacement of stress-sensitive plant targets such as ferredoxin by stress-resistant cyanobacterial flavodoxin. The expression of cyanobacterial flavodoxin in chloroplasts in transgenic tobacco plants led to tolerance to various stresses including drought and iron starvation, thus representing a biotechnological application for the generation of crops tolerant to multiple stresses. In the present study, we have tested additional cyanobacterial proteins, flavodiiron proteins (FDPs), for further investigation of this approach. FDPs are widely distributed among bacteria, archaea and cyanobacteria and show various properties such as dioxygen-scavenging reductase and nitric oxide-scavenging reductase activity indicating a response to oxidative stress superior to that of flavodoxin. In cyanobacteria, FDPs are encoded by four different genes *Flv1, Flv2, Flv3* and *Flv4* and function in tandem. Further, FDPs are a sub-class of redox-active proteins containing Fe in a form that does not occur in higher plant proteins. We have introduced the *Flv* genes in the genome of the plant species Arabidopsis, tobacco and barley to identify the underlying molecular and biochemical mechanisms for their protective action against oxidative stress and to identify the environmental and nutrient conditions, under which *Flv*-mediated stress tolerance allows for biomass and yield enhancement.

Biography

Fahimeh Shahinnia has completed her PhD in Plant Genetics and Breeding. She is a Senior Scientist working on engineering the strategies aimed at improving stress tolerance in barley with emphasizing on genome-editing and overexpression of plant-endogenous genes belonging to different molecular networks for stress responses. Her research interests are: Cereal structural and comparative genomics, map-based cloning, QTL mapping, marker assisted breeding, genetics and genomics of drought tolerance, genome-editing and systems biology in barley and wheat.

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