CHX20 Mediates Stomatal Opening to Enhance Carbon Assimilation Under Water-Deficit Conditions

Amith Devireddy[1]

[1]Research Associate, Biosciences Division, Oak Ridge National Laboratory, Oak Ridge, TN, USA;
*devireddyar@ornl.gov

Drought is a primary limiting factor for plant growth and development impacting agricultural productivity worldwide. Water deficit conditions beyond the plant's physiological optimum can trigger significant physiological perturbations, reduce the rate of photosynthesis, and accelerate leaf senescence leading to a decrease in canopy size and yield. One way to enhance drought tolerance in plants is by delaying drought-induced leaf senescence, retaining photosynthetic activity, and maintaining leaf water potential. In this study, genome-wide association studies (GWAS) in *Populus* identified a genetic locus that is highly associated with drought-induced leaf senescence. This genetic locus is predicted to encode a member of the putative Na^+/H^+ antiporter family CATION/H^+ EXCHANGER (*CHX20*). To validate the function of *CHX20*, we developed transgenic poplar lines with altered expression of *CHX20* and tested these lines under water deficit conditions. The Populus *CHX20* overexpression (OE) lines retained not only photosynthetic activity (albeit at a reduced level) but also maintained high water potential compared to wildtype (WT) or KO lines during the drought treatment without significant yield penalties. Furthermore, testing the role of *CHX20* using *Arabidopsis thaliana* plants indicated that *AtCHX20* transgenic overexpression (OE) plants had greater stomatal aperture size, enhanced photosynthetic activity, and higher osmolyte contents compared to WT or KO under water deficit conditions.