

Dark chilling increases glucose-6-phosphate dehydrogenase activity in soybean leaves

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Available evidence suggests that the stress-induced increase in the activity of glucose-6-phosphate dehydrogenase (G6PDH, EC 1.1.1.49), the key regulatory enzyme of the oxidative pentose phosphate pathway, might often be related to the presence of plant water deficit. The response of G6PDH to dark chilling in chilling sensitive plant species is still unknown. In this communication we report on this response and its dependence on the presence of chill-induced drought stress. A chilling sensitive soybean (*Glycine max* L. Merr.) genotype was exposed to dark chilling of the entire plant (whole-chilled) or only the shoots and leaves (shoot-chilled). The development of chill-induced drought stress upon illumination was quantified by measurement of proline and relative water content (RWC). Chill-induced drought stress (decrease in RWC and increase in proline content) developed with time in whole-chilled plants, but not in shoot-chilled plants. The response of the above-mentioned treatments on G6PDH activity in

fully expanded leaves was assessed. In parallel, the effects on CO₂ assimilation, PSII activity and chloroplast fructose-1,6-bisphosphatase (FBPase EC 3.1.3.11) and ribulose-1,5-bisphosphate carboxylase/oxygenase (Rubisco EC 4.1.1.39) activity were quantified. A decrease in CO₂ assimilation rate, FBPase activity and ribulose-1,5-bisphosphate (RuBP) content was observed in whole-chilled but not in shoot-chilled plants. However, in shoot-chilled plants regulation of diurnal PSII activity was altered. The increase in the activation state of NADP-dependent malate dehydrogenase (NADP-MDH EC 1.1.1.82) in shoot-chilled plants suggests an increase in stromal redox state. Although the two different dark chilling treatments resulted in distinct physiological and biochemical effects, both induced an increase in foliar G6PDH activity, suggesting an important role of this enzyme during and following dark chilling stress, irrespective of the presence of chill-induced drought stress.