Close

Web of Science
Page 1 (Records 1 -- 1)

Print

[1]

Record 1 of 1

Title: Control of glycerol biosynthesis under high salt stress in Arabidopsis

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Abstract: Loss-of-function and gain-of-function approaches were utilised to detect the physiological importance of glycerol biosynthesis during salt stress and the role of glycerol in conferring salt tolerance in Arabidopsis. The salt stress experiment involved wild type (WT) and transgenic Arabidopsis overexpressing the yeast GPD1 gene (analogue of Arabidopsis GLY1 gene). The experiment also involved the Arabidopsis T-DNA insertion mutants gly1 (for suppression of glycerol 3-phosphate dehydrogenase or G3PDH), gli1 (for suppression of glycerol kinase or GK), and act1 (for suppression of G3P acyltransferase or GPAT). We evaluated salt tolerance levels, in conjunction with glycerol and glycerol 3-phosphate (G3P) levels and activities of six enzymes (G3PDH, ADH (alcohol dehydrogenase), ALDH (aldehyde dehydrogenase), GK, G3PP (G3P phosphatase) and GLYDH (glycerol dehydrogenase)) involved in the glycerol pathway. The GPD1 gene was used to overexpress G3PDH, a cytosolic NAD(+)-dependent key enzyme of cellular glycerol biosynthesis essential for growth of cells under abiotic stresses. T(2)GPD1-transgenic plants and those of the two mutants gli1 and act1 showed enhanced salt tolerance during different growth stages as compared with the WT and gly1 mutant plants. These results indicate that the participation of glycerol, rather than G3P, in salt tolerance in Arabidopsis. The results also indicate that the gradual increase in glycerol levels in T(2)GPD1-transgenic, and gli1 and act1 mutant plants as NaCl level increases whereas they dropped at 200mM NaCl. However, the activities of the G3PDH, GK, G3PP and GLYDH at 150 and 200mM NaCl were not significantly different. We hypothesise that mechanism(s) of glycerol retention/efflux in the cell are affected at 200mM NaCl in Arabidopsis.

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Web of Science
Page 1 (Records 1 -- 1)

Print

[1]