Expression of genes for the biosynthesis of compatible solutes during pollen development under heat stress in tomato *(*Solanum lycopersicum*)*

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Abstract

Accumulation of compatible solutes is considered a key adaptation mechanism in many plants in response to abiotic stress. The expression of four genes, involved in sucrose metabolism (SPS and SuSy), biosynthesis of galactinol (GoLS1) and proline accumulation (P5CS) was compared: at meiosis (MM), vacuolated and mature stages of pollen development in heat tolerant and heat sensitive tomato genotypes. The results showed differences in gene expression across tomato genotypes and stages of pollen development. Three genes (P5CS, SPS and SuSy) were up regulated in heat tolerant genotype CLN1621L at the mature stage and one gene (P5CS) in genotype CLN5915-93D at the MM stage. Two genes (SPS and GoLS1) were down regulated in heat sensitive genotype CA4 and one gene (GoLS1) in genotype CLN2498E at the MM stage. Additionally, the continuous exposure of tomato genotypes to temperatures of 35 °C/28 °C day/night completely impaired flower development in genotypes CA4 and CLN2498E but not in genotypes CLN1621L and CLN5915-93D. Tomato genotypes CLN1621L and CLN5915-93D produced fully developed flowers containing mixture of non viable pollens and very few viable pollens grains. Membrane permeability was affected at all stages of development under heat stress with heat tolerant genotypes CL5915-93D4, CLN2498E and CLN1621L showing varying degrees of heat acclimation. Significant increases in total chlorophyll were seen in all genotypes in response to heat stress. The expression of compatible solute genes at MM is more critical than at mature stage for the development of viable pollen grain.

Keywords

Compatible solute accumulation; Gene expression;Heat stress tolerance; Pollen viability; Solanum lycopersicon