Proceedings of the Joint Meeting AGI-SIBV-SIGA
Assisi, Italy – 19/22 September, 2011
ISBN **978-88-904570-2-9**

Poster Communication Abstract – 6A.30

CONDITIONAL EXPRESSION OF THE TOMATO PROLINE TRANSPORTER LeProT1 CONFERS TOLERANCE TO HEAT AND OTHER ABIOTIC STRESSES

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*HSP 18.2 promoter, heat stress, drought, salinity, tomato proline transporter (*LeProT1*)*

High temperature stress is becoming a major problem because of predicted increase of 2°C of earth surface temperature by 2050. Increased temperature is a problematic factor for both vegetative and reproductive development of crop plants. Exposure to high temperature causes reduced yields in tomato (*Solanum lycopersicum* L.), that are mainly due to adverse effects on male gametophyte development. Proline protects membranes and proteins against temperature extremes and functions as a hydroxyl radical scavenger. It was demonstrated that the proline content of anthers plays important roles in acquiring heat tolerance in tomato, but proline transport to anthers is seriously impaired by heat stress. This leads to high proline accumulation in leaves (source) instead of developing pollen grains (sink). In this research, we engineered tomato plants to express the endogenous anther-specific proline transporter *LeProT1* under the control of the heat-inducible *HSP 18.2* promoter from Arabidopsis, in order to increase proline supply to developing anthers under heat stress. Primary transformants and control plants (cv MicroTom) were subjected to a heat stress of 38°C for 2 h at about 3 d before anthesis of the first flowers. Transformed plants performed better than control plants for pollen stainability (94.0% vs 81.1%) and germinability (91.6% vs 74.6%). This was reflected into a significant difference in yield between untransformed control plants and plants engineered with the *LeProT1* gene. These phenotypes of increased heat tolerance were positively correlated with the proline content in the developing anthers of transformed plants. Because proline is believed to act as an osmoprotectant also in plants subjected to drought and/or salt stresses, we checked if heat shock-driven activation of the *LeProT1* proline transporter could positively affect the proline metabolism and the development of seedling subjected to water deficiency or salinity. Experiments on seedlings showed that transformed genotypes performed better also under drought and salinity stress. As these latter stresses are often correlated with heat, the engineering of the *LeProT1* expression in tomato represents a useful strategy to increase abiotic stress tolerance and increase crop yields under this present arena of global warming.