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MITIGATION OF HIGH TEMPERATURE-INDUCED PHENOTYPIC ALTERATIONS IN TOMATO (SOLANUM LYCOPERSICUM L.) PLANTS ENGINEERED FOR AN L-PROLINE TRANSPORTER

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Plant growth and productivity may be negatively influenced by high temperature. The detrimental effect of heat stress on the plant’s vegetative and reproductive stages is a major problem because of increasing global surface temperatures as predicted in the coming years. Tomato is highly sensitive to heat stress, which can result in a total yield loss. L-proline transportation to the anthers plays an important role in acquiring heat tolerance in tomato, although it may seriously be impaired by heat stress. Here, we engineered tomato cv Microtom (MT) plants with the endogenous LePROT1 proline transporter gene under the control of the conditional HSP18.2 promoter from Arabidopsis. MT plants and two T_3 progenies were grown in optimal conditions; half of the plants were subjected to repeated heat stress (38°C, 3 h/d for 2 weeks). An in vitro experiment was also carried out to subject seedlings to an acute heat treatment. Whereas MT plants under chronic heat stress showed a decrease in anther L-proline content, T_3 plants had significantly more L-proline than either the stressed control and the unstressed transformants. This pattern was paralleled by estimation of viable pollen. At phenotypic level, transformed plants under stress performed better than controls for inflorescence length, number of flowers, fruit set and Brix value. In vitro grown T_3 seedlings after heat shock showed better root growth than the controls. In the epigeal part of seedling, the L-proline level was higher in trasformed plants than in controls irrespective of the treatment. Total expression levels of LePROT1 were higher in trasformed plants at 48 h after heat shock. In conclusion, our data show that L-proline transport engineering represents a promising tool to endow tomato plants with thermotolerance at the reproductive level.