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Genetic Diversity and Greenhouse Modelling for More Successful Crop Production – A Case Study of *Solanum lycopersicum* grown in Greenhouses in the Tropics

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Abstract

The tomato crop is an invaluable source for essential vitamins and minerals. Abiotic stresses restraint tomato greenhouse production in the tropics mainly due to high temperatures. The development of crop plants tolerant to high temperatures is essential to meet the growing food demand and sustainable agriculture.

In the tropics, where the crops are near their maximum temperature tolerance yields are likely to decrease. The objective of plant breeding for stress environments is to accumulate favourable alleles that contribute to stress tolerance in a plant genome. To enable improvements in thermotolerance, it is necessary to determine the genetic variation available for heat tolerance. Screening techniques are required to characterise this variation, to identify appropriate breeding materials and ultimately for selection for improved adaptation.

Earlier investigations revealed pollen as indirect selection criterion for heat tolerance since pollen viability and pollen amount are negatively influenced by high temperatures. Therefore, pollen viability and pollen amount which are essential for successful fruit fertilisation were investigated both under controlled conditions and in greenhouses with different set-ups in Thailand.

Experiments were undertaken to characterise the genetic variability of 16 tomato genotypes under greenhouse growth conditions in Thailand with regard to heat tolerance.

Generally, gene resources for tolerance to environmental stresses are not found within the cultivated species of tomato, in part due to the limited genetic variation, which resulted from the occurrence of several population bottlenecks during domestication and evolution. Nevertheless, our investigations under heat stress revealed remarkably variation between the pollen traits of the genotypes classified as heat tolerant by their suppliers.

The different greenhouse set-ups influenced the pollen characteristics in different ways depending on the season and other factors than ambient air temperatures were shown to influence pollen viability negatively.

We proved that genetic variation exists in the ability to reproduce under heat stress conditions even within *Solanum lycopersicum* and this needs to be combined with the increased ability of yield due to enhanced growing conditions obtaining an increased stability of yield.

Keywords: Genetic diversity, heat tolerance, *Solanum lycopersicum*, tomato