Analysis of Pollen-Pistil Interactions To Model Reproductive Thermotolerance in Tomato

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Under current global circumstances of climate change, developing heat-tolerant crops has become of critical importance. S. lycopersicum, the most commonly cultivated tomato variety, is a valuable crop contributing an estimated 9.81 billion dollars to the global economy. Successful pollination in tomato under heat stress requires thermotolerant pollen tubes to carry the sperm cells and grow within the pistils to complete fertilization. Accordingly, tomato accessions with shorter pistils and pollen tubes were hypothesized to have greater thermotolerance because the pollen tubes travel a shorter distance and have fewer opportunities for premature bursting events, both aspects likely to be experienced by pollen tubes grown under heat stress. Reproductive thermotolerance in tomato was characterized using three assays. In vitro pollen tube burst rates were measured in replicates of eight per accession, at both 26 degrees C and 34 degrees C, for eight diverse tomato accessions. Pollen tube length (at 26 degrees C) for each of the selected accessions was measured in ImageJ, to determine if there was any correlation between pollen tube length and pollen tube burst rate. Pistil lengths of the same accessions were measured to determine if pistil lengths influence pollen tube burst rate. While there was no significant correlation between pistil lengths and burst rates, burst rates were directly correlated with pollen tube lengths, verified using several statistical tests. Accessions with comparatively shorter pollen tubes resisted bursting under heat stress conditions, whereas accessions with longer pollen tubes burst at a higher rate. This research presents a direct benefit to agriculture.

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Third Award of $1,000