mRNA Sequence Analysis to Determine Genes Causing Unilateral Incompatibility in S. lycopersicum and S. pennellii

Nelson, Alexander (School: Nelson Home School)

Unilateral incompatibility (UI) occurs in an interspecific cross when the flower pistil terminates pollen tube formation prematurely before fertilization. UI occurs in one direction, the opposite combination of pollen and pistil results in a successful cross fertilization (interspecific compatibility). Solanum pennellii and Solanum lycopersicum tomato exhibit unilateral incompatibility wherein S. pennellii can be fertilized by S. lycopersicum but not vice versa. The research purpose is to determine the genes causing UI in S. lycopersicum x S. pennellii crosses, and the biological role they serve in preventing pollen tube growth. Analyzing tissue sequence data, genes that are up expressed in cross-pollinated flower pistils vs. UI pistils will be associated with the termination of pollen tube growth. Triplicate mRNA reads of S. lycopersicum x S. pennellii pistils were obtained from the NCBI SRA project PRJNA309342: three sequence reads of cross-pollinated pistils (lyc pistil, pen pollen), and three sequences of UI pistils (pen pistil, lyc pollen). Sequence reads were mapped to the reference S. lycopersicum using S.T.A.R. program in a command line in a High-Performance computing cluster and exported to RStudio. R DESeq2 package was used to measure differential gene expression, and the genes were ranked by log fold change. The cross-pollinated mRNA sequence resulted in an increased log fold change of proteinase-inhibitors in relation to the UI sample. In the future, the identified series of proteinase release inhibiting genes could be tested by over-expressing the genes in a UI sample, possibly preventing premature inhibition of pollen tube growth.

Awards Won:
University of Arizona: Renewal Tuition Scholarship