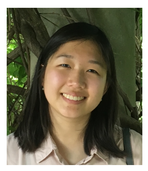
Purple fruit pigmentation in tomato is controlled by a gene on chromosome 10



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Introduction:

Many plant pigments are phytochemicals such as anthocyanins and are thought to be important to human health because they have anti-oxidant or other biological activity. We aimed to describe the genetic basis of purple pigment in fruit of a wild tomato, *S. galapagense*. The objectives of this study were to:

1. **Characterize the chemical basis of purple pigment in *Solanum galapagense*, accession LA1141**
2. **Determine the genetic basis of purple fruit pigmentation inherited from the wild species, *S. galapagense*, LA1141.**

Methods:

Plant Material

- Primary characterization used 161 progeny derived from a cross between accession LA1141 and *S. lycopersicum* cv Ohio 8245.
- A validation population was created crossing purple-fruited progeny SG18-124 again to Ohio 8245.

Population Characterization

- Data for fruit color were collected using the L*a*b* color scale.
- Purple fruit were extracted with acidified MeOH and analyzed using ultra high-performance HPLC with a photodiode array detector. Mass spectrometry was used to determine molecular weights and facilitate identification.

Genetic Analysis

- Eighteen primer sets based on MYB transcription factor gene sequences were used to detect polymorphisms.
- DNA differences were associated with color and pigment

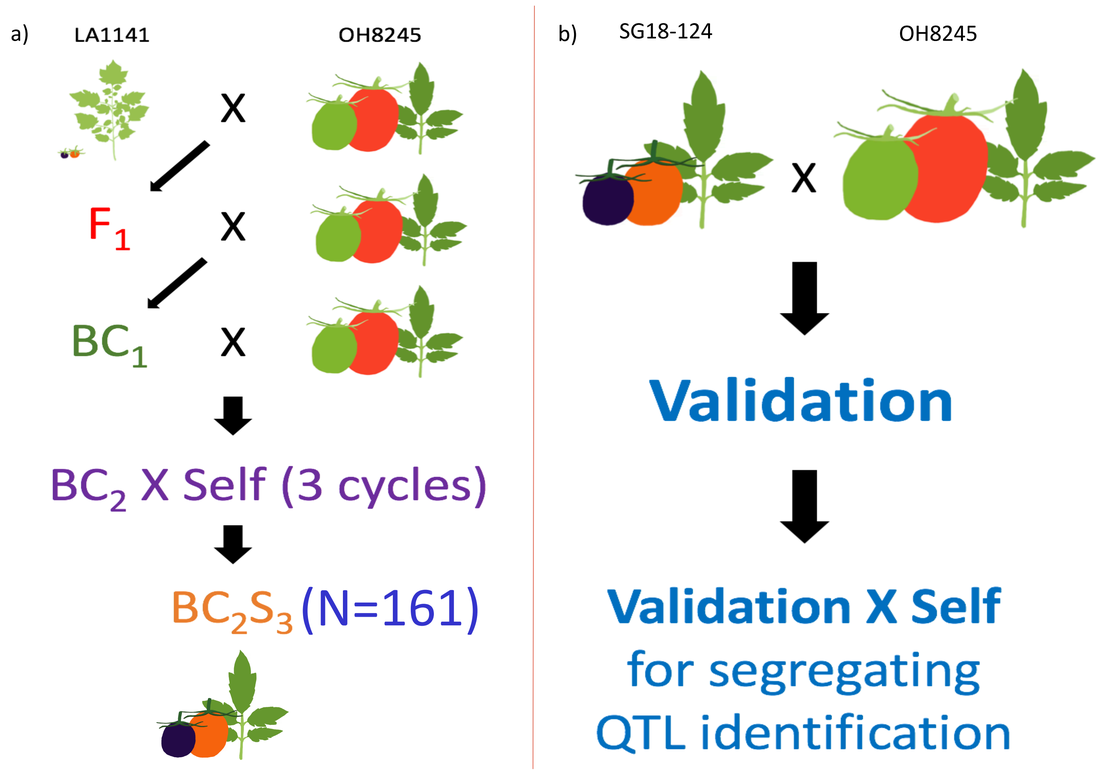

Fig 1. a) Population development for genetic mapping of fruit traits from LA1141. The purple fruit trait was introduced into the cultivated OH8245, a commercially viable tomato line using a technique called backcrossing. The resulting population was selfed three times to produce a BC_2S_3 population with 161 progeny. b) A validation population was developed to test reproducibility of genetic analysis.

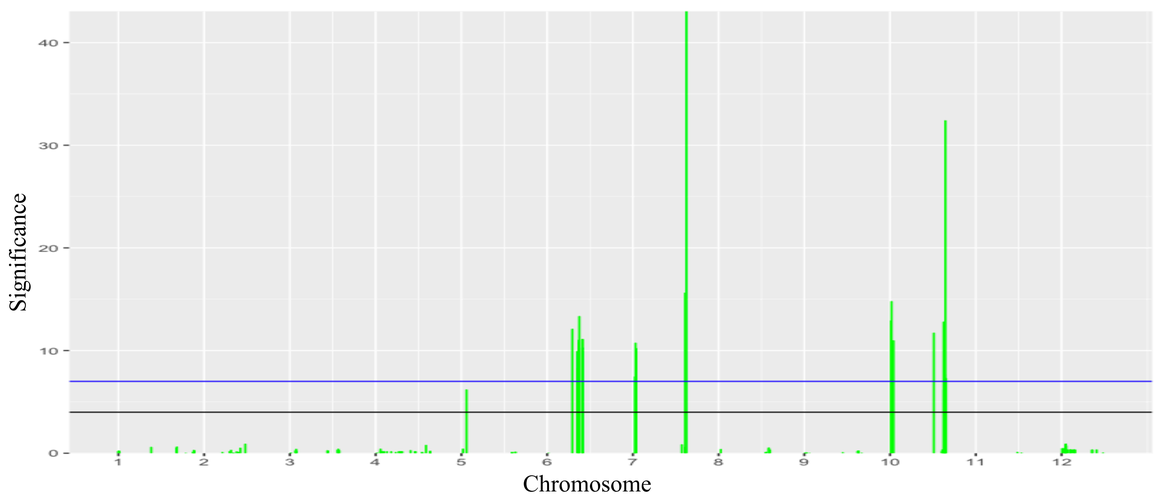

Fig 4. Manhattan plots show the relationship between genetic position (x axis) and significance of association (y axis). Hue is a measure of color, calculated from a* and b*. High F-values on the y-axis indicate the significance of DNA polymorphisms, or markers, on chromosome 6, 7 and 10.

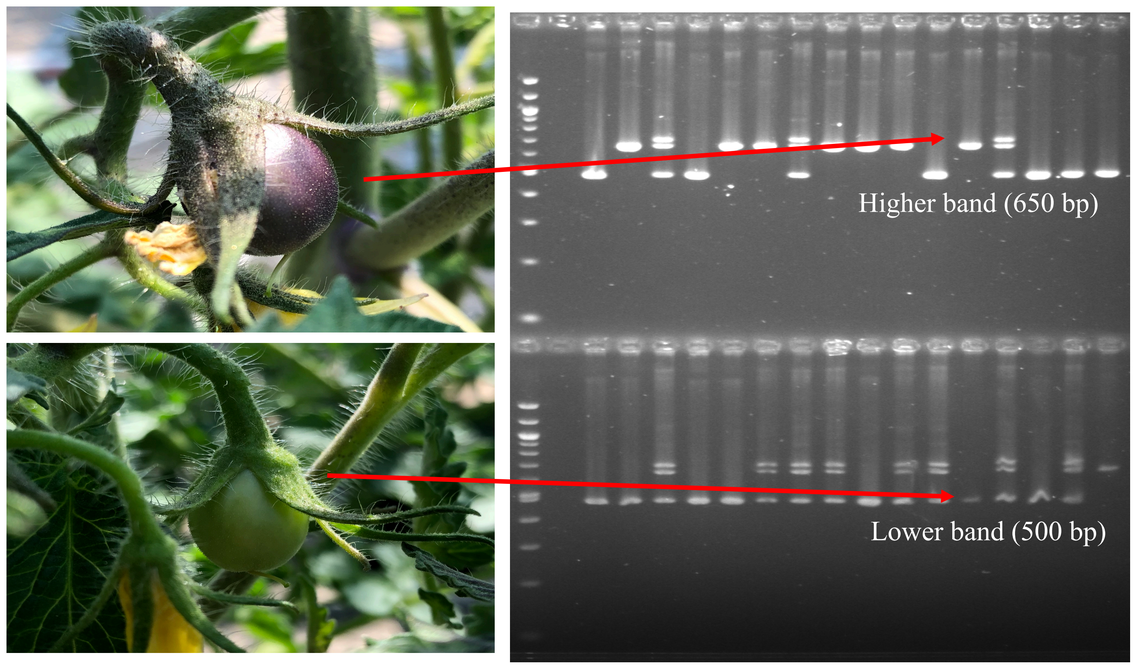

Fig 5. Fruit and DNA fragment size images. A comparison of fruit traits with genetic data shows that purple-fruited accessions in the validation population always correspond to a larger band at 650 bp while lack of purple pigment corresponds to a smaller band at 500 bp. Bands correspond to differences in the chromosome 10 MYB transcription factor Ant-1.

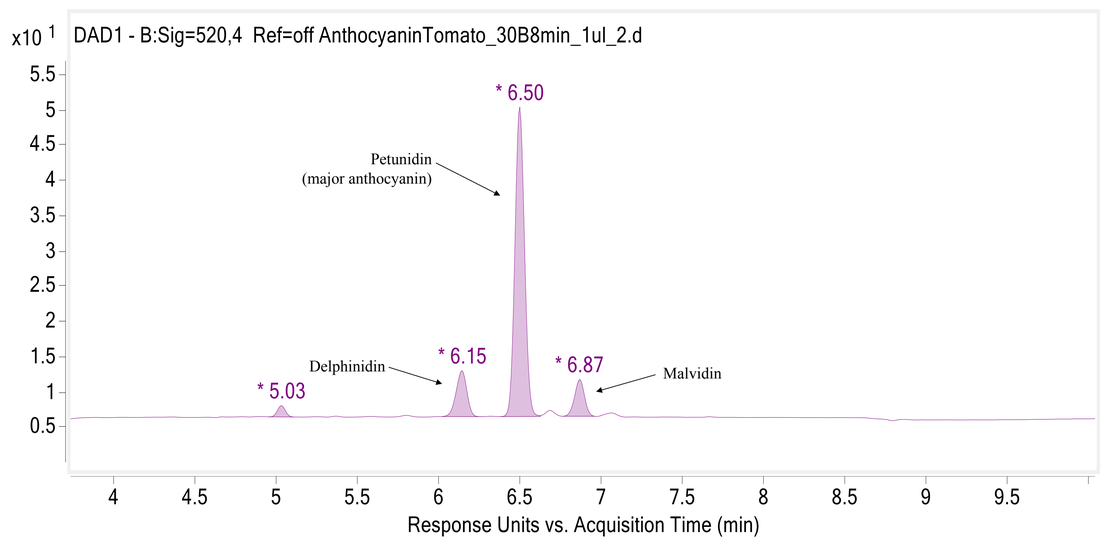

Fig 3. HPLC analysis detects peaks identified as anthocyanins in fruit from selection SG18-124. These peaks were identified as petunidin, delphinidin, and malvidin based on molecular weight and UV/Vis spectra.

Results & Conclusions:

- Putative loci affecting fruit color were discovered on chromosomes 6, 7 and 10.
- MYB transcription factors were explored as candidate loci because they had previously been shown to control fruit and flower pigmentation in a number of crops.
- A DNA marker based on the Ant1_1 MYB mapped to chromosome 10, and was associated with to the purple fruit pigmentation trait. An allele of the MYB AFT was confirmed on chromosome 10.
- Polymorphism in the Beta gene on chromosome 6 is associated with orange color.
- *S. galapagense* LA1141 fruit have the anthocyanin, Petunidin, which is purple.

Future Work:

- Sequence accessions to determine the origin of the AFT mutation in *S. galapagense* LA1411.
- Explore MYB candidates on chromosome 7 for potential association with purple fruit pigmentation
- Determine if anthocyanins in purple tomatoes have health benefits

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