CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Saumya R. Keremane

Project Number
J0407

Project Title
Understanding Color Development in Citrus

Abstract

Objectives/Goals
Fruits with carotenoid pigments are excellent sources of antioxidants and provide several health benefits including prevention of cancer. My project was to understand the molecular basis of fruit color development in citrus. The first goal was to characterize the presence or absence of selected few genes involved in the pigment synthesis pathway. The second goal was to understand the differences in sequences of expressed proteins in plants with different colored fruits. The third goal was to characterize mRNAs in fruits. A better understanding of the molecular mechanisms of color development would help us develop/engineer better fruit crops.

Methods/Materials
I collected four citrus varieties with different colored fruits: yellowish white, pink, orange and blood red. Since no genomic sequences were available, primers were designed based on EST library for two genes in pigment synthesis pathway; phytoene desaturase (PDS) and lycopene epsilon cyclase (LEC). PCR amplifications were done using both external and internal primers using both DNA and cDNA from leaves and fruit flesh as templates. Selected products were cloned, sequenced and analyzed.

Results
Phytoene desaturase and Lycopene epsilon cyclase genes were present in all four varieties. Comparison of amplicons from cDNA and DNA templates revealed the presence of large introns. The exons of four different varieties were of identical lengths, but showed differences in sequence. cDNA sequences from fruit tissue showed evidence of alternate splicing in certain varieties.

Conclusions/Discussion
Color development in citrus fruits is controlled by several genes. I have selected two genes for my study: Phytoene desaturase that mediates conversion of Phytoene to zeta carotene and Lycopene epsilon cyclase that helps in the conversion of Lycopene to beta carotene. A full complement of both the genes was present in all four varieties. The sequence of the two genes showed a few aminoacid differences between the varieties which might be important for pigment synthesis. In addition, the fruit tissue showed alternate splicing that might have contributed to the differences in the length of the active protein and in turn this might affect the color development in the fruit. Understanding the basis of color development in citrus may lead to development of healthier varieties of citrus by breeding and genetic engineering in future.

Summary Statement
Study of sequence and expression of two genes involved in pigment biosynthetic pathway in citrus fruits.

Help Received
Used lab facilities at the USDA Citrus Germplasm Repository under the supervision of Dr. Richard Lee.