Investigation of a low-browning variegated grapevine mutant cv. Bruce's Sport

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Background

- Major postharvest challenge:
  Enzymatic browning
- Polyphenol oxidase (PPO) enzymes major drivers
- Bruce's Sport (BS) bud sport mutant derived from Sultana.
- BS shows low browning potential – variegated tissues exhibit **reduced PPO activity** and **decreased enzymatic browning**



○ Variegated leaves of Bruce's Sport





○ Flowers and berries are paler in colour



Sultana Bruce's Sport



Sultana Bruce's Sport



Sultana Bruce's Sport

○ Striped variegation on berries of Bruce's Sport



Sultana Bruce's Sport



Bruce's Sport



Bruce's Sport

Aim Investigate the genetic basis of Bruce's Sport

Methodology

RNA Extraction → RNA-Sequencing → Data analysis



Sultana & Bruce's Sport

Illumina sequencing
~21 M read pairs per sample

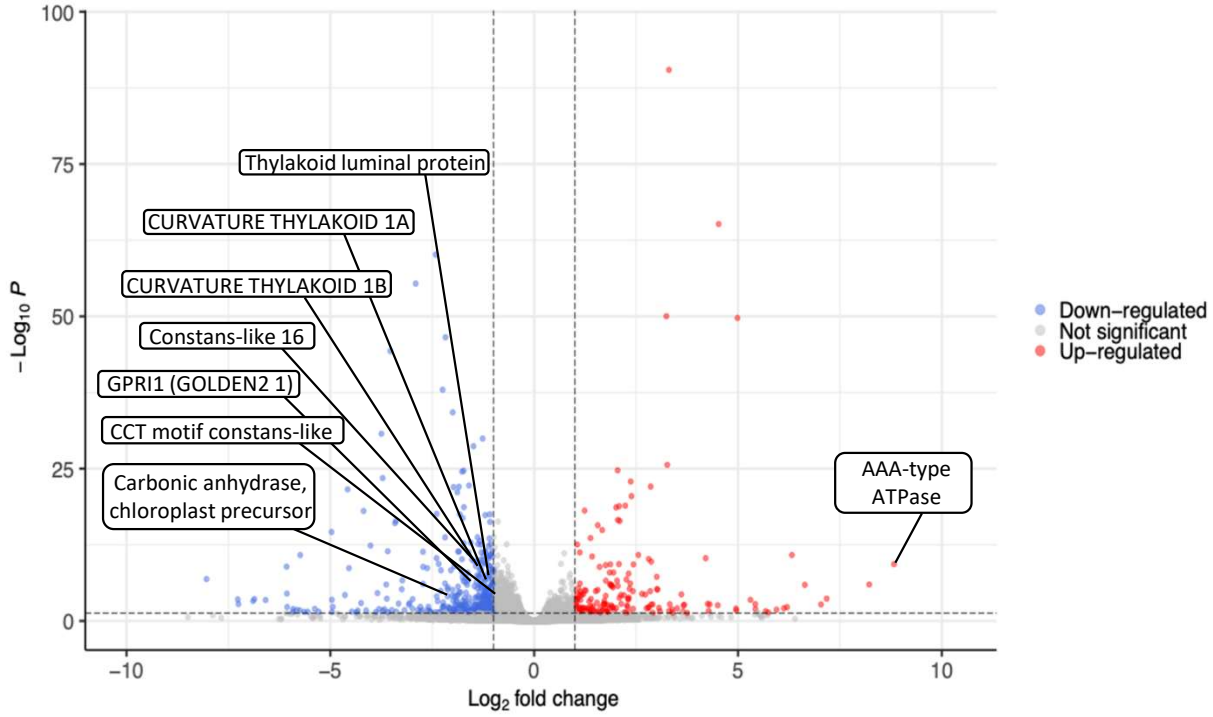




Differentially Expressed Genes (DEGs) are genes that are significantly higher or lower

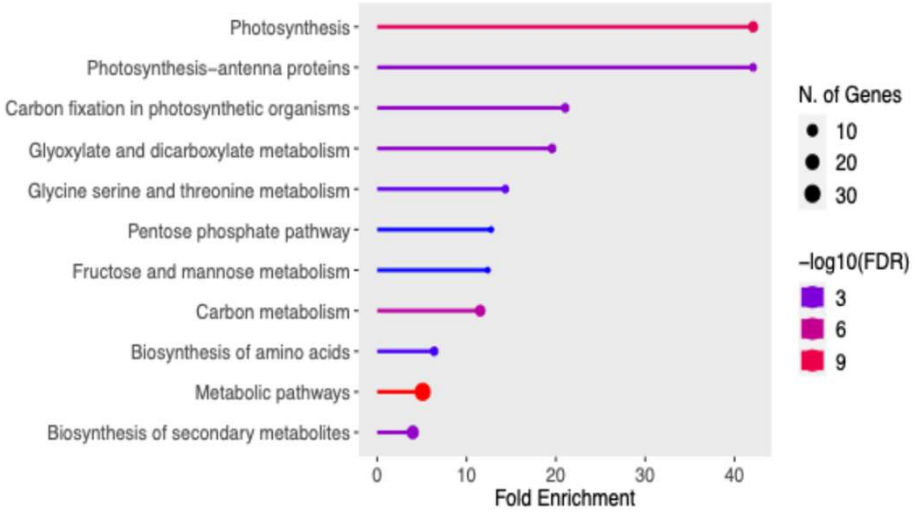
Results

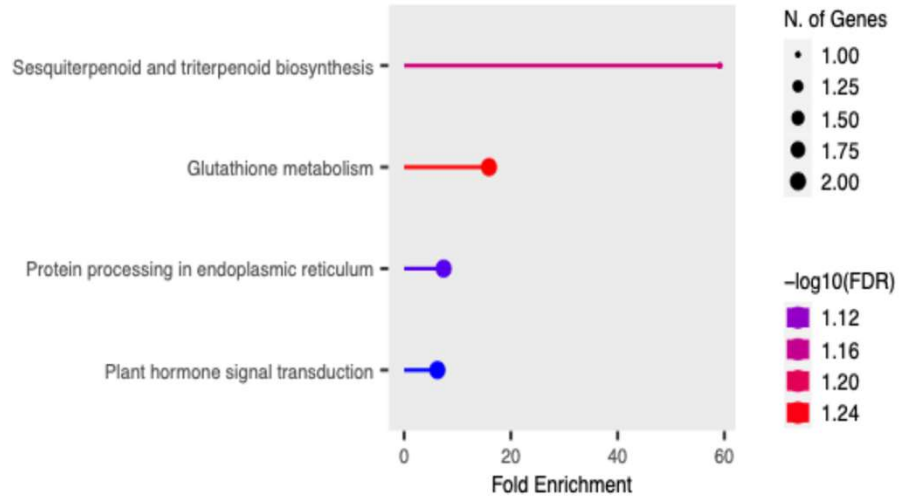
A total of 1 844 DEGs were successfully identified



202 DEGs

85 DEGs





Results

- Down-regulation of **photosynthesis, energy production**
- Variegated Bruce's Sport is under stress: Up-regulation **antioxidant defence** and **stress response**

Potential candidates

- Thylakoid luminal protein
- CURVATURE THYLAKOID 1A
- CURVATURE THYLAKOID 1B
- Constans-like 16
- GPRI1 (GOLDEN2 1)
- CCT motif constans-like
- Carbonic anhydrase, chloroplast precursor
- Ribulose bisphosphate carboxylase/oxygenase activase, chloroplast
- AAA-type ATPase

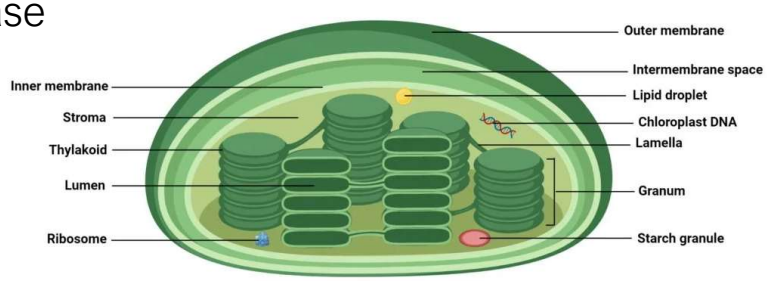


Figure: Chloroplast, Image Copyright © Sagar Aryal, www.microbenotes.com

Results

- Gene levels of known PPO genes in grapevine remained similar
- **10 genes** identified potentially underlying the BS phenotype
- Involved in **chloroplast development** and **photosynthetic pathways**

Take home message

- Bruce's Sport phenotype affects energy production, plant metabolism, pigment production
- **Conclude:** reduced PPO activity associated with BS phenotype
- Identified 10 potential targets for future functional studies
- Improve knowledge of genetic resources associated with reduced browning and postharvest quality

Funded by

SATI
South African Table Grape Industry