

Comparative analysis of inarching of invigorating rootstock onto incompatible graft combination in citrus

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BACKGROUND

- Citrus trees are commercially propagated by grafting. Most citrus in China are cultured in hilly areas with barren soil and often display leaf/shoot severe chlorosis.
- *Citrus junos* Sieb ex Tanaka cv. 'Pujiang Xiangcheng', as a new invigorating rootstock, inarched with etiolated trees can restore tree vigor. But we know little of the molecular basis of this trait.
- The purpose of this study was to explore the physiological and molecular mechanisms of inarched plants recovering their normal growth and to deepen our understanding of the interaction between scion and rootstock in citrus.

RESULTS

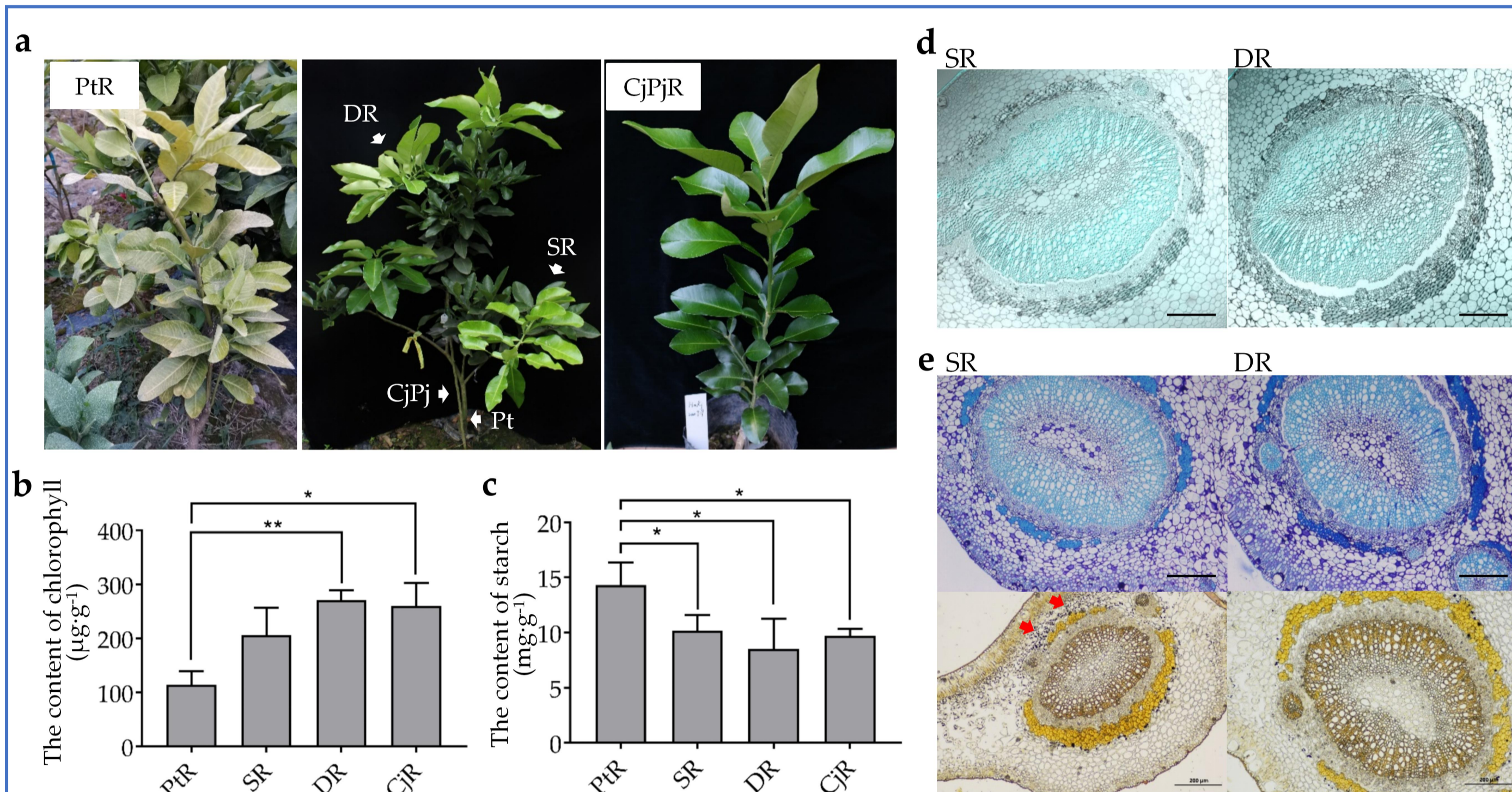


Fig. 1 Characteristics of grafted plants. a diagram of the grafting methods and grafted plants. b chlorophyll content of different grafted plants. c starch content of different grafted plants. Asterisks represent significant differences compared to PtR (* $p < 0.05$, ** $p < 0.01$). d, e Transverse sections showing changes in leaves of SR and DR grafts. d Epifluorescence photomicrographs of phloem, e Starch grains were dyed blue. bars = 200 μ m.

Note: PtR: *Citrus maxima* (Burm.) Merrill cv. 'Hongmian miyou' grafted onto *Poncirus trifoliata*, CjPjR: 'Hongmian miyou' grafted onto *Citrus junos* Sieb ex Tanaka cv. 'Pujiang Xiangcheng', Etiolated plants of incompatible graft combination were inarched with two-year-old 'Pujiang Xiangcheng' to form single root system (SR) and double root system (DR). The same as below.

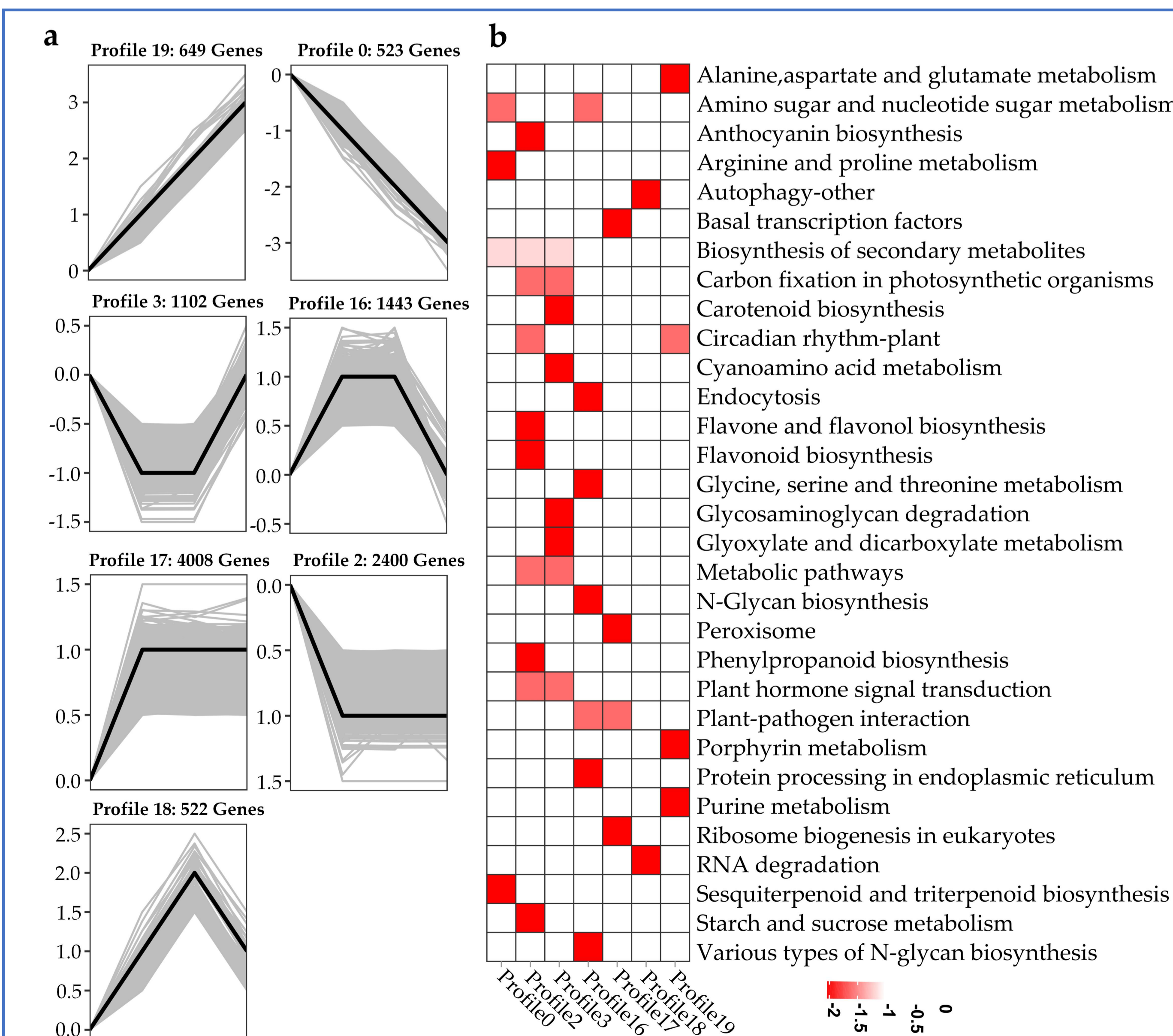


Fig. 2 Gene expression trend analysis. a Gene expression trends, b KEGG enrichment analysis of all profile. Each line in the graph a represents a gene, The pathway enrichment map is based on the top 10 pathways with p -value less than 0.01.

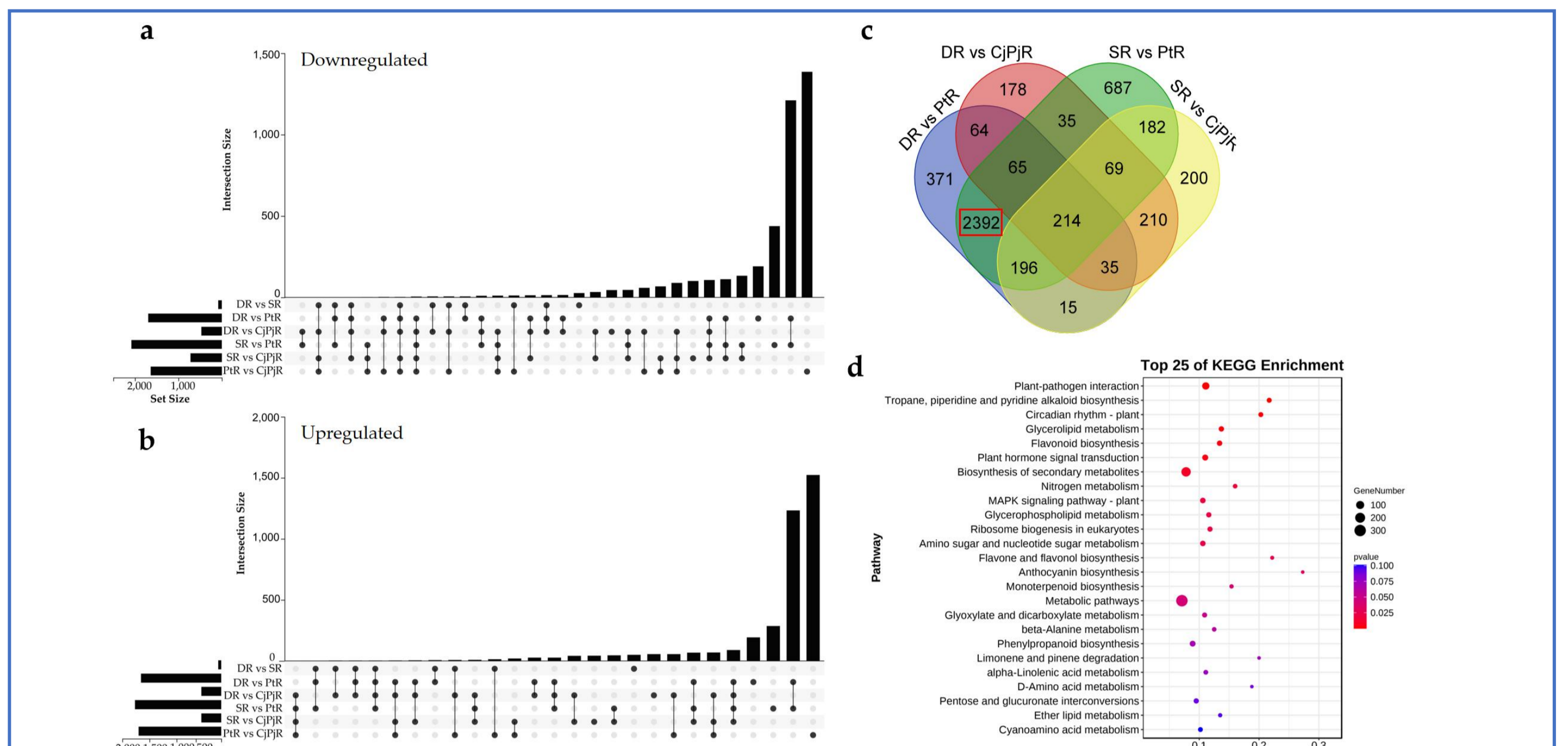


Fig. 3 Analysis between different graft combinations. a, b Upset plots of the number of downregulated and upregulated genes c Venn diagram of DEGs in all graft combinations. d KEGG pathways for 2392 DEGs.

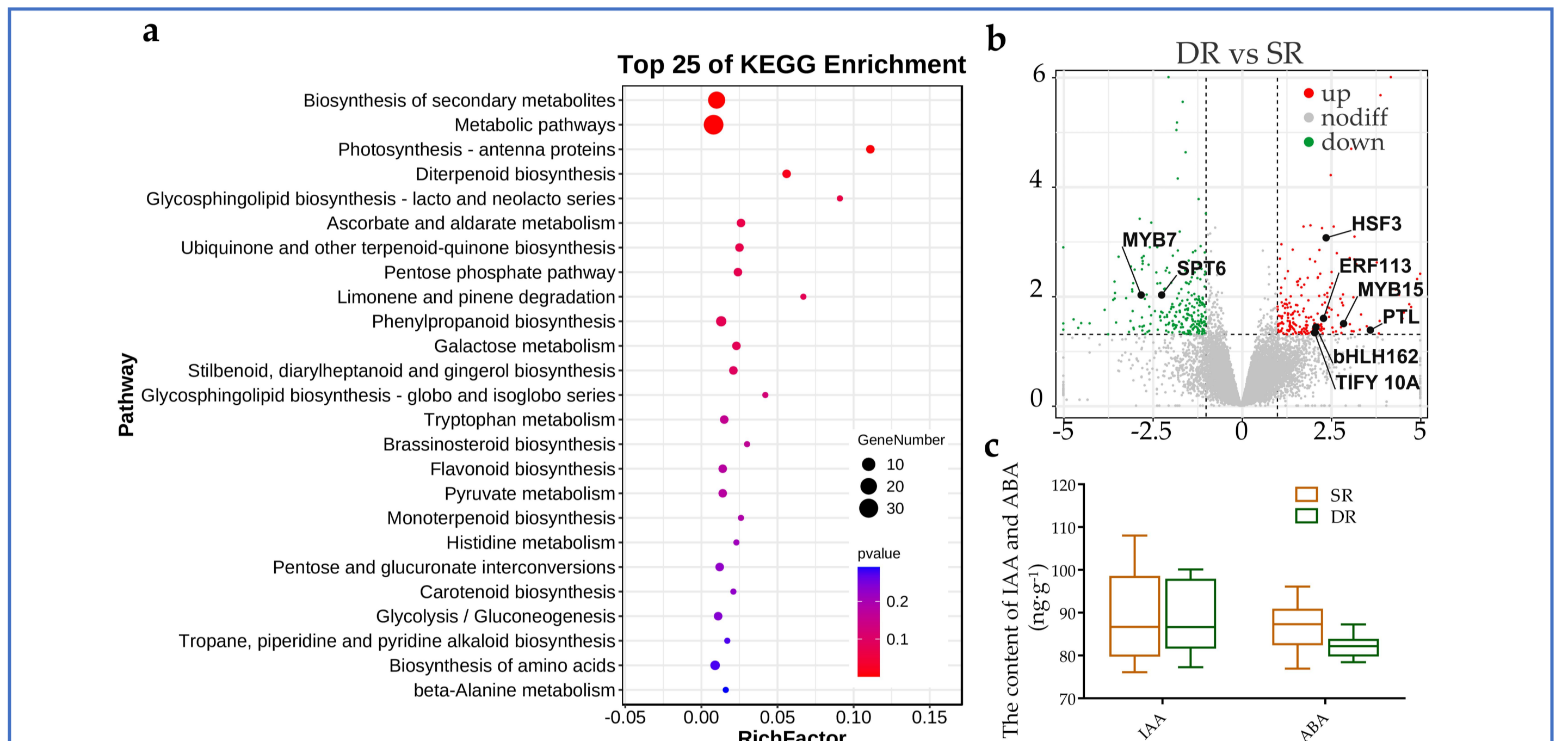


Fig. 4 Different analysis among single-root and double-root grafted plants. a KEGG enrichment analysis of DEGs, b Volcano plots of DEGs with transport factor and hormone related genes labeled, c the content of IAA and ABA.

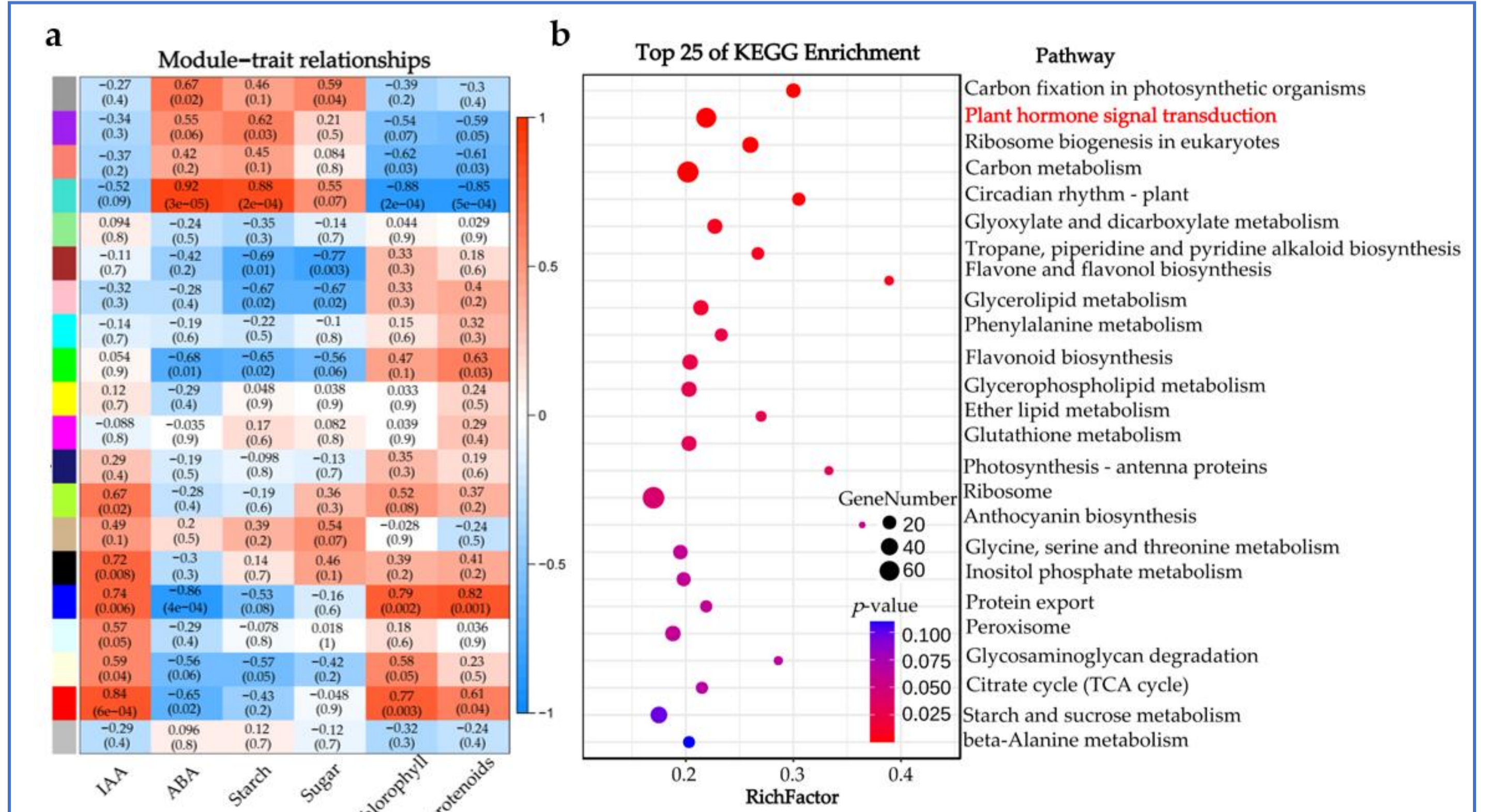


Fig. 5 WGCNA of DEGs identified from different graft combinations. a Module-trait correlations and corresponding p -values. b KEGG enrichment analysis the genes in module turquoise.

CONCLUSION

- Canopy volumes were rapidly increased by inarching of 'Pujiang Xiangcheng' rootstocks, and strong vigor eased the symptoms of graft incompatibility.
- Decrease of ABA content was the most likely inducer of the rejuvenation of weak citrus trees.
- Hormone signal regulators were differentially expressed and played key roles in the inarched plants to recover the normal growth.

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