

Figure S1. The relative electrolyte leakage of apple under freezing treatment at 4 (CK), -10, -15, -20, -25, -30, -35, and -40 °C. fs, 'Fuji'; gg, 'Ralls'.

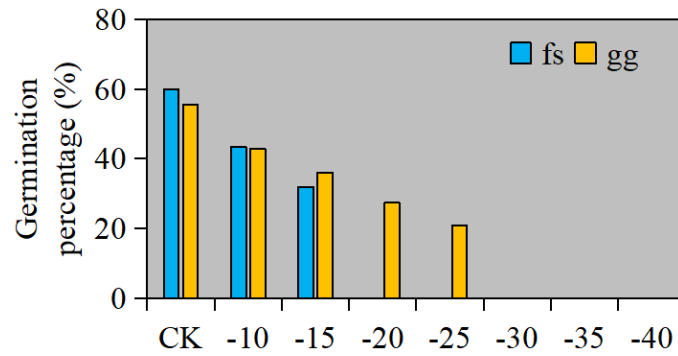


Figure S2. The germination percentage of apple under freezing treatment at 4 (CK), -10, -15, -20, -25, -30, -35, and -40 °C. fs, 'Fuji'; gg, 'Ralls'.

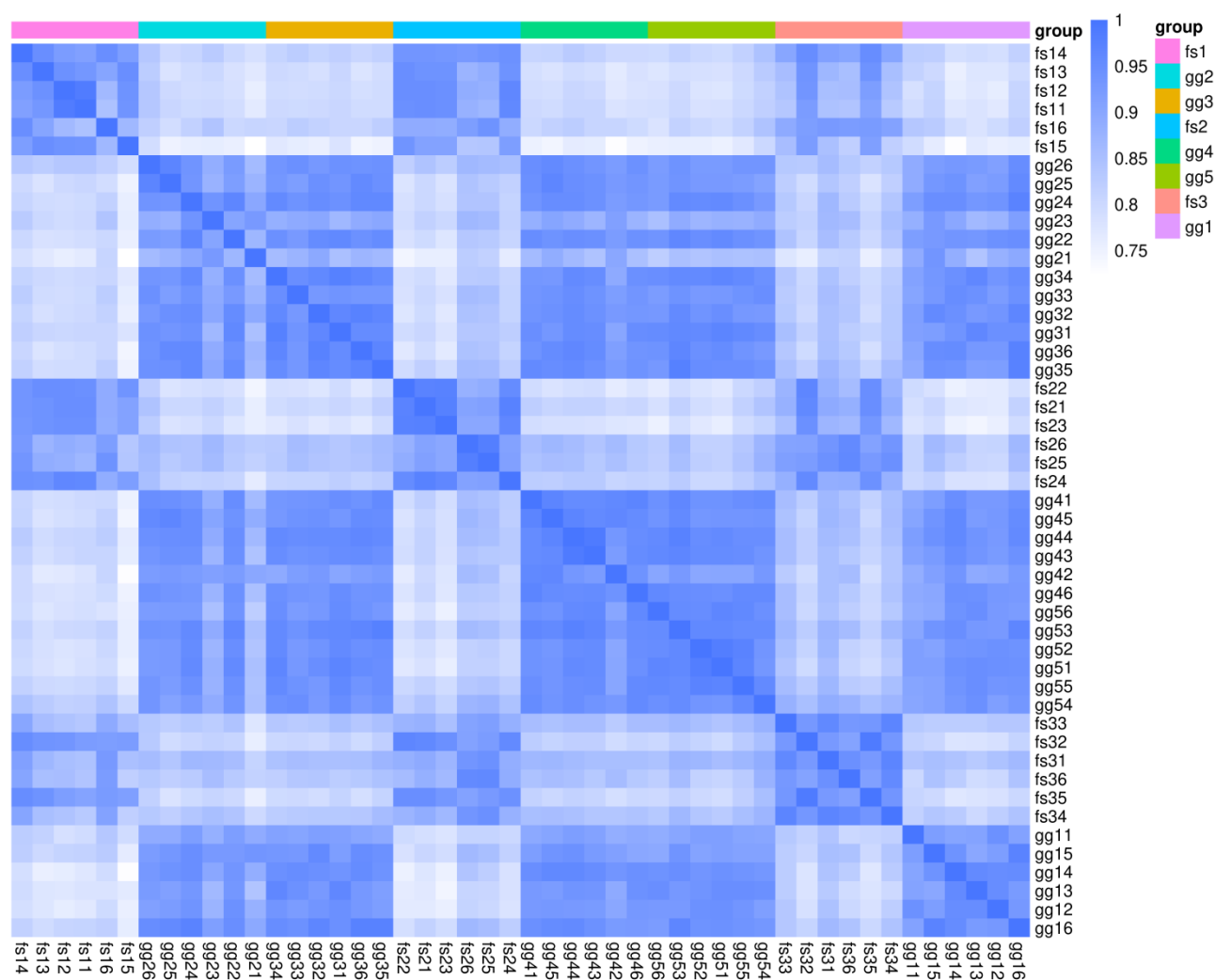


Figure S3. The spearman rank correlation analysis of sample metabolites. fs, 'Fuji'; gg, 'Ralls'.

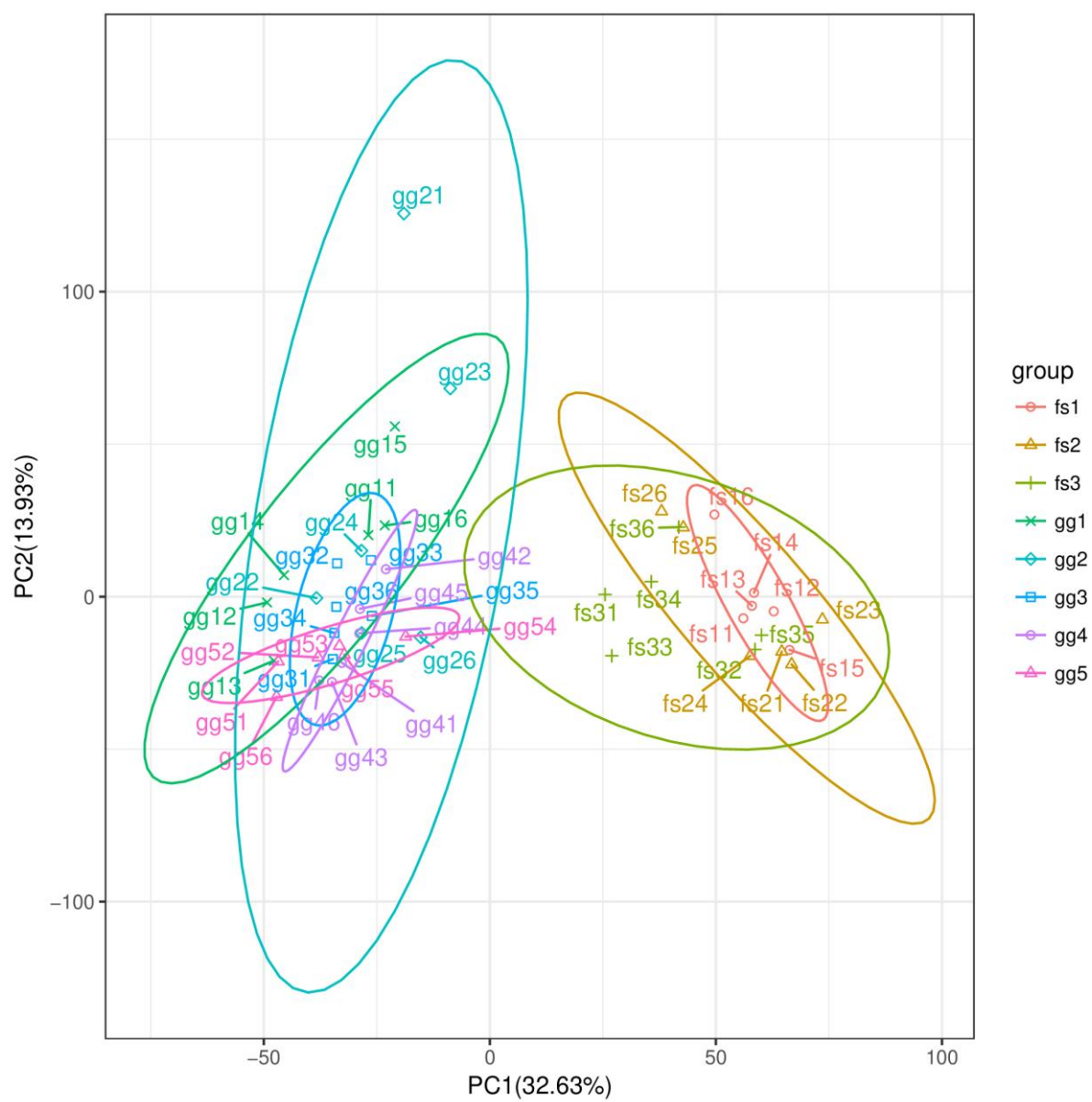


Figure S4. Principal component analysis of two dimensions. fs, 'Fuji'; gg, 'Ralls'.

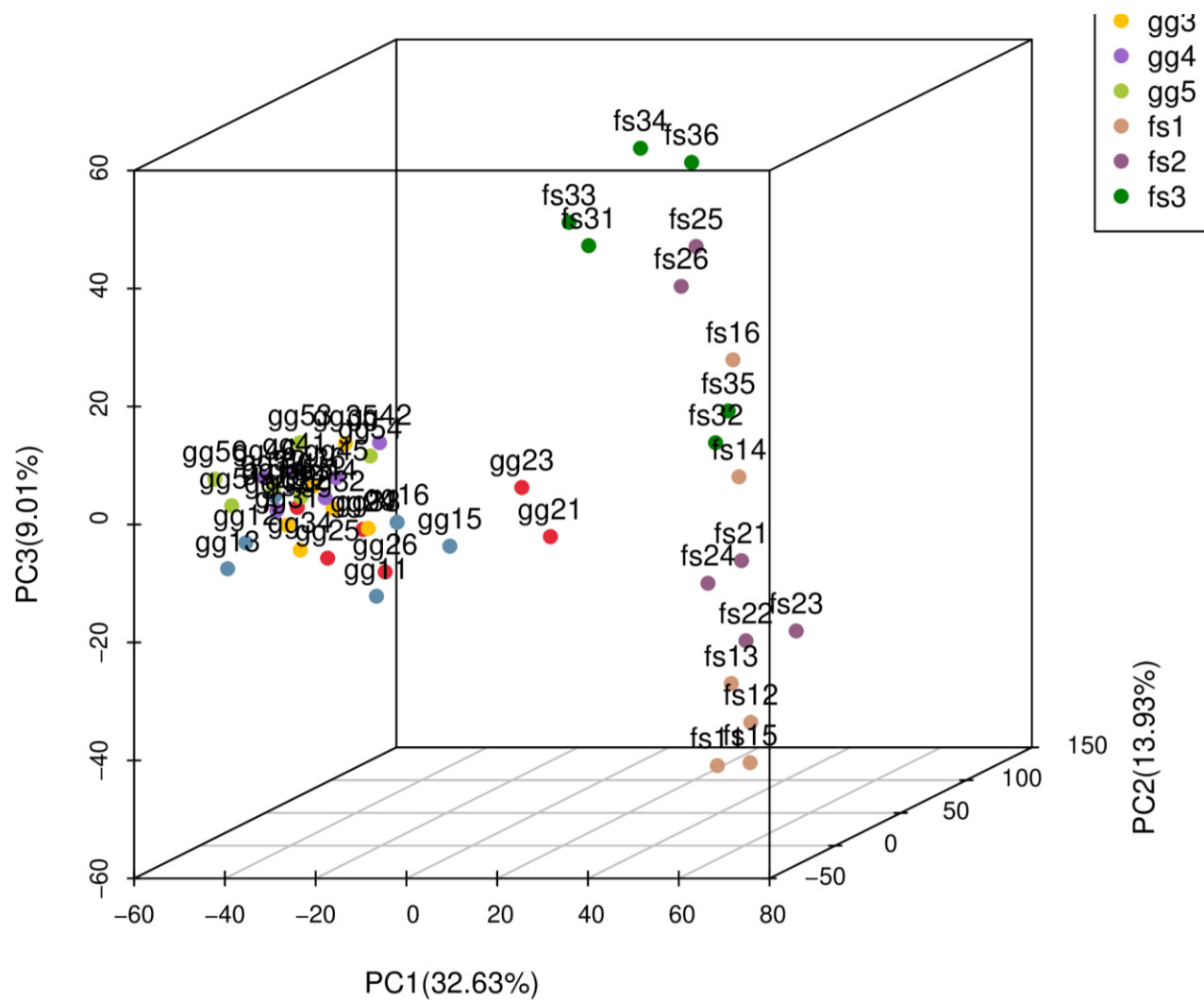


Figure S5. Principal component analysis of three dimensions. fs, 'Fuji'; gg, 'Ralls'.

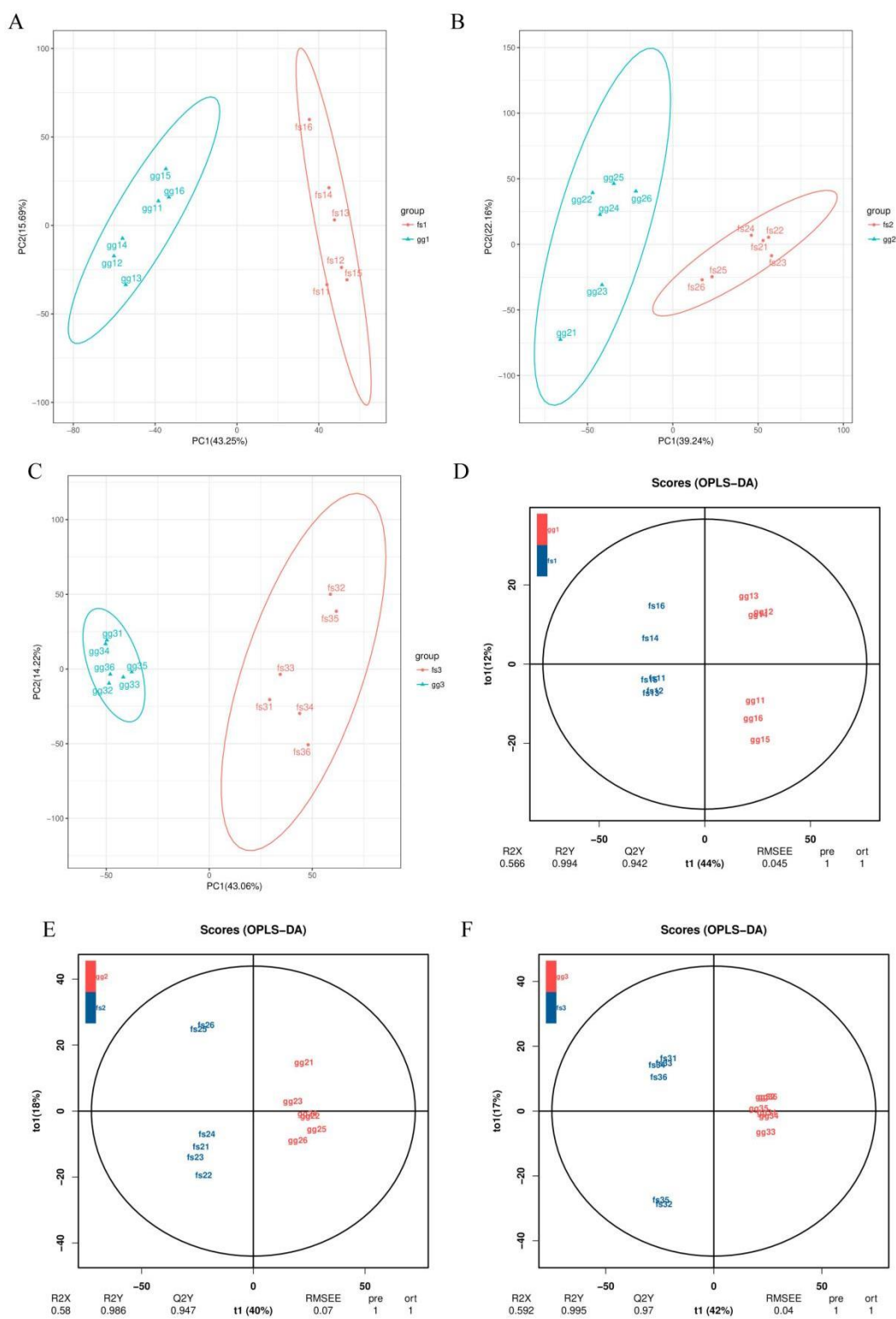


Figure S6. Principal component analysis and orthogonal projections to latent structures- discriminant analysis on pairwise comparison groups. A, B and C. Principal component analysis on pairwise comparison groups. D, E and F. Orthogonal projections to latent structures- discriminant analysis on pairwise comparison groups. fs, 'Fuji'; gg, 'Ralls'.

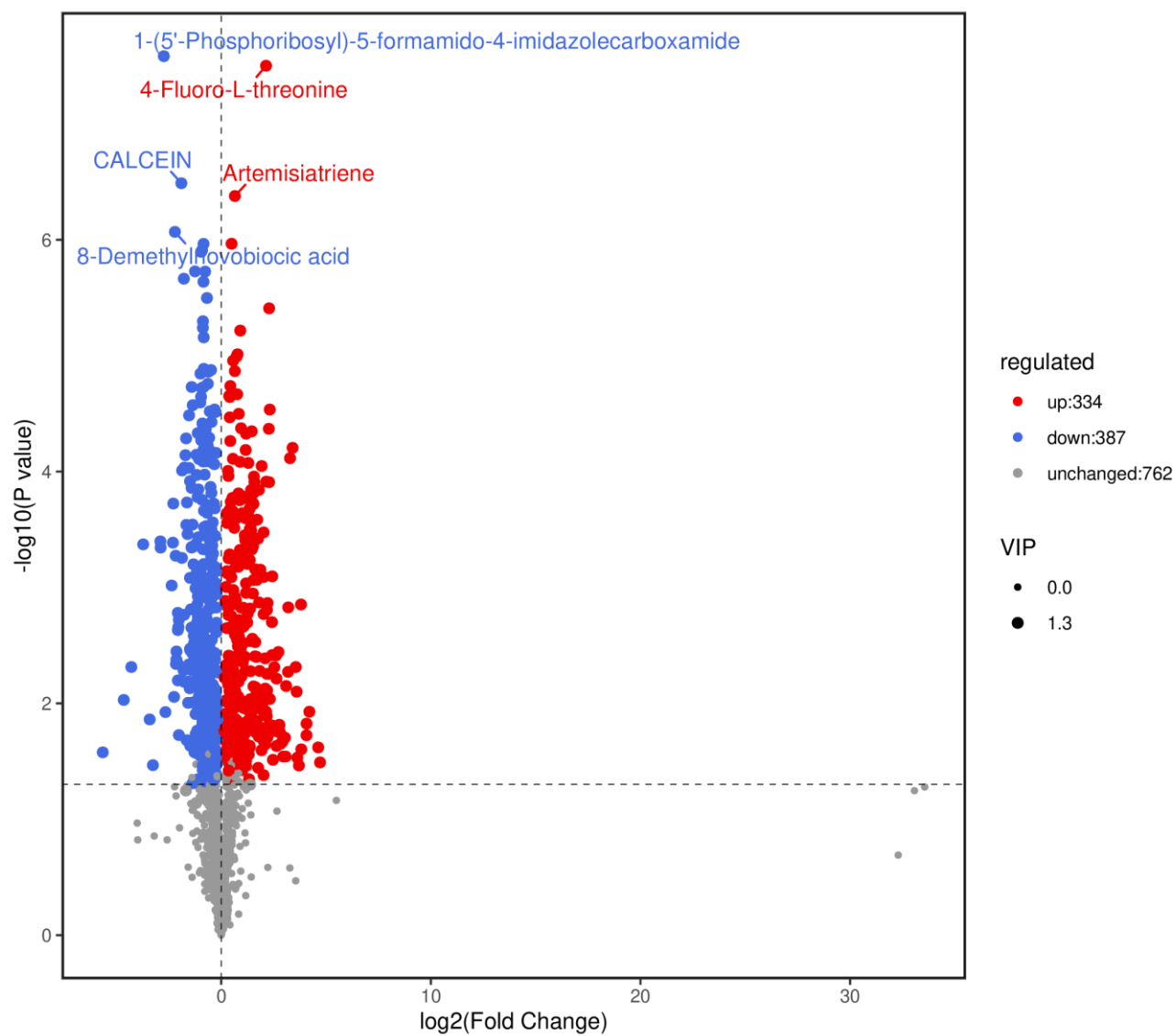


Figure S7. The volcano plot of differential metabolites between 'Ralls' and 'Fuji' under -15°C treatment.

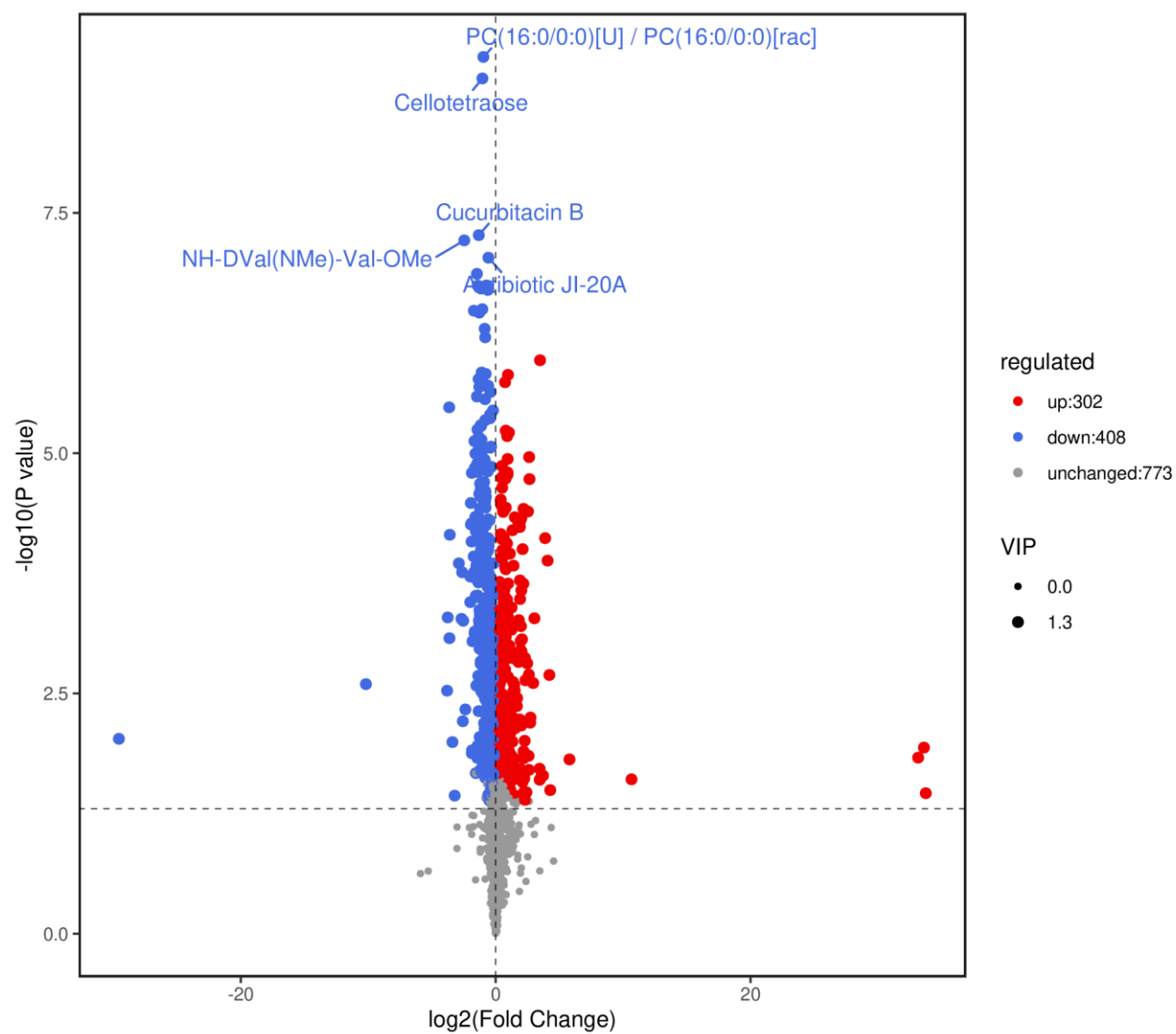


Figure S8. The volcano plot of differential metabolites between 'Ralls' and 'Fuji' under -20°C treatment.

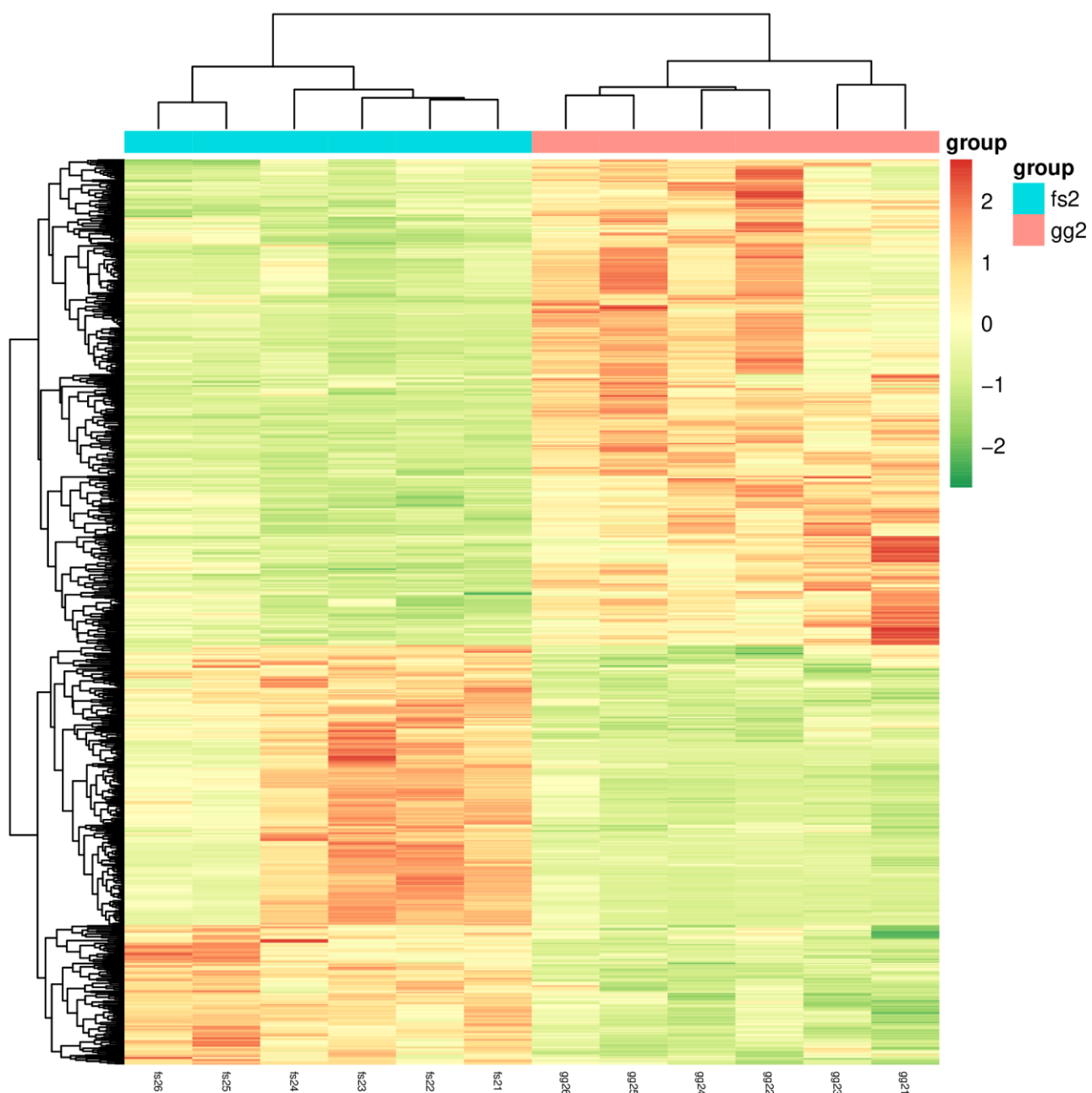


Figure S9. Clustering heat map of differential metabolites between 'Ralls' and 'Fuji' under -15°C treatment. Quantitative values of metabolites after Z-score standardization. fs, 'Fuji'; gg, 'Ralls'.

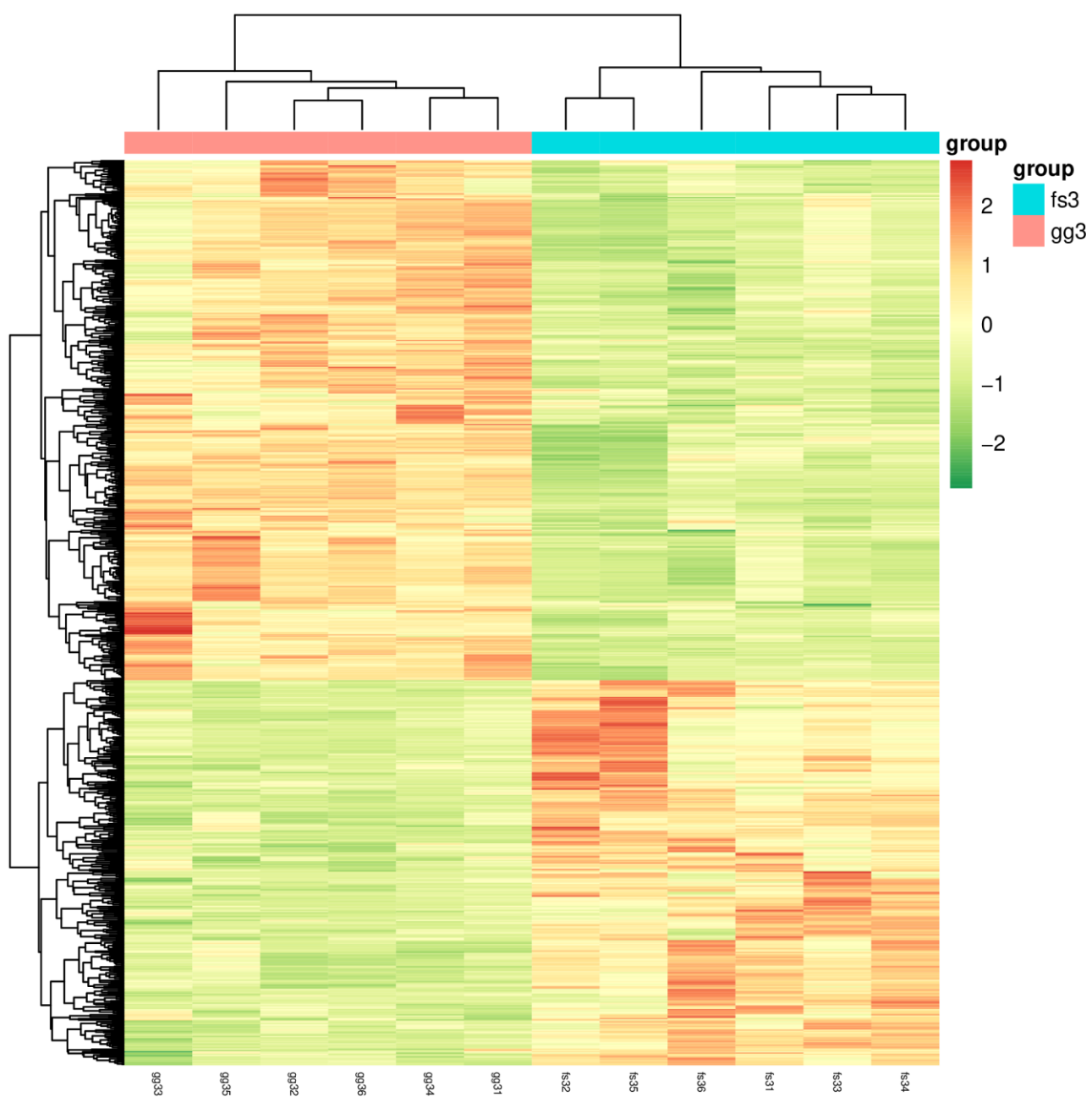


Figure S10. Clustering heat map of differential metabolites between 'Ralls' and 'Fuji' under -20°C treatment. Quantitative values of metabolites after Z-score standardization. fs, 'Fuji'; gg, 'Ralls'.

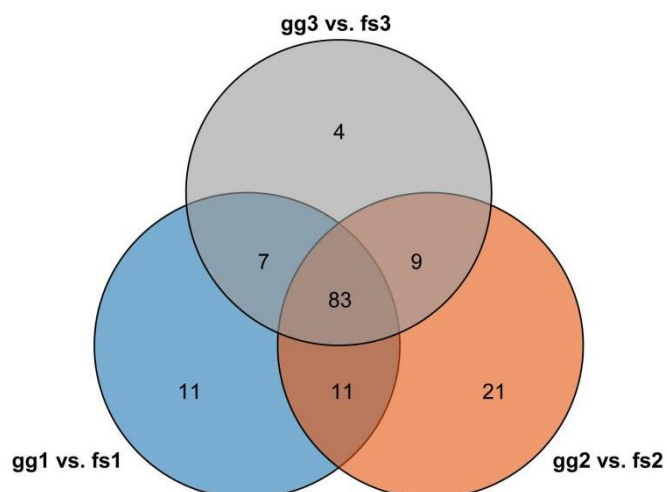


Figure S11. KEGG annotation of DAMs under different low temperatures. fs, 'Fuji'; gg, 'Ralls'.

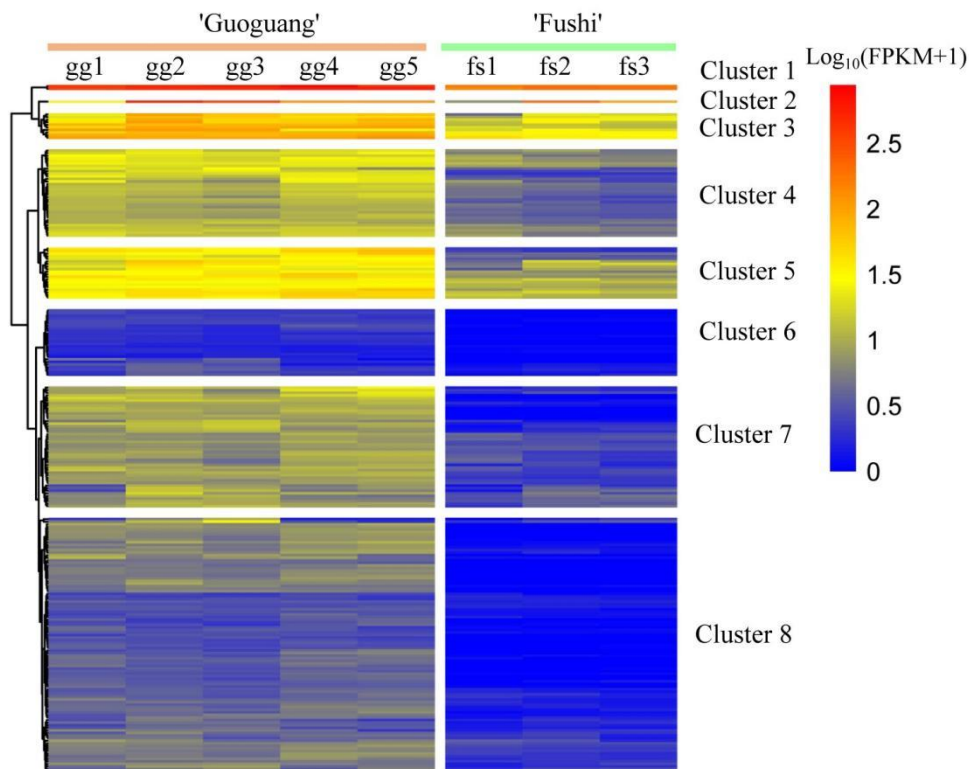


Figure S12. Expression patterns of shared up-regulated genes. The letter gg represents 'Ralls', and the letter fs represents 'Fuji'. The number 1, 2 and 3 represent the low temperature treatment of -10, -15 and -20°C, respectively.

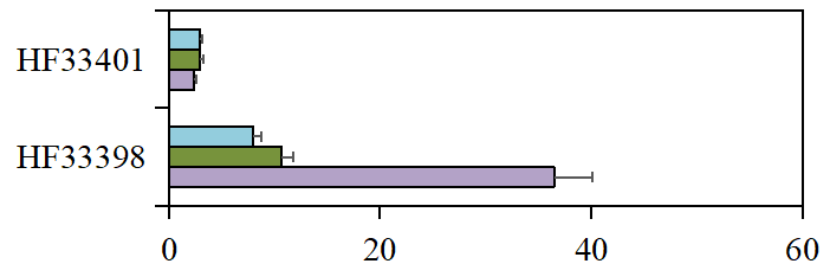


Figure S13. Differential expression multiples of flavone and flavonol biosynthesis pathway associated genes. The letter gg represents 'Ralls', and the letter fs represents 'Fuji'. The number 1, 2 and 3 represent the low temperature treatment of -10, -15 and -20°C, respectively.