Similar regulatory mechanisms were also discovered in the maple trees. When the color of the maple leaves changed, the expression levels of some *MYB* and *bHLH* genes would significantly alter. Genomic studies have shown that this species has a total of 95 R2R3-type *MYB* genes, among which some genes showed a significant increase in expression during the red leaf period, indicating that they may be involved in the regulation of anthocyanins (Figure 4) (Gong et al., 2025; Zhang et al., 2025). The transcriptome study conducted on the Jiwafan maple tree found that genes related to anthocyanin regulation include *46 MYB, 33 bHLH*, and *29 WD40*, indicating that the formation of leaf color is influenced by multiple transcription factors (Zhu et al., 2022). In the study of red maples, after the leaves were subjected to ring excision treatment, they gradually turned red, and some transcription factors related to anthocyanins were also activated (Yang et al., 2022). These research results indicate that MYB, bHLH, and other transcription factors can integrate different signals and regulate the expression of anthocyanin-related genes.

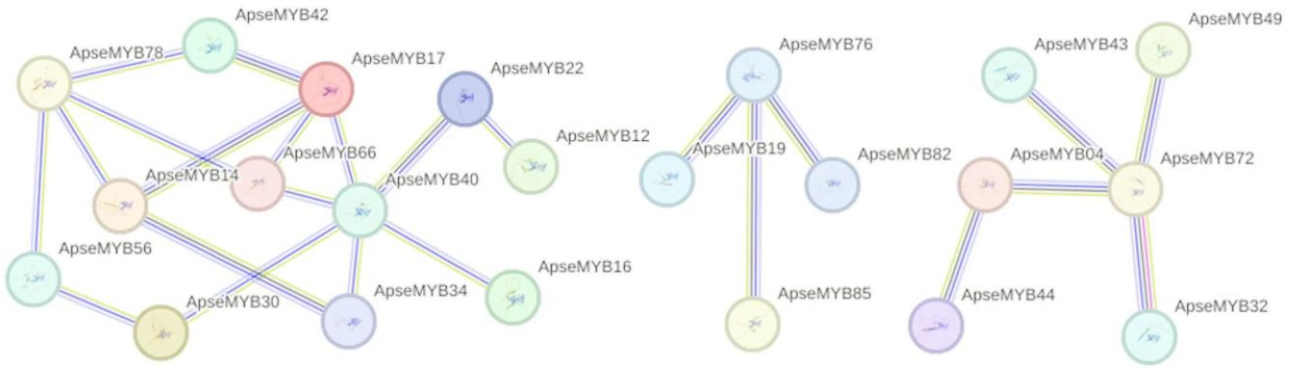

Figure 4 Analysis of the ApseMYB protein-interaction network (Adopted from Zhang et al., 2025)

4.3 Genetic expression differences lead to different leaf colors in different maple tree varieties

The differences in leaf color among different maple tree varieties are mainly related to the varying levels of gene expression, rather than a fundamental change in the metabolic pathways. After conducting a comparative study on red-leaved varieties and yellow-leaved varieties, it was found that the difference in anthocyanin content is associated with changes in the expression levels of 18 structural genes and various MYB, bHLH, and WD40 regulatory factors. Additionally, these two types of varieties also show significant differences in their gene co-expression patterns (Zhu et al., 2022).

Similar phenomena were also observed in red maples. When comparing the mutant branches of red, yellow and green colors, it was found that most of the genes related to anthocyanins had the strongest expression in red leaves, the lowest expression in green leaves, and an intermediate level in yellow leaves. This trend of change is consistent with the changes in anthocyanin content and the depth of leaf color (Chen et al., 2019). This indicates that under the same genetic background, different expression intensities of genes can affect pigment content, thereby forming different leaf colors (Figure 5).

5 Application of Maple Trees in Landscape Design

5.1 Utilizing different leaf colors to enrich landscape colorfulness

There are many types of maple trees, and their leaf colors are also very diverse, such as yellow-green, orange, red and purple, etc. By appropriately combining different colored maple leaves, a distinctive and colorful plant landscape can be created. Research indicates that maple trees with red, orange and yellow-green leaves can enhance the overall visual appeal of the landscape to a certain extent. In landscape design, if the number of red-leaved maple trees is appropriately increased, it can make the originally green-dominated environment more eye-catching and form a clear visual center (Yang et al., 2022).

Research on the color combination of plants in autumn has also found that designs featuring warm colors or creating an appropriate contrast between warm and cool colors are more likely to be favored by the public. Relevant indicators such as the autumn color index and the ratio of warm colors to cool colors are positively correlated with the attractiveness of the landscape (Luo et al., 2023b). Therefore, in actual design, attention should