Novel transcription factor inhibits flavone and anthocyanin biosynthesis in chrysanthemum at high temperatures

December 21 2021

Credit: Pixabay/CC0 Public Domain

Plant flavonoid accumulation is promoted by various environmental factors, including excess light, UV radiation, drought, and low

temperatures. Increased flavonoid content helps plants to maintain normal growth and development by eliminating excess reactive oxygen species (ROS) produced under adverse conditions. Intriguingly, high temperature, a common environmental stress, induces ROS production but inhibits flavonoid accumulation in plants. Although reductions in anthocyanin accumulation induced by high temperature have been well studied, it remains unclear how high temperatures inhibit the accumulation of flavonoids other than anthocyanins, especially flavones. Because the model plant Arabidopsis thaliana lacks a gene encoding flavone synthase (FNS), the regulatory mechanism of FNS-catalyzed flavone biosynthesis has rarely been studied in plants.

In a new study, investigators from Nanjing Agricultural University in China reported that flavones played a predominant role in eliminating ROS and were suppressed by high-temperature treatment in chrysanthemum (Chrysanthemum × morifolium). Consistent with these observations, the expression of CmFNS also decreased dramatically after high-temperature treatment. To reveal the regulatory mechanism underlying CmFNS downregulation at high temperature the researchers performed yeast one hybrid (Y1H) screening and identified CmMYB012, a potential regulator acting upstream of CmFNS. Y1H assays, chromatin immunoprecipitation (ChIP)-PCR, electrophoretic mobility shift assays (EMSAs), and dual-luciferase (Dual-LUC) assays demonstrated that CmMYB012 bound directly to the AACATT element in the CmFNS promoter, inactivating CmFNS expression. As expected, overexpression of CmMYB012 had a negative effect on plant fitness under high temperatures, whereas CmMYB012 suppression had the opposite effect.

The group also found that CmMYB012 served as a negative regulator of both anthocyanin biosynthesis and pink flower color formation in chrysanthemum. According to Y1H and Dual-LUC assays, CmMYB012 interacted with the promoters of CmCHS,

CmDFR, CmANS, and CmUFGT to inhibit their transcription, thereby reducing anthocyanin content. These findings demonstrate that high temperatures affect chrysanthemum flower color formation by upregulating the expression of CmMYB012. This work was published in the open-access journal *Horticulture Research* on Dec. 1.

The authors note, "our findings provide new insights into the mechanisms by which high temperatures regulate the metabolism of flavones and anthocyanins to affect plant fitness and flower color formation."

More information: Li-Jie Zhou et al, A novel transcription factor CmMYB012 inhibits flavone and anthocyanin biosynthesis in response to high temperatures in chrysanthemum, *Horticulture Research* (2021). DOI: 10.1038/s41438-021-00675-z

Provided by Nanjing Agricultural University The Academy of Science