Melatonin Improved Vase Quality by Delaying Oxidation Reaction and Supplying More Energies in Cut Peony (Paeonia Lactiflora cv. Sarah)

Authors : Tai Chen, Caihuan Tian, Xiuxia Ren, Jingqi Xue, Xiuxin Zhang

Abstract : The herbaceous peony has become increasingly popular worldwide in recent years, especially as a cut flower with great economic value. However, peony has a very short vase life, only 3-5 d usually, which seriously affects its commodity value. In this study, we used the cut peony (Paeonia lactiflora cv. Sarah) as a material and found that melatonin treatment significantly improved its postharvest performance. In the control group, its vase life was 4.8 d, accompanied by petal dropping at last; melatonin treatment (40 μM) increased this time to 6.9 d without petal dropping at the end. Further study showed that melatonin treatment significantly increased the activity of antioxidant enzymes as well as reduced sugar content in petals, whereas the starch content in petals decreased. These results indicated that melatonin treatment may delay the oxidation reaction caused by aging, which also provides extra energy for maintaining flowering. Through full-length transcriptome sequencing, a total of 2819 differentially expressed genes (DEGs) between control and melatonin treatment groups were identified. KEGG enrichment analysis showed that these DEGs were mainly involved in three pathways, including melatonin synthesis, starch and sucrose conversion, and plant disease resistance. After the RT-qPCR verification, we identified three DEGs, named PlBAM3, PlWRKY22 and PlTIP1, and they should play major roles in melatonin-improved postharvest performance. One possible reason is that PlBAM3 caused maltose production (by starch degradation), maintained the proline biosynthesis, and then alleviated oxidative stress. Another reason is that both PlBAM3 and PlWRKY22 are key drought resistance regulators, which have the ability to alleviate osmotic stress and improve water absorption, which may also help to improve the postharvest quality of cut peony. In addition, PlTIP1 is involved in the sugar signal pathway, indicating sugar may also as a signal substance during this process. Our work may give new ideas for developing new ways to prolong the vase life of cut peony and improve its commodity value eventually.

Keywords : cut peony, melatonin, vase life, oxidation reaction, energy supply, differentially expressed genes
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