

## **UNVEILING THE MOLECULAR MECHANISMS BEHIND NON-BROWNING PHENOTYPE IN THE APPLE CULTIVAR 'MAJDA' (MALUS DOMESTICA BORKH.) BY A COMPREHENSIVE INVESTIGATION**

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Fruit flesh browning is a natural oxidative process that occurs after cutting or processing, resulting in a dark-brown coloration. This phenomenon can significantly impact the production and marketability of fresh cut fruit products. While antioxidant compounds can partially mitigate this browning, they can also affect the overall quality and sensory properties of the fresh products. In this study, we investigated the regulation of a natural non-browning trait in the apple cultivar 'Majda' compared to the browning reference cultivar 'Golden Delicious' using a multidisciplinary approach.

Our findings revealed that the non-browning phenotype of 'Majda' is governed by multiple mechanisms, particularly characterized by distinct concentrations of chlorogenic acid and the expression of the polyphenol oxidase (*MdPPO*) gene. Metabolite analysis and gene expression profiling further demonstrated the involvement of organic acids and glutathione in preventing oxidative browning. Additionally, the unique non-browning behavior of 'Majda' was confirmed through a DPPH• kinetic assay, which highlighted its superior antioxidant activity.

Based on these results, we propose 'Majda' as a potential candidate for breeding programs aimed at selecting novel non-browning varieties, thereby enhancing the sustainability of pre-cut fresh products.