Phenylalanine treatment generates scent in flowers by increased production of phenylpropanoid-benzenoid volatiles

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Abstract

Fragrance is a desirable characteristic for cut flowers, but is rare among commercial cultivars. To date, there are no transformed commercial flower cultivars with increased fragrance, despite the fact that genetic engineering can generate fragrance in ornamentals without compromising on other commercial traits. One of the major volatile groups responsible for fragrance of flowers such as roses, petunia, snapdragon and clarkia, are the phenylalanine-derived benzenoid phenylpropanoids (BPVs). Here we show that a variety of commercial flowers, belonging to taxonomically distant plant species have the potential of producing fragrant BPVs when treated with exogenous phenylalanine. This group of flowers includes chrysanthemums, roses, anemones, *Ornithogalum dubium* and gerberas. Chrysanthemums, among the five leading flowers in the cut flower industry, lack flowery fragrance. However, treatment of cut chrysanthemums with phenylalanine resulted in an increase in BPVs preexisting in the flowers, producing a flowery fragrance clearly distinguished by a sensory panel. Similarly, phenylalanine treatment of anemones, also lacking fragrance, resulted in fragrant flowers. However, unlike chrysanthemums, in anemones, in addition to increasing preexisting BPVs, phenylalanine treatment resulted in production of new BPVs, not detected in non-treated flowers. Production of novel compounds due to phenylalanine treatment suggests that concealed metabolic pathways do exist in plants, may be activated by increased substrate availability. This study presents the potential of phenylalanine treatment as a way for increasing flowery fragrance in a large variety of non-fragrant commercially important plants.