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Commentary

Important Role of Carotenoids in Plants

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DESCRIPTION

Nature's vibrant palette has always captivated our senses, from the mesmerizing hues of a sunset to the stunning array of colors found in flora and fauna. Behind these captivating shades lie a group of natural pigments known as carotenoids. In the world of plants, carotenoids play a crucial role, not only in adding splendor to our surroundings but also in safeguarding their own survival. These remarkable compounds not only contribute to the visual appeal of plants. We delve into the captivating world of plant carotenoids, uncovering their significance, diversity, and potential applications. Plant carotenoids encompass an extensive range of pigments that provide a vast spectrum of colours, ranging from vivid yellows and oranges to deep reds and purples. These pigments are synthesized by plants during photosynthesis, serving as crucial accessory pigments in light-harvesting processes. While the most well-known carotenoids include beta-carotene, lutein, and lycopene, there are hundreds of other lesser-known members of this family. Each carotenoid possesses a unique molecular structure, enabling it to absorb specific wavelengths of light and consequently manifest a specific colour. Beyond their aesthetic appeal, carotenoids play an indispensable role in the defense mechanisms of plants. Acting as potent antioxidants, they protect plant cells from harmful free radicals generated by exposure to environmental stressors such as UV radiation and excess light. By neutralizing these free radicals, carotenoids help prevent oxidative damage and maintain the structural integrity of plants. Moreover, carotenoids also contribute to photo protection by dissipating excessive energy and reducing the risk of photo oxidation, thus ensuring the survival of plants in challenging environments. As we move towards a more sustainable and eco-conscious future, plant carotenoids hold significant promise. With their natural origin, these pigments offer a viable alternative to synthetic dyes and colorants, reducing our dependence on petrochemical-derived compounds. Furthermore, their antioxidant and health-promoting properties make them an attractive focus for nutraceutical and pharmaceutical industries, spurring continued research and innovation. They are vital parts of the photosynthetic apparatus and are crucial in guarding against photooxidative damage. Plant-insect interactions involve carotenoid catabolism products such -ionones. Since carotenoid precursors are the source of at least two main phytohormones, strigolactones and abscisic acid, the significance of carotenoids for plant growth and development is clear. A 'bottleneck' in the carotenoid biosynthesis pathway, phytoene biosynthesis is the first committed step and is known as such. Most other plant species, unlike Arabidopsis, produce several functionally redundant copies of phytoene Synthase (*PSY*), despite the fact that various *PSY* genes seem to have distinct patterns of expression and regulation. The maize genome encodes at least three *PSY* homologues, and one of them, *PSY3*, was activated by salt and drought, and this induction resulted in enhanced carotenoid content.

The majority of plant tissues, including green shoots, flowers, fruits, seeds, and roots, accumulate carotenoids. Although the levels and varieties of carotenoids found in green tissues are generally conserved across most plant species, they are much more variable and influenced by a variety of factors, including the stage of development, environment, stress, or a combination of these, in nongreen tissues, such as flowers, fruits, and seeds. Generally speaking, the rate of production, the cell's storage capacity, and the rate of catabolism and degradation dictate the steady-state levels of carotenoids.

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