

Preface

Ascorbic acid (vitamin C) is synthesized from hexose sugars. Ascorbic acid is an important antioxidant and redox buffer in plants, playing important roles in metabolism and plant responses to abiotic stresses and pathogens. It also works as an enzyme cofactor, so it has multiple roles in various plant physiological processes. Humans have lost the ability to synthesize ascorbate and have to absorb ascorbic acid from the diet including fresh fruits and vegetables, as they are the major sources of ascorbate.

Several pathways for ascorbic acid biosynthesis and metabolism have been identified in plants since 1998. Significant progresses have been made in relation to key enzymes and genes involved in the ascorbate biosynthesis and metabolism. Biochemical and molecular genetic evidence supports synthesis from GDP-D-mannose via L-galactose (D-Man/L-Gal pathway) as a significant source of ascorbic acid. More recently, evidence for pathways via uronic acids has been obtained: overexpression of myo-inositol oxygenase, D-galacturonate reductase and L-gulonolactone oxidase all increase ascorbic acid concentration in plants.

An understanding of how ascorbate is synthesized should provide a basis for engineering or otherwise manipulating its accumulation. However, in the examples of pathway engineering so far, the increase in ascorbic acid has been modest on an absolute or proportional basis. Therefore, a deeper understanding of ascorbic acid metabolism is needed to achieve larger increases. Identifying genes that control ascorbate accumulation may hold promise, particularly if regulatory genes can be identified. Recently, more attention has been paid to the control and regulation of ascorbic acid biosynthesis, as it is constantly regulated by the plant development and the environmental factors, e.g., light. Ascorbic acid is also frequently reported to affect plant growth and development, e.g., flowering time and fruit ripening. The increasing knowledge about ascorbic acid regulation should facilitate engineering or modulating its accumulation. Besides the metabolic engineering from genes, the environmental regulation may stand close to industrial practice.

The author takes this opportunity to give a brief review covering the biological function, biosynthesis and metabolism, regulation, and metabolic modification of ascorbate in plants. Processing and storage of plant product is not included, though it decides the final amount of this nutrient. The outstanding work on ascorbic acid in plants by scientific colleagues is greatly acknowledged.

Ascorbic Acid in Plants

Biosynthesis, Regulation and Enhancement

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