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Plant sterols: Diversity, biosynthesis, and physiological functions

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Abstract

© 2016, Pleiades Publishing, Ltd.Sterols, which are isoprenoid derivatives, are structural components of biological membranes. Special attention is now being given not only to their structure and function, but also to their regulatory roles in plants. Plant sterols have diverse composition; they exist as free sterols, sterol esters with higher fatty acids, sterol glycosides, and acylsterol glycosides, which are absent in animal cells. This diversity of types of phytosterols determines a wide spectrum of functions they play in plant life. Sterols are precursors of a group of plant hormones, the brassinosteroids, which regulate plant growth and development. Furthermore, sterols participate in transmembrane signal transduction by forming lipid microdomains. The predominant sterols in plants are β-sitosterol, campesterol, and stigmasterol. These sterols differ in the presence of a methyl or an ethyl group in the side chain at the 24th carbon atom and are named methylsterols or ethylsterols, respectively. The balance between 24-methylsterols and 24-ethylsterols is specific for individual plant species. The present review focuses on the key stages of plant sterol biosynthesis that determine the ratios between the different types of sterols, and the crosstalk between the sterol and sphingolipid pathways. The main enzymes involved in plant sterol biosynthesis are 3-hydrox--3methylglutaryl-CoA reductase, C24-sterol methyltransferase, and C22-sterol desaturase. These enzymes are responsible for maintaining the optimal balance between sterols. Regulation of the ratios between the different types of sterols and sterols/sphingolipids can be of crucial importance in the responses of plants to stresses.

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Keywords

plant sterols, sphingolipids, stress