Amino acid synthesis under abiotic stress

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Résumé en anglais	Almost all plants have to deal with climatic factors and to develop strategies to adapt their metabolism, which may have been adversely affected, in order to acclimate and survive under these unfavourable growth conditions. Mechanisms of plant stress tolerance involve some changes in gene expression, protein modification and metabolic pathways. More particularly, plant amino acid (AA) composition is modified by environmental conditions and characterized by an elevated accumulation of specific AAs involved in plant stress tolerance. These free AAs are synthesized by various distinct metabolic networks and accumulate differentially in plant species exposed to various stresses. In response to these environmental constraints, AA metabolism plays an important regulatory role, not only because AAs are constituents of proteins but also because free AAs are potential regulatory and signalling molecules, and precursors for energy-associated metabolites, as well numerous secondary metabolites, that have several functions in plant growth and adaptive responses to various stresses. The AA synthesis pathways are complex and undergo tight regulation, particularly in respect of the metabolism of three specific AA family pathways when plants are exposed to abiotic stresses. First, the glutamate family pathway is strongly activated under stress, leading to the accumulation of proline and γ-aminobutyric acid (GABA), two stress-related molecules involved in metabolic responses to stress. Secondly, stimulation of the metabolism of the pyruvate family pathway mainly allows the production and accumulation of alanine, which is the most abundant amino acid under oxygen deficiency; it also leads to the accumulation of branched-chain amino acids, such as leucine and valine, which could play the role of compatible solutes and provide an alternative source of respiratory substrates. Thirdly, regulation of biosynthetic and catabolic fluxes through the aspartate family pathway appears to be essential for generating energy, mainly via lysine catabolism, as stress causes energy deprivation.
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