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Abstract

Remodeling of Carbon and Nitrogen Metabolites in Durum Wheat: A Simple Response to Complex Stimuli †

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Abstract: Plant stress studies dealing with a single stress approach have been useful for dissecting stress perception of defined stimuli and related gene expression and metabolic changes. However, in real-world scenarios, plants are simultaneously exposed to a plethora of stresses counteracted by mean of tailored responses completely different from the responses to individual stresses. Durum wheat seedlings were used as an experimental model to investigate the plant response to salinity (100 mM NaCl) and low/high light (350/900 μmol m^{-2} s^{-1}) or low/high nitrogen (0.1/10 mM KNO_3, respectively), focusing on the physiological and metabolic changes potentially involved in osmotic adjustment and antioxidant defense. The data showed that durum wheat plants are able to fine-tune relatively few selected metabolites, in particular proline, amides, GABA, minor amino acids, hexoses, and glycine betaine, which may be the key actors in osmotic adjustment, scavenging of ROS, biochemical pH-stat, assimilation of the excess of ammonium, and signaling under the combined stresses. To unravel, in particular, the reason of proline, glycine betaine, and GABA accumulation and their possible mode of action, all possible roles for these metabolites under stress are considered, and mechanisms of action triggered by stresses suggested.

Keywords: combined stresses; tailored responses; salinity; high light; proline; glycine betaine; GABA; osmotic adjustment; pH stat; ROS scavenging

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