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Proteome analysis of sorghum leaf and root in response to heavy metal stress

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Abstract

Heavy metals at toxic levels have the capability to interact with several vital cellular biomolecules such as nuclear proteins and DNA, leading to oxidative stress in plants. The present study was performed to explore the metal tolerance mechanism in Sorghum seedling. Morpho-physiological and metal ions uptake changes were observed prominently in the seedlings when the plants were subjected to different concentrations of $CuSO_4$ and $CdCl_2$. The observed morphological changes revealed that the plants treated with Cu and Cd displayed dramatically altered shoot lengths, fresh weights, and relative water content. In addition, the concentration of Cu and Cd was markedly increased by treatment with Cu and Cd, and the amount of interacting ions taken up by the shoots and roots was significantly and directly correlated with the applied level of Cu and Cd. Using the 2-DE method, a total of 24 and 21 differentially expressed protein spots from sorghum leaves and roots respectively, 33 protein spots from sorghum leaves under Cd stress were analyzed using MALDI-TOF/TOF MS. However, the over-expression of GAPDH plays a significant role in assisting *Sorghum bicolor* to attenuate the adverse effects of oxidative stress caused by Cu, and the proteins involved in resistance to stress helped the sorghum plants to tolerate high levels of Cu. Significant changes were absorbed in the levels of proteins known to be involved in carbohydrate metabolism, transcriptional regulation, translation and stress responses. In addition, the up-regulation of glutathione S-transferase and cytochrome P450 may play a significant role in Cd-related toxicity and stress responses. The results obtained from the present study may provide insights into the tolerance mechanism of seedling leaves and roots in Sorghum under heavy metal stress.

Keywords: heavy metal stress, leaf and root proteome, metal uptake, sorghum

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