World Academy of Science, Engineering and Technology
International Journal of Agricultural and Biosystems Engineering
Vol:9, No:04, 2015

Differential Response of Cellular Antioxidants and Proteome Expression to Salt, Cadmium and Their Combination in Spinach (Spinacia oleracea)

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Abstract : Agriculture lands suffer from a combination of stresses such as salinity and metal contamination including cadmium at the same time. Under such condition of multiple stresses, plant may exhibit unique responses different from the stress occurring individually. Thus, it would be interesting to investigate that how plant respond to combined stress at level of antioxidants and proteome expression, and identifying the proteins which are involved in imparting stress tolerance. With an approach of comparative proteomics and antioxidant analysis, present study investigates the response of Spinacia oleracea to salt (NaCl), cadmium (Cd), and their combination (NaCl+Cd) stress. Two-dimensional gel electrophoresis was used for resolving leaf proteome, and proteins of interest were identified using PDQuest software. A number of proteins expressed differentially, those indicated towards their roles in imparting stress tolerance, were digested by trypsin and analyzed on mass spectrometer for peptide mass fingerprinting (PMF). Data signals were then matched with protein databases using MASCOT. Results show that NaCl, Cd and both together (NaCl+Cd) induce oxidative stress which was highest in combined stress of Cd+NaCl. Correspondingly, the activities of enzymatic antioxidants viz., SOD, APX, GR and CAT, and non-enzymatic antioxidants had highest changes under combined stress compares to single stress over their respective controls. Among the identified proteins, several interesting proteins were identified that may be have role in Spinacia oleracia tolerance in individual and combinatorial stress of salt and cadmium. The functional classification of identified proteins indicates the importance and necessity of keeping higher ratio of defence and disease responsive proteins.

Keywords : Spinacia oleracea, Cd, salinity, proteomics, antioxidants, combinatorial stress
Conference Title : ICABBBE 2015 : International Conference on Agricultural, Biotechnology, Biological and Biosystems Engineering
Conference Location : Los Angeles, United States
Conference Dates : April 03-04, 2015