ANTIOXIDANTS IN PLANT MODEL SYSTEM EXPOSED TO HEAVY METAL STRESS

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Reactive oxygen species (ROS) are forms of activated oxygen which may cause severe oxidative damage that contributes to significant biological effects, such as carcinogenesis, mutagenesis, and cytotoxicity. Because dietary plants contain several hundred different antioxidants, it would be useful to know the total concentration of electron-donating antioxidants (i.e. reductants) in individual items. Common bean (*Phaseolus vulgaris L., Fabaceae*) was chosen as the object of this study because it is a widespread crop plant and is frequently used as a model plant in ecotoxicologycal studies. The objective was to investigate if short-term exposure of bean seedlings to different metals can induce significant changes in endogenous total antioxidants level in the plant. To assess the total antioxidant capacity of plants, the Ferric-Reducing Antioxidant Power (FRAP) assay was used.

Bean seeds were exposed to different metals (Cu, Cd, Pb, Zn, Ni, Mn) in different concentrations for seven days period. Methanol extraction was performed from grind plant tissue and then samples were analyzed for total antioxidants by FRAP assay using microplate reader (ChemWell). The antioxidant status is expressed as μmol $FeSO_4$ L^{-1}.

The ability of plants to increase antioxidative protection to combat negative consequences of heavy metal stress appears to be limited since many studies showed that exposure to elevated concentrations of redox reactive metals resulted in decreased and not in increased activities of antioxidative enzymes. This fact is also valid for bean as model system. The results demonstrated that the increasing metal concentration changed synchronously antioxidant levels in samples, decreased total antioxidant activity in all samples with exception of samples treated with Ni and Cd. In average, the samples treated with metals in concentrations of 150 mg L^{-1} show for 17.2% lower antioxidant activity compared to the control sample, while for the samples treated with 350 mg L^{-1} this percentage is 21.23.

The results show that the antioxidative defense system plays an important role in heavy metals tolerance in investigated plant and suggested that mineral nutrient imbalance is involved in changes of antioxidant levels, which may help to understand the mechanism of metal toxicity in plants.

Keywords: antioxidants, plants, metals.