

The protective role of zinc and calcium in *Vicia faba* seedlings subjected to cadmium stress

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Summary

Along with rapid development of modern industry, environmental contamination by heavy metals has increased drastically. The heavy metal cadmium (Cd^{2+}) is considered to be one of the most dangerous occupational and environmental poisons. The cytotoxic and mutagenic effects of Cd^{2+} have been demonstrated in different plant and animal species. Cd^{2+} was found to inhibit seed germination and root growth, decrease the mitotic index of cells, besides that it produced chlorophyll mutation, chromosomal aberration, important effects on protein metabolism and enzymes in plants. The aim of the present study was to evidence the possible antagonistic effect of Zinc (Zn^{2+}) and Calcium (Ca^{2+}) against cadmium Cd^{2+} -induced DNA damage by using random amplification of polymorphic DNA (RAPD) and metabolic activities in *Vicia faba*. The results showed that all doses of Cd^{2+} (10^{-3} M, 10^{-5} M) caused an increase in polymorphism value and a decrease in genomic template stability (GTS %). In addition, when 10^{-4} - 10^{-6} M Ca^{2+} , 10^{-6} M Zn^{2+} were added together with 10^{-3} M, 10^{-4} M, 10^{-5} M of Cd^{2+} , polymorphism value decreased besides GTS, total protein and chlorophyll content increased. Results suggested that Zn^{2+} and Ca^{2+} have an antagonistic effect against Cd^{2+} . The order of the antagonisms of Ca^{2+} , Zn^{2+} against Cd^{2+} toxicity was $\text{Ca}^{2+} > \text{Zn}^{2+}$. Especially, the degree of antagonistic effect of Zn^{2+} against Cd^{2+} is probably related to its concentration ratio.

Key words: *Vicia faba*, antagonism, DNA damage, cadmium