RESEARCH ARTICLE | International Journal of Plant Sciences, Vol. 4 Issue 1 : 239-244 (January to June, 2009)

Bioaccumulation and effect of lead, chromium and cadmium on peroxidase activity in bittergourd (*Momordica charantia* L. walp) cv. PRIYA

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Accepted : December, 2008

SUMMARY

A study was conducted to determine the effect of lead, chromium and cadmium on peroxidase activity and accumulation of these metals in bittergourd (*Momordica charantia*) which is a common vegetable crop. The plants were grown in pot culture under green house conditions, irrigated with nutrient solution supplemented with 10, 25, 50, 100 and 200 µM lead; 15, 30, 60, 120 and 240 µM chromium and 5, 10, 25, 50 and 100 µM cadmium till the harvest of mature fruits. The root and shoot systems as well as fruits were analysed for Pb, Cr and Cd using atomic absorption spectrophotometer and peroxidase activity was assayed spectrophotometrically. Peroxidase was more active in root and shoot systems of treated plants and the increase in the activity was proportional to the concentration of treatments. Maximum accumulations of all the metals were localized in roots, minimum in fruits and shoots being intermediate. Translocation of Cr^{3+} to the fruits was very low and only negligible quantity was present even in the highest concentration of treatments. More sensitivity was shown by plants to cadmium but maximum accumulation was observed in this fruits owing to the fast mobility of Cd^{+2} ions. Therefore, cadmium at comparatively low concentration causes serious health hazards than Cr and Pb, as it reaches the food chain in magnified proportions through the edible fruits of bittergourd.

Key words : Bittergourd, Bioaccumulation, Lead, Chromium, Cadmium, Peroxidase.

Eventhough some heavy metals are essential for plant nutrition, large quantities of them are toxic to most plants (Turner, 1994). The pronounced effects of metal toxicity include reduction of growth (Levitt, 1980; Hagemeyer, 1993; Huang and Cunningham, 1996), impaired photosynthesis (Baszynski, 1986; Lang *et al*., 1998), inhibition of essential enzyme activities (Rauser, 1993), free radical accumulation and lipid peroxidation (Parmar *et al*., 2002; Parmarand Chanda, 2005) and synthesis of phytochelatins (Rhodes, 1987; Leopold *et al*., 1999). Nevertheless, bioaccumulation of heavy metals in root, shoot, fruits and seeds has been reported in different plant species (Stefanov *et al*., 1995; Ye *et al*., 1997; Brennan and Shelly, 1999). Reports on the bioaccumulation data of heavy metals in higher plants, reveal that metallic ions are adsorbed in the roots in abundance and their rate of transport and distribution to the shoot system vary from plant to plant (Cseh, 2002). Bio accumulation of toxic metals like Cd, Cr, Hg etc. are now-a-days used as a accumulating potential of plants and use of this quality in phytoremediation of polluted soil/water (Rai *et al.*, 2003, Podar *et al.*, 2004).

Oxidative stresses induced by heavy metals stimulate the production of free radicals which cause lipid peroxidation (Mallick and Rai, 2002) and peroxidase activity is considered as a measure of tolerance towards heavy metals because peroxidase activity is directly proportional to lipid peroxidation but inversely proportional to plant growth and tolerance. Hence, in the present study, this enzyme activity is taken as a criterion to assess the tolerance of *M. charantia* plants towards Pb, Cr and Cd.

According to Barman and Bhargava (1997) and Barman *et al*. (1999) selection of suitable varieties of plants is essential for the cultivation crops in fields prone to heavy metal contamination and accumulation of toxic metals may be considered as important criteria for the selection of suitable species or variety. Bioaccumulation of heavy metals in plants in general and fruits in particular, receives much attention since these toxic metal ions get into the food chain (Stefanov *et al.*, 1995). With this background the uptake and accumulation of lead, chromium and cadmium in different parts of bittergourd (*Momordica charantia*) was studied by growing the plants in pots irrigated with nutrient medium containing known quantities of these heavy metals since this plant is widely cultivated even in industrially polluted areas and the fruits are consumed as an important vegetable.

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