Phytoremediation potential of tobacco and *Brassica juncea* exposed to Cd stress

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1. Introduction - Cadmium (Cd) is the fifth most toxic metal to vertebrates and the fourth most toxic metal to vascular plants [1]. Because of the adverse effects of increased metal concentrations on most living organisms, techniques have been developed to remediate contaminated soils. In phytoremediation, plants may be used to remove contaminants from soil by phytoextraction and then harvested for processing such as subsequent disposal of the biomass as a hazardous waste, or eventual recuperation of metals from the metal-enriched biomass. A plant suitable for phytoremediation should especially possess the following characteristics: (1) ability to accumulate metals preferably in the aboveground parts, (2) tolerance to metal accumulated, (3) fast growth and high biomass and (4) easy harvestability. Members of the family Brassicaceae e.g., *Thlaspi* spp. and *B. juncea* are nowadays popular as phytoremediators. Many of the candidate plants are crop plants. Instead of crop plants, one can use high biomass noncrop plants such as Nicotiana species which are repulsive to herbivores [2]. In this study tobacco and *B. juncea* were used aimed to identify the plant with higher tolerance to Cd-toxicity and higher capacity to accumulate Cd, so that it can be used for phytoremediation of Cd-polluted sites without much reduction in its growth and yield. Plants usually experience oxidative stress when they are exposed to Cd and other heavy metals thus, changes of the activities of major antioxidant enzymes (superoxide dismutase, SOD; guaiacol peroxidase, GPX; ascorbate peroxidase, APX; catalase,CAT and glutathione reductase GR) were also investigated.

2. Experimental – Greenhouse pot (2 kg) experiments were conducted using a sandy soil spiked with cadmium nitrate [$Cd(NO_3)_2$] solution and for comparison, an unamended control. The final Cd soil concentration was 5, 15 and 35 mg Cd kg^{-1} (ppm), respectively. After 45 days, seeds of tobacco and *B. juncea* were sown in the soil. Plants were harvested after 90 days and separated into shoots and roots. Cadmium in the plant tissues was determined by atomic absorption after digestion of dried plant material in concentrated acidic mixture. Fresh samples of both plants were used for enzyme assay. To determine the bioavailability of metals in soils, specific extractants were used, like EDTA 0.05M and $NaNO_3$ 0.1M. The treatments were completely randomised with three replicates.

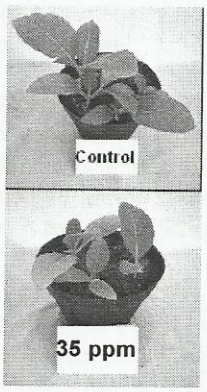

Figura 1 Tobacco plants grown with 0 and 35 ppm of Cd. after 90 davs.

3. Results and Discussion – The results of biomass production showed that the presence in soil of 5 ppm of Cd stimulated the growth of *B. juncea plants* (hormesis effect), but the Cd concentration of 35 ppm reduced the growth of tobacco plants compared with the control due to Cd stress. Some changes have been observed in the activities of antioxidant enzymes under Cd stress, for both plants. The EDTA extracted more than 70% of the total metal concentration in soil, but extraction with $NaNO_3$ was always lower than 2%.

4. Conclusions - The Cd-stress was found to affect plant growth and the activity of many key enzymes of various metabolic pathways. Cadmium causes oxidative stress probably through indirect mechanisms such as interaction with the antioxidative defence, disruption of the electron transport chain or induction of lipid peroxidation

5. Referências

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