UTILIZATION OF *ANADENANTHERA PEREGRINA* (FABACEAE) AS ARSENIC - PHYTORREMEDIATOR SPECIES

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INTRODUÇÃO

In Brazil, especially in the Minas Gerais State (MG), arsenic (As) background concentrations in soil is becoming increasingly high due the mining activities. We reported soil As concentrations as high as 27.000 mg kg - 1 in mine spoils at Santa Luzia (MG, Brazil). Due its carcinogenicity and mutagenicity, As pose a great threat to human health and thus there is an urgent need to remediate As - contaminated environments. The common physic - chemical techniques used for remediation of soil or sediments polluted by metals are expensive and unsuitable in cases of extensive areas (Dary *et al.*, 2010), therefore, biotechnological approaches have received a great deal of attention in the recent years. Phytoremediation, the use of plants for metal reclamation, emerges then as an environmental friendly proposal, and may be the most cost - effective treatment for metal polluted soils, especially in the case of extensive pollution (Dary *et al.*, 2010). In this context, the plant naturally occurrence in contaminated areas is an indicative of its potential use in phytoremediation programs. We verified the naturally occurrence in As - contaminated soi(576.32 mg Kg^{-1}) of Anadenanthera peregrina var. falcata (popularly called "angico - vermelho), an important woody leguminous tree of Brazilian savanna. Despite of the high As - levels in the soil, these plants appeared to be healthy, reason why we chose this species for this study. Arsenic, a non - essential nutrient, interferes with plant metabolism and inhibits plant growth (Tu and Ma, 2005). It is able to influence the nutrient uptake and distribution in plants through competing directly with nutrients and/or altering metabolic processes (Meharg and Hartley - Whitaker, 2002; Tu and Ma, 2005). Arsenic also influences the nutrient contents in plants, i.e. N, P, K, Ca, Mg, B, Cu, Mn, Zn (Tu and Ma, 2005).

OBJETIVOS

The objective of this study was to evaluate the As - influence in the concentration and distribution of nutrients in the roots and shoots of A. *peregrina*.

MATERIAL E MÉTODOS

The arsenic was added to the substrate (sand and vermiculite 1:1 v v - 1) at 0 (control), 10, 50 and 100 mg kg - 1 as Na2HAsO4. The pH (1:1 soil/water ratio) of the substrates were checked and adjusted to 7.1 + 0.1, and then, the substrates were placed in a 500 mL plastic pot. One healthy plant were allowed to grow for 25 days in the greenhouse. Fortnightly, a half - strength Hoagland solution was applied. At the end of the experiment, plants were harvested and oven - dried for 3 d at 50 - 55 °C. Plant biomass was determinate and the dried plant material was then ground to a powder with mortar and pestle.

At harvest, plant samples were digested using a microwave in 5 mL of concentrated HNO3. After digestion the solution were cooled and diluted to 50 ml using ultra - pure water. Arsenic concentration was determined on a graphite furnace atomic absorption spectrophotometer using USEPA Method 7060A. Phosphorous concentrations in solution were measured according Sarruge and Haag (1974), and K, Ca, Mg, Fe, Mn, Cu, Zn, B, and Mo concentrations on a flame atomic absorption spectrometry. Results were expressed as means of four replicates. The data were statistically analyzed with analysis of variance using the SAS program (SAS Institute Ins., 1996).

RESULTADOS

At harvest, we verified phytotoxic symptoms thickening and blackening of roots. Biomass production of A. peregrina decrease as As addition increased. The biomass of 10 mg As kg - 1 from was 38% of the control. At 50 and 100 mg As Kg - 1 biomass reduction was greater, being 31% of the control. No As concentration was verified in the roots and shoots of 0 mg kg - 1 treatment plants. Regardless of the treatment, under present of the metalloid, As - concentration of root (201.33 to 676.11 g g - 1 DW) was greater than shoots (87,23 to 255,22 g g - 1 DW). Root (62.01 to 37.64 g g - 1 DW) and shoot (158.43 to 96.24 g g - 1 DW) P concentration decrease as As addition increases.. Root P concentration had a positive correlation with the root As concentration of the higher As level (r = 0.973**). At 10 mg As kg - 1, root P concentration had a negative correlation with the shoot As concentration (r = - 0.995**), however, at 50 and 100 mg As kg - 1, this correlation was positive (r = 0.992* and 0.954*). Arsenic supply increased K concentration in the roots (10.80 to 37.98 g g - 1 DW) and shoots (12.14 to 22.14 g g - 1 DW) and was mainly concentrated on roots. At 10 mg As Kg - 1, we verified a negative correlation between root K and shoot As concentrations (r = - 0.899*). Unlike, at 50 mg As Kg - 1, there was a positive correlation between K and As root concentrations (r = 0.890*). Enhanced As uptake would result in an increase in plant K concentrations to balance excessive anions caused by As accumulation (Tu and Ma, 2005), and the As distribution between the tissues leads in the K distribution in A. peregrina plants. Calcium concentration in both roots (17.07 to 10.04 g g - 1 DW) and shoots (27.05 to 19.12 g g - 1 DW) decrease in the presence of As and was mainly concentrated on roots. The greatest amount of Ca founded on the roots may be explained due its relative immobility in plants. According to Tu and Ma (2005), the fact that As concentrations in the shoot increased while Ca concentration decreased may suggest that Ca had a limited role in the defense of plant against As toxicity. Like Ca, Mg concentration in both roots (6.25 to 3.99 g g - 1 DW) and shoots (7.13 to 3.47 g g - 1 DW) decreased in the presence of As. Arsenic did not influence (P ¿ 0.05) the concentrations of micronutrients Cu, Zn, B and Mn. However, the concentrations of Fe decrease as As addition increase and had a significant negative correlation with As rates (r = - 0.896 to - 0.898 for roots and r = - 0.898 to - 0.954 for shoots).

CONCLUSÃO

The As in *A. peregrina* was predominantly accumulated in the roots and influences in uptake and distribution of some nutrients (P, Ca, Mg and Fe), probably due its phytotoxicity. Despite the decrease in some nutrient contents, *A. peregrina* showed ability to maintenance of normal concentration of nutrients even at high As - doses, which can be a important characteristic in the As - tolerance of this species.

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