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Phytoremediation Characteristics of Weeds and Mushrooms as a Metal Scavenger in Restoring Metal Contaminated Soil

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Abstract: The switch of polluted soils from heavy metals is the utmost challenging mission, predominantly on a huge scale. The soil is composed of organic and inorganic solid constituents, water and mixture of different gases present in various proportions. During prospective study about the accumulation of metals in plants; the enormous growth of weeds and mushrooms attract our attention to check these in comparison with growth of plant under investigation in the contaminated soil. It was established after checking the growth of plant under study that these weeds were supportive in growth regulation via accretion of metal leaving soil for growth of regular plant. It was observed that Myco-remediation competently collapse contaminants and heavy metals by directing them to the fruit bodies of mushrooms. It was related with capability of mushrooms to absorb the metal and act as a scavenger. The function was very clear after observing the growth of the plants under study and can easily be understood that fungal mycelia grip soil organized, aid in hold water and makes the nutrient accessible for vegetation. The mechanism of mushroom action to absorb the toxins via enzymes secretion into soil was developed. Their growth in contaminated environment opens new biological remediation techniques to secure the food chain even in presence of toxins. It was suggested on the basis of naturally grown spore of wild mushroom and weeds in metal contaminated environment; that it may be powerful tool in new emerging remediation technology at domestic and global hazardous waste management sites especially in developing countries, where toxins are in action and it's a dream of safe atmosphere for just health of concerns.

Key words: Metal, scavenger, weeds, mushroom, Myco-remediation

INTRODUCTION

The pollution due to unsafe discharge of heavy metal in the environment is a serious concern because they cannot be destroyed biologically but are only renovated from one oxidation state or complex formation to control their mobility. Therefore, heavy metal pollution poses a great potential threat to the environment and human health. The switch of polluted soils from heavy metals is the utmost challenging mission, predominantly on a huge scale (Sanghamitra *et al*., 2011). The soil is composed of organic and inorganic solid constituents, water and mixture of different gases present in various proportions. The mineral components fluctuate permitting to source tools on which the soil had been established under a precise set of environmental situations. Therefore, soils vary enormously in physical, chemical and biological properties with varying geochemical reactions (Tsujikawa *et al*., 2003). Soil structure and texture; are the physical properties which control the water movement as soil moisture that has extreme attitude in regulatory of solute movement, salt solubility, chemical reactions and microbiological activities and finally the bioavailability of the metal ions (Lasat, 2000; Zhou and Kiff, 1991). A successful phytoremediation program, therefore, must be taken into consideration for variations in soil properties of the specific site. Different approaches have been used or developed to mitigate/reclaim the heavy metal (Lone *et al*., 2008). Wei *et al*. (2004) reported the phyto- remediated ability of 45 species of weeds in situ to accumulate Cd, Pb, Cu and Zn combined pollution. The use of plant species for remediation of metal in a soil include hyper accruing characteristic to accumulate one or more metals (Costa and Leite, 1991).

This article discuss the soil restoration through growth of mushroom and weeds as a metal scavenger in metal mediated environment in relation with new emerging natural bioremediation technologies in cleaning up of

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contaminated environment. The article will highlights the action of weeds and mushrooms in renovating the soil for healthy and safe growth of cops for human food chain.

MATERIAL AND METHODS

The pot culture experiments for growth of spinach were launched for monitoring the growth rate and photochemical and photo biological reaction in plants; conducted in a soil treated with Copper sulphate and Lead nitrate salt and for comparison with non-treated (control). The plants were watered in alternate days with tap water and solution of both salts. During observation of growth rate of spinach in artificially contaminated soil enormous growth of weeds were recorded without sowing its seeds while growth of mushrooms noted in Pb treated soil only.

RESULTS AND DISCUSSION

Upswing of plants under Pb and Cu contaminated environment display growth which was less when compared with regular plants but it was continuous like that of normal plant. The research covers natural growth of weeds and mushroom in Cu and Pb contaminated soil during spinach cultivation. Mushrooms growth was observed only in Pb treated soil while weeds were reported in both artificially contaminated soils.

Growth of mushroom spore in Pb contaminated soil: Natural biotechnology (Myco-remediation) was observed during spinach plant cultivation under Pb metal stress condition. The growth continuations of the spinach plants were related with weeds and wild mushroom growth in Pb treated soil (Fig. 1 and 2). It was established that growth of fungal spore into mushrooms was compassionate or remove poisons metals from the soil (Kroulek, 2008; Costa and Leite, 1991). It was accomplish by the natural growth of the wild mushrooms in Pb contaminated environment that nature support the growth of edible plants via directing or extracting contaminate through myco-remediation. This competently folds contaminants and absorb heavy metals by leading them

Fig. 1: Mushroom from Pb contaminated environment

Fig. 2: Detached mushroom from Pb contaminated environment

to the fruit bodies of mushrooms. The fungal function of extracting heavy metal from soil or disassembling molecules or breaking down hydrocarbon bonds of the toxins was pragmatic in this study. It was related with capability of mushrooms to restore the soil for running cultivation of edible species through converting them into less lethal chemicals or complexes (Costa and Leite, 1991). It was very clear after observing the growth of the plants under study and spore growth can easily be understood that fungal mycelia grip soil organized, aid in hold water and makes the nutrient accessible for vegetation. The mechanism of mushroom action to degrade the toxins via enzymes secretion into soil was already developed (Tsezos and Deutschmann, 1992). Their contribution in organic function of soil with natural ability to clean up the soil to absorb toxic metal and growth in polluted environment opens new biological remediation techniques to secure the food chain even in presence of toxins. It was suggested on the basis of naturally grown spore of mushroom in metal spoiled situation; that it may be powerful tool in new emerging remediation technology at local and global hazardous waste management sites especially in developing countries, where toxins are in action and it's a dream of safe atmosphere for just health of concerns. This study outcome suggested that the growth of wild mushroom involve in cleaning soil under study through chelates of fungus where it forms complex with the metal through degradation of available chemicals (Sanghamitra *et al*., 2011). The growth of mycelium in this research not only demonstrates about tainted location that was favorable in their growth, also shares with us the power to modify our lethal locations into once again flourishing, strong, profuse ecosystems (Tsujikawa *et al*., 2003). The normal growth of the plant in metal contaminated environment in presence of mushroom recommended that mycoremediation offerings a kind of economical and supportable solution that farmers can instantaneously apply in their own field with nominal effort without waiting and cooperation of any agency and administration.

Weeds as a metal scavenger in Cu and Pb environment: The growth of weed species in this investigation appeared to be a good choice for decreasing metal concentration in soil and liable for reducing accumulation in plant under study (Fig. 3 and 4). These weeds were hardy, tolerant class, easily grow in most severe situations above massive areas and give a good support to the growth of desired plant (Zhou and Kiff, 1991). The growing ability of the weeds plant in contaminated environment showed that it accumulate unusually large masses of the toxins from the soil into the above ground biomass and referred as hyper accumulator help in restoring the soil for normal growth of test species (Lone *et al*., 2008). The most popular characteristics of weeds were earlier reported in the literature likeacceleration in crop production and handling charges, lessen product/crop worth, availability of water and nutrients essential for crop production, an substituted hosts for creatures and viruses, Upsurge animal production costs and product quality, decline terrestrial standards, disturb human and animal health like allergies and poisonings, decrease wildlife habitat, increase soil erosion by wind and water, decrease water quality and damage watersheds and systems, decrease recreational opportunities, Shift intrinsic, susceptible and vanishing species (both plant, animal, insects), increase

Fig. 3: Weeds growth with spinach plants in Cu contaminated environment

Fig. 4: Weeds growth with spinach plants in Pb contaminated environment

expenditures for carrying due to control and asphalt damage, increase fire danger, increase costs at industrial and utility sites (costs to control weeds) (Tsezos and Deutschmann, 1992). Certain weeds are reduced the noxiousness of heavy metals from the crop plants as observed in this investigation. The consequences of weeds grownup, found in polluted soil indicate that weeds act as soil indicator and not always completely bad. The presence of these weeds is often an indication of problems in the growing environment. Weeds offers intimations to the type of environment and management problems that commonly occur under certain conditions (Wei *et al*., 2004).

CONCLUSION

It was concluded that the natural growth of mushrooms and weeds were supportive for soil restoration and it is recommended that these should not be detached from the soil for safety of food chain.

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