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In vitro Studies on Effect of Chromium on *Lantana camara*

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ABSTRACT

Environmental pollution is an extremely important issue today, affecting all of us in one way or the other. Due to rapid increase in human population and industrialization, the demand for natural raw materials and source of energy are increasing day by day in developing as well as underdeveloped countries, the industrial effluents are released directly or indirectly into natural water resources, mostly without proper treatment, thus posing a serious threat to the environment. The aim of our research was to identify some interesting accumulators which may associate an important biomass production with an effective absorption and translocation of heavy metals. The present study is focused on the ability of *Lantana camara* to accumulate and tolerate high concentrations of heavy metal Chromium which is associated in polluted areas.

Key words: Heavy Metals, Chromium, Pollution, Biomass, Environment, Energy.

1. INTRODUCTION

The chromium discharged mainly from the industries such as alloy manufacturing, dyes and pigments, metal finishing, petroleum refining, electroplating, wood preservation factories and leather tanning (Aleves *et al.*, 1993; Mishra and Doble, 2008). In soil, the most stable oxidation states of chromium are Cr (III) and Cr (VI). It may be carcinogenic and mutagenic even at low concentrations, (Chidambaram *et al.*, 2009). Land application of tannery waste as organic fertilizer has led to extensive Cr contamination of agricultural areas (Lakshmi and Sundaramoorthy, 2001). It has also been reported that even the lower concentrations of chromium showed inhibitory effect on plant growth (Sundaramoorthy *et al.*, 2006).

To overcome the industrial contamination of soil by heavy metals, there are some conventional methods but these different conventional methods like physical and chemical methods have severe restrictions like high cost, intensive labor, and change in soil properties and disturbance of soil native micro flora. In spite of this, phytoremediation is a better solution to the problem (Ali H, Khan E, Sajad MA, 2013). Introduction of invasive species for phytoremediation purposes in Bhopal may affect the local biodiversity. Therefore, identification and selection of locally available plant species for phytoremediation research and implementation is one of the challenges that need to be met and a pre-requisite for successful phytoremediation research.

Lantana camara is a native plant of tropical Americas as well as West Africa. It has great phytoremediational importance. Lantana is commonly known as cariaquillo, filigrana, mille fleurs, sauge, red sage, yellow sage, prickly sage, and lakana. Lantana is an aromatic shrub with quadrangular stems, with prickles. This shrub may be suberect, scrambling, or occasionally clambering (Howard 1989, Liogier 1995).

Lantana camara is generally known as notorious weed. Indian region have been invaded by several exotic plants of which *Lantana camara* is of more concern, because of its rapid spread, intensity of infestation, and resistance to cutting and burning. Lantana is a native of tropical America, and was introduced to India as an ornamental to be planted in gardens and hedges. Since then, the species has spread rapidly into both farm and forest lands, and is one of the most widespread, terrestrial invasive species in India today. Lantana biomass has potential for utilization as organic manure, has antimicrobial, insecticidal and medicinal properties also.

Phytoremediation of different types of contaminants requires different general plant characteristics for optimum effectiveness Careful selection of plant and plant variety is critical, first, to ensure that the plant is appropriate for the climatic and soil conditions at the site, and second, for effectiveness of the phytoremediation of the pollutant at hand. There were number of studies have demonstrated that plant tissue cultures are an extremely valuable tools in phytoremediational research till now. Tissue culture is a powerful tool that gives the possibility to grow millions of cells under in vitro conditions, and to understand physiological information about the behavior of the plant cells under stress conditions. Plant tissue culture and molecular genetics have opened new avenues in plant improvement. Screening and selection at the plant cell level has established plant clones with increased tolerance or resistance in salt, heat, cold, drought, disease, insects, heavy metals and herbicides.The uptake efficiency of the plant depends on soil type, plant species and conditions. Phytoremediation has gained popularity with government agencies and industry in the past 10 years. This popularity is based in part on the relatively low cost of phytoremediation.

2. METHODOLOGY

The in-vitro cultured plants tested for heavy metal tolerance and accumulation. This will be achieved by increasing the heavy metal concentration in media. The specific toxic effect on plants will also be studied. The growth parameters are optimized for better growth and resistance to heavy metals.

For studying the effect of Chromium on *in vitro* culture of *Lantana camara,* firstly plantlets were established on basal M. S. medium in controlled conditions. Then plantlets established on control were transferred on different concentrations of Chromium contaminated medium for growth (Waoo AA et al 2014). The primary objective of this study is to assess the effects of Chromium on developing cultures of *Lantana camarain vitro*.

After 20- 25 days of incubation the initiated plants were taken out the culture bottle with a clean and sterilized forceps in the laminar flow hood also the medium adhered to the plants was removed, broken or brownish leaves were excised from the plants and then they were taken to the culture bottles containing autoclaved semi-solid media supplemented with individual heavy metal of varying concentrations for screening the effect of heavy metals on *in vitro* plantlets.

Then the bottles were incubated in the culture room under the standard conditions of temperature like (25± 2°C) for 16/8 hrs of day/night break under the cool white light of average 2500 lux intensity. The culture medium was agar gelled M. S. basal medium supplemented with 2 % sucrose (w/v). The pH of the media was adjusted to 5.8 prior to autoclaving. Stock solution (100 mM) of Chromium Sulphate ($CrSO_4$), were prepared and filter sterilized. Suitable aliquots of filter sterilized solution of Chromium were added aseptically to attain final concentrations of 0.5,1.0,3.0,5.0,10,15,20,25,30,35,40,45,50 mg/l metal.

The in-vitro cultured plants tested for heavy metal tolerance and accumulation. This is will be achieved by increasing the heavy metal concentration in media. The specific toxic effect on plants will also be studied. The growth parameters are optimized for better growth and accumulation of heavy metals heavy metals. In screening experiments, total stem length was measured of surviving plantlets. Survival and mortality rate of plants were calculated by rating the plants grown in contaminated medium in comparison to individual metal and standard medium. The results are the mean of three repeats.

3. OBSERVATIONSAND RESULTS

Analysis of Chromium accumulator or tolerant plantlets was performed on M. S. medium supplemented with 0.5 BAP, NAA and Kinetin and the addition of Chromium at concentrations 0.5-50 mg/l. this have created the exposure of cultures to a selection pressure by toxic metal for several months to increase the accumulation capacity during *in vitro* cultivation. The cultures were formed and grown on a medium with increasing concentrations of Chromium, whereas such quantity was already lethal for the tissue cultures. The increased external Cr concentration considerably decreased the shoot length and percentage of survival.

As the heavy metal concentration increases growth of Lantana reduces. On the other side, accumulation capability culture has shown the survival up to 35 mg/l Cr in culture medium showing its phytoremediation potential. Upon increasing the concentrations of Cr in medium, the percentage survival rate was decreased in the culture. Shoot length was also affected by higher concentrations of Cr in the medium. The proportion of growth in shoot length was decreased at the higher concentration of Cr in the medium as shown in Fig 1. Number of shoots was decreased due to necrosis and browning during sub culturing in varying concentrations.

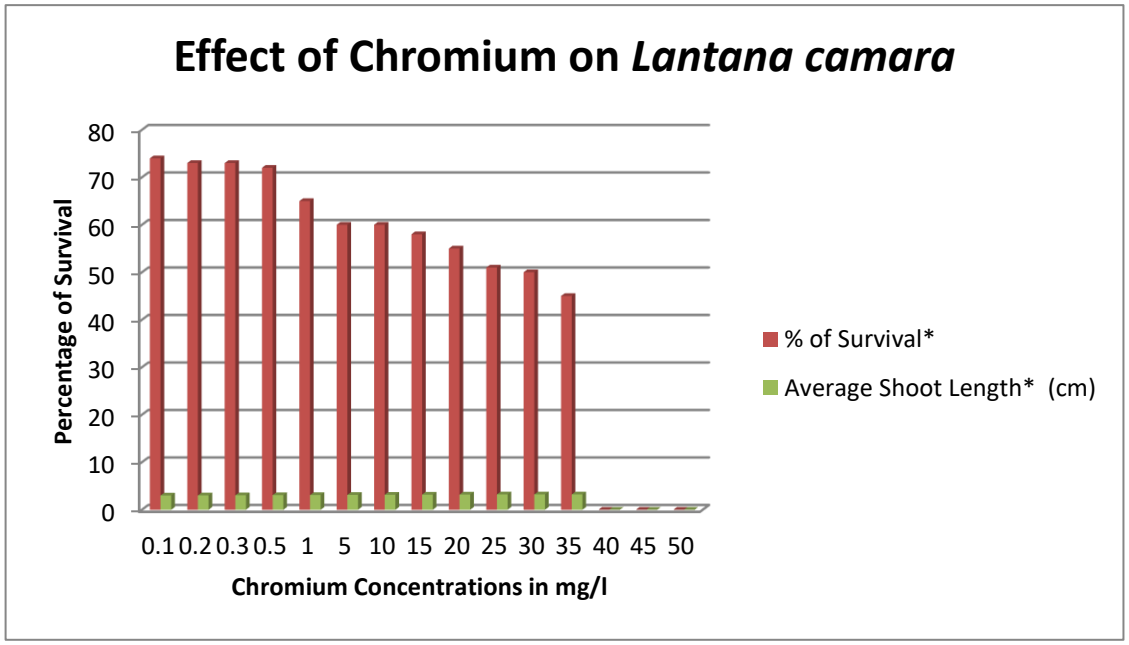

Figure 1
Effect of Different Concentrations of Chromium on % Survival of Lantana camara

Figure 2
In vitro plantlets of *Lantana camara* showing Effect of Chromium on

4. CONCLUSION

Phytoremediation is still in its research and development phase, with many technical issues needing to be addressed. The results, though encouraging, suggest that further development is needed. The government agencies in India are not coming forward for application on a large scale unlike United States, Europe, and Australia, although there is much interest in universities and research institutes in India. By using the plants like Lantana camara, phytoremediation of industrially polluted sites can be done. There were number of studies have demonstrated that plant tissue cultures are an extremely valuable tool in phytoremediational research till now. Thus this research opens up new avenues with reference to *Lantana camara as a* phytoremediationally important plant. Emerging phytoremediation companies must have two things in common. They will be all founded by university scientists after an extensive research and their norms should be compulsory for each pollutant producing company. Each company doing phytoremediation work has developing expertise in a specific contaminants or plant mechanism. For marketing their services they most rely on partnerships with environmental engineering and consulting firms.

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