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Biochemical Study of *Andrographis paniculata* under the stress of Cadmium

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ABSTRACT

Medicinal herbs contamination due to heavy metals can be attributed to pollute environment by metal dyeing, smelter, electroplating and other industries. Herbs are subjected to a range of abiotic stresses, such as drought, heat, alkalinity, heavy metals, temperature and pathogen infection, all of which cause devastating impact on plant growth and crop production. 5th for Chordates and 4th for vascular plants Cadmium is most toxic metal.With inhibiting pollen germination and tube growth Cd may have opposite effect in the process of reproduction of plants. The toxic effects of Cd on living system and its reports have already carried out by a number of authors. The main aim of this paper is that to provide the major effects of Cd *i.e.* toxicity are oxidative stress mediated by increased level of reactive oxygen species (ROS) but in contrast with other heavy metals.

Figure : 00 References : 10 Table : 00
KEY WORDS : *Andrographis paniculata*, Biochemical, Cadmium, ROS, Stress

Introduction

As we know that naturally occurring soil contains a variety of heavy metals. Now a days different manmade activities affect the concentration level of the heavy metals present in the soil. The imbalance of the concentration of heavy metals may affect the life process of plants and animals. Herbs which are contaminated may be toxic and produce undesirable side effects[10]. To avoid unwanted contamination of soil we must have quality medicinal herbs[9]. Due to nutritional values, traces of heavy metals are required in our daily life. Heavy metals are those which have a specific gravity more than 5mg/dm. Fe, Cr, Cu, Zn, Co, Mn and Ni are the essential elements or metals. They play a vital role in our biological systems, whereas Hg, Pb, and Cd are the non-essential elements. The non-essential metals may be toxic even in very little amounts[2]. Pb, Cd, Cr, and As are mainly responsible for the contamination of environment[1].

Metal dyeing, smelter, electroplating and other industries are mainly responsible for contamination of medicinal herbs. These may be harmful for our health that is already investigated and limited[3].

Salinity of the Soil is the main factor that is responsible for the growth of plants and their good yield has received indication from a number of agriculturists worldwide. Around 6% of total earth *i.e.* greater than 800 million hectares of the total earth's surface is affected by salinity[5]. There are two types of salinity known on the basis of salinity produced, one is primary and other is secondary salinity. Improper irrigation and dry land is the main factor responsible for the secondary salinity.

5th for Chordates and 4th for vascular plants Cadmium is most toxic metal.With inhibiting pollen germination and tube growth, Cd may have opposite effect in the process of reproduction of plants. The toxic effects of Cd on living system and its reports have already carried out by a number of authors. Toxicity is oxidative stress mediated by increased level of reactive oxygen species (ROS) but in contrast with other heavy metals.

The toxic effects of Cd can be easily identified in the plants with the help of general symptoms like stunting growth, clorosis and alternation of anatomical, physical appearance and their physical and biological characters of leaves, stem and roots. The evidence of Cd induced oxidative stress takes place due to lipid peroxidation, degradation of chlorophyll and activity of stimulation and inhibition of the enzymes like SOD,GR,DHAR,CAT,APX and gujacol peroxidase.

Regular increase in the concentration of heavy metals increase the adverse effect on all the living organisms. There are many techniques have been developed to remediate effected soil. These remediation are costly and are not ecofreindly, hence its use is not so common while it must be kept in mind that the remediation techniques should be cheap *i.e.* in the range of general farmers and useful for the society and safe for human health by utilization of potential of plant species[6]. Plants can be used to remediation to remove

heavy metal concentration by dumping it at another site where Cd can be extracted from harvested materials[8].

Acanthaceae *i.e. Andrographis paniculata* is nowadays a menacing global problem, results to loss in agricultural yield and it may be harmful to the health issues when take enter in the food chain[7].

Due to excess production of toxic ROS like superoxide ion, H_2O_2 and OH radicals oxidative stress takes place.

Materials and Methods

From the beginning of civilization Medicinal plants always play a vital role in human life. Around the world there are millions of plants are identified as medicinal plants as ethno-medicinal plants. These plants and their derivatives are videly used as a best alternative sources of suitable drugs. The experimental medicinal plant is *Andrographis paniculata.*

Family Acanthaceae known as green chiretta (Kalmegh). This plant is common, annual, herbaceous from India and Sri Lanka. This is also famous as a plant of King of Bitter.

Southern and South eastern Asia are the popular area for its cultivation. Used for treatment of some bacterial diseases in tropical and sub-tropical regions of Asian countries. In plains, hillsides, coastlines, it is very common. South India and Sri Lanka are the native places of *A. paniculata i.e.* the center of origin and diversity of the species.

Observation

A. paniculata is a medium sized plant ranging from 30 cm to 110 cm grows as an erect herb in moist, shady places. The stem of plant have dark green colour, square in cross-section with longitudinal furrows and wings along the angles. The leaves are hairless, lance-shaped blades having size 8cm long and 2.0 cm wide. Flowers are pink in colour, solitary, arranged in lax spreading racemes. Fruit *i.e.* a capsule having size 2.0 cm. lenth and have few mm of width. Fruits contain a number of yellow-brown seeds *i.e.* sub quadrate, rugose and glabrous. September to December of the year is the best time for the vernalization.

Scientific classification

Kingdom	-	Plantae
Order	-	Lamiales
Family	-	Acanthaceae
Genus	-	*Andrographis*
Species	-	*paniculata*

Sunny location is not a suitable environment for *Andrographis paniculata.* June is the best month or time for the sowing the seeds in the northern hemisphere. The seedlings are transplanted at a distance of 60.0 cm. x 30.00 cm. This plant is very useful in the view of medicine like Siddha and Ayurvedic medicine. It is also promoted as a dietary supplement for prevention and cure against some diseases. For the curing Cancer there is no prompt proof that it helps in curing cancer.

A bicyclic diterpenoid lactone *i.e.* Andrographolide is extracted from the leaves of *Andrographis paniculata* that is a crucial constituent. Biochemical process was carried out and extracted some well known constituents as-

- 14- Deoxy-11-dehydroandrographolide, Plant.
- 14-Deoxy-11-oxoandrographolide, Plant.
- 5-Hydroxy-7,8,2',33-tetramethoxyflavone, Plant.
- 5-Hydroxy-7,8,2'-Trimethoxyflavone, Tissue Culture.
- Andrographine, Root.
- Andrographolide, Plant.
- Neoandrographolide, Plant.
- Panicoline, Root.
- Paniculide-A, Plant.
- Paniculide-B, Plant.
- Paniculide-C, Plant.

Treatment Conditions

In normal natural conditions the plants were grown. Two weeks plants were treated with NaCl solution (200mM) and other plants were treated with $CdCl_2$(100mM) solution. A few of the plants were used for control. Samples of plants collected after 10 days of NaCl and $CdCl_2$ treatment for measuring actuions of enzymatic antioxidant and contents of non-enzymatic antioxidants.

Add 10 ml. of conc. HNO_3 to 1.000 g on samples of leaves, root and stem. Now samples were kept for whole night at room temp. Now samples were carried out treated for 4 hrs. at 120°C temp. after which the temp. was increased to 140°C. At this temperature the digestion was continued till it remains 1.0 ml of acid. Cooled the suspension was filtered in a flask of 50.0 ml and diluted it to the mark. Hence the samples each of leaf, root and stem of the plants were prepared. Using Flame Atomic Absorption Spectrometry, samples having an unknown amount of Cd were carried out to measure under the optimum operating conditions with an Air Acetylene flame.

Results and Discussion

In the samples of root, stem and leaves of

Andrographis paniculata, Cd was reported in the homogenized leaves but absent in samples of root and stems. Determination was based on atomic absorption spectrophotometry. On the basis of present study it was revealed that Cd was accumulated to greater or lesser extents by the leaf extract.

The concentration of Cd in taken sample of leaf was found 0.46 mg/kg. When the presence of Cd in soil is dangerous to the plants and the animals depend on these plants for their survival. Cd can accumulate in their bodies, specially when they take various plants as their food[4].

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