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EFFECT OF HEAVY METALS AS ENVIRONMENTAL STRESS ON SOME LEAFY VEGETABLES

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ABSTRACT

Under present investigation effect of Arsenic (As), Chromium (Cr), Lead (Pb), Mercury (Hg) and Selenium (Se) was observed on *Coriandrum sativum* and *Spinacea oleracea.* From the qualitative morphological studies it was observed that *Coriandrum sativum* could survive the most, the toxic effects of the concentration doses of test heavy metals given.

KEYWORDS: *Coriandrum sativum, Spinacea oleracea.*

The heavy metals keep accumulating in our food items through various kinds of pollution and because of this when they reach the end of food chain ie. in human body; appears in the form of various ailments. These may vary from simple allergies to severe neurological disorders.

The present study is to see the accumulation level and sites of deposition of Arsenic (As), Chromium (Cr), Lead (Pb), Mercury (Hg) and Selenium (Se) in *Coriandrum sativum* L. and *Spinacea oleracea* L.; the most commonly used green leafy vegetables. During the preliminary studies the effect of heavy metals is observed as morphological disparity in test plants in comparison to the control. This is then taken into account for further studies of heavy metals to achieve concise results.

MATERIALS AND METHODS

The test plants are grown in polythene bags having approximately four kgs. of soil. The seeds of the test plants are sown and doses of known concentrations of HMs are given to five replicates per set of experiment; as per the research design.

The techniques used for detection of HM concentrations in test plants are taken from the Standard Methods, published by American Public Health Association (APHA, 21st edition).

The chemicals, reagents used are of AR grade. Borosilicate glassware is used for performing different tests.

Qualitative morphological observations were made to see the effect of HMs on test plants, which included overall growth and development of the plants. For reporting the sites of accumulation of HMs, sample drying in oven is followed by acid digestion (HNO_3: H_2SO_4:: 2:1). These pretreated samples are then proceeded for spectrophotometric studies.

A Systronic made spectrophotometer was used for concentration analysis studies.

RESULTS AND DISCUSSION

HM doses were given to test plants after 20- 25 days of sowing seeds. The concentrations given were of 20, 30, 40 and 50 ppms of test HMs. Qualitative morphological observations were made every 10 days after treatment. The observations were as mentioned in the table.

From the above observations of Selenium and Mercury, samples were collected from their test plants and after acid digestion spectrophotometric readings showed no accumulation of above HMs in their above ground as well as underground parts. Though leafy vegetables such as *Amaranthus hybridus*, *Amaranthus sp.*, *Cucurbita maxima*, *Ipomoea batatas*, *Solanum villosum*, *Solanum scabrum*, and *Vigna unguiculata* were explored for their capabilities to accumulate selenium by Petro et al., 2015.

Lead was seen to affect the test plants even at lower (20 -30 ppm) concentrations and more damage signs were seen over the prolonged time period, after the treatment of the doses. Lead is non-essential toxic element which causes carcinogenic effects in human, even at very low concentrations (Nazar et al., 2012). Domergue and Vedy (1992) reported that, when Pb is absorbed from the soil by crops, it remains mainly in the root area as it cannot effectively go through the endodermis of roots.

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Leaves, however, can absorb vast quantities of Pb from the atmosphere. Hence, GLV have the capability to accumulate Pb from the soil as well as from the atmosphere through their leaves. Lead has been reported as a severe cumulative body toxin which enters the body through food, air and water and cannot be eliminated by washing the vegetables (Abbas et al.,2010 and Zamor et al., 2012).

Table 1: Qualitative morphological effects of Test Heavy Metals on Test Plants over different incubation periods.

HMs	Concn. Doses of HMs	*Coriandrum sativum* L.			*Spinacea oleracea* L.		
		10 DAT	20 DAT	30 DAT	10 DAT	20 DAT	30 DAT
Lead (Pb)	20 and 30 ppm.	No change from control	No change	Wilting occurred	No change	Wilting occurred	
	40 and 50 ppm.	No change	Slight stunted growth	Plants seemed unhealthy	Yellowing of leaves along with smaller size	Stunted growth along with wilting	Plants looked weak and wilted
Arsenic (As)	20 and 30 ppm.	No change	No change	No change	No change	No change	Wilted plants
	40 and 50 ppm.	No change	No change	Yellowing of leaves	No change	Yellowing of leaves with wilting and stunted growth	
Chromium (Cr)	20 and 30 ppm.	Normal growth as of control			Normal growth as of control		
	40 and 50 ppm.	No change	No change	Flowering occurred later than control	No change	Yellowing of leaves and stunted growth	Growth is highly diminished
Mercury (Hg)	20,30,40 and 50 ppm	No changes from the control			No changes from the control		
Selenium (Se)	20,30,40 and 50 ppm	No changes from the control			No changes from the control		

From the qualitative morphological effects of arsenic and chromium on *Coriandrum sativum* and *Spinacea oleracea* arsenic caused more damage to test plants than chromium and *Coriandrum sativum* could resist more to environmental stress due to heavy metal presence than *Spinacea oleracea.*

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