Evaluating Genotoxic Potential of Chromium on *Pisum sativum*

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ABSTRACT: Heavy metal presence in soil is increasing due to anthropogenic activity lead to undesirable genotoxic effect on plants. The purpose of present investigation was to analyze genotoxic potential of chromium on *pisum sativum* root meristematic cell. Three concentration of chromium 10, 40, 80 ppm were used in the investigation. It was analyzed that with the increase in concentration mitotic index decrease. Control show highest 27 percent mitotic index and chromium 80 ppm show lowest mitotic index 8 percent. It reduce germination percentage by 50% at highest concentration. Chromium induce considerable amount of chromosomal aberration including, stickiness, legards, clumping, bridge, asynchronous division .chromosomal disintegration and loops .stickiness is induced in every stage of cell division.

KEYWORDS: Chromium, Chromosomal aberration, Genotoxicity, Heavy metal

In this era of industrialization and urbanization heavy metal contamination in air, water and soil is a major problem causing environmental hazard worldwide heavy metal pollutant are stable in the environment but highly toxic to biological organism (Chander *et al.* 2001; Zou *et al.* 2006; Leuent *et al.* 2009), chromium disrupt several physiological and cytological process in cell.

According to Shankar *et al.* (2005), effect of chromium leads to reduced root growth and seed germination. Chromium induce various chromosomal abnormalities in plant cells thereby severally reducing mitotic index and root growth (Dorunfemi *et al.* 2010). Chromium interfere with several metabolic process cause toxicity to plant exhibited by reduced seed germination or early seedling development (Sharma *et al.* 1995). Source of chromium are mining, pigment manufacturing, petroleum refining, leather industry, textile industry etc. Analysis of chromosomal alterations is an effective method for observing genotoxic potential of substance. The aim of present study was to analyze the genotoxic potential of chromium and lead on *Pisum sativum* meristematic root cells.

MATERIALS AND METHODS

Seeds of *Pisum sativum* were subjected for sterilization by using 2% mercuric chloride for 2 min after that seeds were rinsed with distill water. Sodium di chromate at 10, 40 and 80 ppm concentrations were used. Seeds were soaked in these concentration for 12 hrs. while seeds for control set were soaked in the distilled water there after three replicate of each concentration with ten seeds were allowed to germinate in a petridish lined with watman's filter paper till the root length reaches 3 to 4 mm length. Roots were cut and fix in ethanol : acetic acid (3:1) for 24 hrs there after roots were placed in 1 N HCL for 2 min then, washed with the distilled water and dried it on filter paper transferred the roots into 2% acetocarmine solution for 10 min. Stained

root tips were transferred to slide for squash preparation and cytological observation.

Statistical analysis Statistical analysis of data was perform by analysis of variance (ANOVA) using SPSS 16.0. The dunnet t multiple range test was also employed to determine the statistical significance among the mean using significant variation $P < 0.05$.

RESULTS

Genotoxic effect of chromium and lead is significantly showing in different concentrations cause constant decrease in mitotic index 19%, 12%, 8% respectively and control shows highest mitotic index 27 % (Fig.1). Chromium induce constant decrease in germination percentage 80%, 70%, 50%, respectively on forth day of germination while control show 100% germination. shown in Fig.2. Control show no aberrant cell division while treated sets show large number of chromosomal aberration shown in Table 1. Aberration appear during the study include stickiness, bridge, legard, clumping, fragment, c-mitosis shown in Fig.3. Chromosome disintegration n loop formation were induced on highest concentration. Stickiness is prominent in every stage of mitosis.

DISCUSSION

Result clearly elaborated that the chromium produce remarkable amount of genotoxicity. Mitotic index is an acceptable measure of cytotoxicity for all living organism (Smaka-kinel *et al.* 1996). The lowering of mitotic index with increase in concentration support the previous studies. Heavy metal induce considerable range of, legards, bridge, anaphasic bridge formed were probably due to unequal exchange of dicentric chromosome. C-mitosis is one of the consequences of inactivation of spindle apparatus connected with delay in division of centromere (Mann 1997). In the present study stickiness and clumping are

Fig. 1. Effect of chromium on mitotic index of *Pisum sativum*.

Fig. 2. Effect of chromium on germination percentage.

prominent in every stage. Compare to c-mitosis and chromosome bridge stickiness is more serious disturbance in cytology (Zheng *et al.* 2009) stickiness was also reported by various author during their study of environmental factor. Chromosome stickiness is characterized by chromosomal clustering at any phase of cell cycle.

It was concluded from the present investigation that chromium was genotoxic for *Pisum sativum* and it enhance the number of chromosomal aberration and most important it reduce the germination percentage which directly affect the yield.

Fig. 3. Showing mitotic plates.

A to C: Showing normal anaphase, metaphase and telophase, D: Anaphase bridge, E: Sticky anaphase with fragment, F: Asynchronous anaphase, G: Metaphase with fragment, H: Clumping, I: Loop formation, J: Telophase with lagards, K: Chromosome disintegration, L: C-mitosis. Scale bar = 10 μ m.

Table 1. Mitotic aberration induced by chromium treatment in *Pisum sativum*

Conc. (ppm)	St	Lg	Cd	Cm	Mitotic aberrations (Mean±SE)		Ud	Fr	Br
					Clu	Lp			
Control	-	-	-	-	-	-	-	-	-
10	.666 ± .66	-	-	-	.333±.33	-	-	-	-
40	2.0±0	.666±.33	-	1.33±.33	2.0±.57	-	2.33 ± .30	1.33±.33	333±.33
80	2.66±.33	2.33±.88	.666±.33	1.0±0	1.33±.33	.333±.33	1.66±.66	1.0±0	1.0±.57

Conc: concentration of chromium, St: stickiness, Lg: legard, Cd: chromosomal disintegration, Cm: c- mitosis, Clu: clumping, Lp: loop, Ud: asynchronous division, Fr: fragment, Br: bridge

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