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IMPACT OF Pb AND Cd ON ORGANIC FACTORS OF GERMINATED SEEDLINGS OF CHICKPEA PLANT

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ABSTRACT

Cicer arietinum L. is the third most vital within the world when dry beans and dry peas seeds of chickpea square are used to measure valuable supply of macromolecule. It is conjointly a crucial supply of carbohydrates, B-group vitamins, and bound minerals, notably to the population of developing nations. It is principally consumed as bush, whole seeds, and numerous other styles of ancient, fermented, deep fried, sweetened, and puffed product. The current study was aimed to evaluate the biochemical parameters in *Cicer arietinum* L. seedlings grown under Lead and Cadmium stress. It was found that there was a significant reduction in the biochemical parameters when a stress treatment (heavy metals) was applied to seedling. The protein content, amount of crude fiber, and the total carbohydrate concentration in Radhey variety of *Cicer arietinum* L. have been shown an elevation tendency on days (7th, 14th and 21st), however, a remarkable decline was obtained when seedlings were subjected to heavy metal (Pb and Cd) stress treatments. In contrast, a remarkable decline in moisture content in Radhey variety of *Cicer arietinum* L. was observed on days (7th, 14th and 21st), whereas a decrease when the moisture content was subjected to heavy metal stress treatments

Keywords: Heavy metals, Buffer Supernatant, Centrifugation, *Cicer arietinum* seedlings

Introduction

Chickpea (*Cicer arietinum* L.) is a vital pulse crop grown up and consumed everywhere around the globe; specially within the Afro-Asian countries (Bahl and Salimath, 1996; Jukanti *et al*., 2012). Serious metals square measure vital environ-mental pollutants, and their toxicity may be a drawback of skyrocketing significance for ecological, organic process, and environmental reasons. The term ''Heavy metals'' refers to any chemical element that contains a comparatively high density, and it is cyanogenic or toxic even at low concentration (Lenntech, 2004; Nagajyoti *et al.,* 2010). Serious metal contamination possesses fatal effects on plant productivity and threatens human and animal health. The presence of Lead within the atmosphere causes serious problems to plants and animals. It is become a serious environmental source following fast industry and urbanization. Lead is not among the essential parts of plants; however, they absorb this metal if was provided in the atmosphere, particularly in rural areas wherever the soil is impure by automotive exhaust and in fields contaminated with fertilizers that contain serious metals as impurities (Chavan *et al.,* 1986).

Aim of the Study

The study aims to evaluate the biochemical parameters in *Cicer arietinum* L. seedlings grown under Lead and Cadmium stress.

Materials and Methods

All treatment combinations were carried out on 7th, 14th and 21st days of seed germination (A.O.A.C. 2000). Table (1) shows the treatment combinations that were used to provide heavy metal stress.

I. $(Pb(NO_3)_2.4H_2O)$

II. $(Cd(NO_3)_2.4H_2O)$

About five hundred mg of the sample was weighed out and grinded well with a pestle and mortar and placed into 5-10 milliliter of the buffer. Centrifuged and Supernatant was used for macromolecule estimation. A customary graph was drawn, as well as the quantity of macromolecule within the sample was calculated. Heavy metal stress was obtained using treatment combinations as they are shown in table (1).

Table 1 : Treatment combinations that were used to provide heavy metal stress

S. No.	Treatments of $PbNO_3$	S. No.	Treatments of $CdNO_3$
(T1)	50 ppm	(T5)	50 ppm
(T2)	100 ppm	(T6)	100 ppm
(T3)	150 ppm	(T7)	150 ppm
(T4)	200 ppm	(T8)	200 ppm
(T0)	Control		

The crude fat and fiber were calculated using the following formula:

$$\text{Crude fat}(\%) = \frac{\text{Extracted fat}}{\text{Sample weight}} \times 100$$

OR $\frac{W2-W1}{W} x\ 100$

Where,

- W= Weight of flask
- W_1=Weight of sample
- W_2= Weight of flask + sample

$$\text{Crude Fiber}(\%) = \frac{\text{Digested sample}(W_1) - \text{Ashed sample}(W_2)}{\text{Weight of sample}} \times 100$$

Amount of total carbohydrate present in sample

$= W_1 \times V \times 100 / V_1 \times W$

Where,

W_1=sugar value from graph in mg.
W_2=weight of sample in 100mg.
V=total volume of extracts in ml.
V_2=Aliquot sample (0.5 or 1ml)

Moisture content in the Chickpea was determined by a gravimetric method.

$$\text{Moisture}(\%) = \frac{\text{Loss in weight}}{\text{Initial wt. of sample}}$$

OR

$$\frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where:

W_1 = Weight of the empty dish

W_2 = Weight of the dish and the sample before drying

W_3 = Weight of the dish and the sample after drying one unit of enzyme activity was taken as that amount of enzyme, which reduced the absorbance to 50 % in comparison with tubes lacking enzyme.

Results and Discussion

Days (7th, 14th and 21t) have been shown a significant elevation in protein content, however, a declining tendency was obtained when seedlings has been targeted to heavy metal (Pb and Ca) stress treatments. In this species of protein content, highest values at Pb 200 ppm (T4) and Cd 200 ppm (T8) were observed, while lowest values were obtained at Pb25 ppm (T1) and Cd 25 ppm (T5). Rahman *et al.* stated that (54.91 µg/g) of protein content was noted in in *Cicer arietinum* L (Rahman *et al.,* 2008). Table (2) shows the stress treatment of heavy metals on protein content in germinated seedlings of *Cicer arietinum* L

Table 2 : Impact of lead and cadmium stress on protein content in germinated seedlings of *Cicer arietinum* L.

Treatment code	7th Days	14the Days	21st Days
T0	60	63	70
T1	48	51	55
T_2	42	47	50
T_3	40	43	48
T_4	36	40	44
T_5	46	49	54
T6	40	44	49
T7	37	41	46
T_8	30	34	40
F- test			
S. Ed. (±)	0.638	0.626	0.651
C. D. (P =0.05)	1.317	1.292	1.343

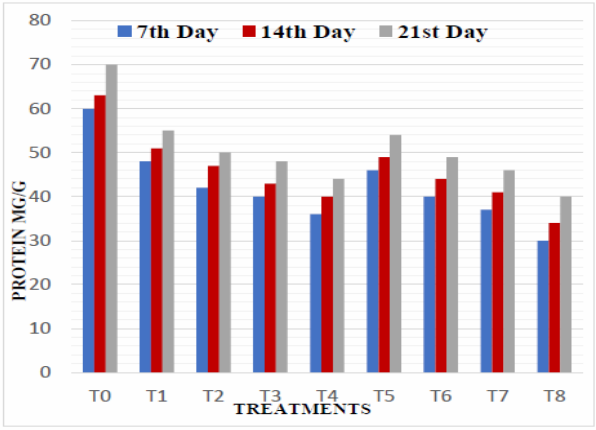

Fig. 1: Impact of lead and cadmium stress on protein content in germinated seedlings of *Cicer arietinum* L.

The amount of crude fiber in this Radhey variety of *Cicer arietinum* L. seeds was listed in table (3). An elevated tendency in the crude fiber was achieved on days (7th, 14th and 21st) while a decreasing tendency has been observed when seedlings were undergone to heavy metal stress treatments. In this species, crude fiber was scored lowest values at Cd 200 ppm (T8) and Pb 200 ppm (T4), whereas high values were acquired at Pb 25 ppm (T1) and Cd 25 ppm (T5). Anbreen *et al*. stated that 4.5 mg/100g crude fiber was obtained in *Cicer arietinum* L. (Anbreen *et al.,* 1999)

Table 3 : Impact of lead and cadmium stress on crude fiber in germinated seedlings of *Cicer arietinum* L

Treatment code	7th Days	14th Days	21st Days
T0	5.71	10.21	15.01
T1	5.68	10.14	14.51
T2	5.41	10.06	14.31
T3	5.15	09.94	14.11
T4	4.99	09.72	14.02
T5	6.01	10.15	14.98
T6	5.81	09.74	14.73
T7	5.54	9.55	14.57
T8	5.12	9.02	14.24
F- test			
S. Ed. (±)	0.239	0.273	0.303
C. D. (P = 0.05)	0.493	0.563	0.625

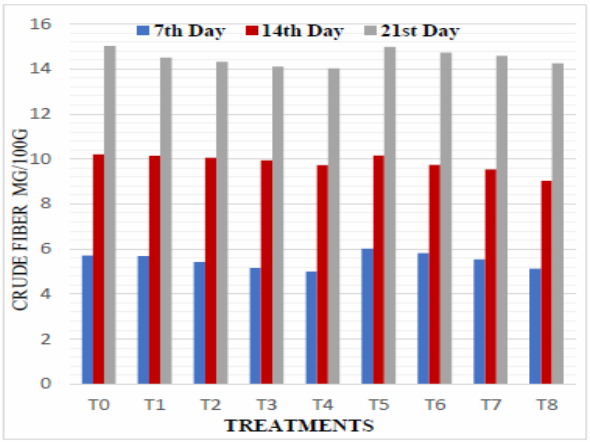

Fig. 2 : Impact of lead and cadmium stress on total crud fiber in germinated seedlings of *Cicer arietinum* L.

Table (4) shows the moisture content in this Radhey variety of *Cicer arietinum* L. There was a noticeable decline in the moisture content on (Days 7th, 14th and 21st) and when the moisture content was subjected to heavy metal stress treatments. In this species, moisture content has been recorded very low values at Cd 200 ppm (T8) and Pb 200 ppm (T4), while highest values were obtained at Pb 25 ppm (T1) and Cd 25 ppm (T5). About (9.30 %) of moisture content in *Cicer arietinum* L. was reported by Anbreen *et al*.

Table 4 : Impact of lead and cadmium stress on moister content in germinated seedlings of *Cicer arietinum* L

Treatment Code	7th Days	14th Days	21st Days
T0	11.01	8.87	6.74
T1	10.06	8.24	6.01
T2	10.01	8.13	5.79
T3	9.97	8.01	5.74
T4	9.80	7.95	5.60
T5	10.04	8.45	6.21
T6	10.00	8.04	6.04
T7	9.85	7.97	5.88
T8	9.74	7.45	5.74
F- test			
S. Ed. (±)	**0.270**	**0.306**	**0.284**
C. D. (P = 0.05)	**0.558**	**0.631**	**0.586**

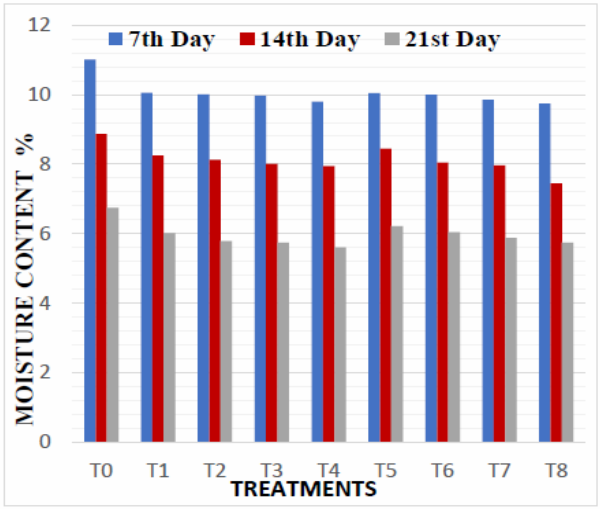

Fig. 3: Impact of lead and cadmium stress on moister content in germinated seedlings of *Cicer arietinum* L

The change in total carbohydrate concentration in the Radhey variety of *Cicer arietinum* L. seeds has been shown in Table 4.4. There was a (day wise, i.e. on 7th, 14th and 21st day) increasing trend in the total carbohydrate whereas a declining trend was observed when the seedlings were subjected to heavy metal (lead and cadmium) stress treatments. In this cultivar total carbohydrate recorded the lowest value at Pb 200 ppm (T4) and Cd 200 ppm (T8) and highest value was observed at Pb 25 ppm (T1) and Cd 25 ppm (T5). Chibbar et al. examined the similar result in Cicer arietinum L. was 0.465 mg/100g of total carbohydrate in sample treated with Pd with the concentration of 100 ppm after 14th day of experiment (Chibbar *et al.,* 2004)

Table 5 : Impact of lead and cadmium stress on total carbohydrate in germinated seedlings of *Cicer arietinum* L.

Treatment code	7th Day	14th Day	21st Day
T0	5.71	10.21	15.01
T1	5.68	10.14	14.51
T2	5.41	10.06	14.31
T3	5.15	09.94	14.11
T4	4.99	09.72	14.02
T5	6.01	10.15	14.98
T6	5.81	09.74	14.73
T7	5.54	9.55	14.57
T8	5.12	9.02	14.24
F- test			
S. Ed. (±)	0.239	0.273	0.303
C. D. (P = 0.05)	0.493	0.563	0.625

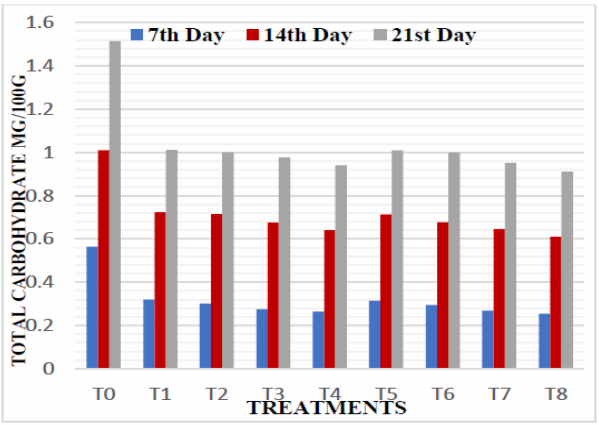

Fig. 4: Impact of lead and cadmium stress on total carbohydrate in germinated seedlings of *Cicer arietinum* L.

Five desi and four Kabuli chickpea cultivars were studied. Proximate composition varied considerably ($p<0.05$) among differing types of chickpea cultivars. The crude macromolecule content varied from eighteen to thirty first being higher in Kabuli chickpea cultivars than desi chickpea.

Among the analyzed chickpea cultivars K850 in desi and PUSA 1108, PUSA 1088 and PUSA1053 in Kabuli cultivars had sensible potential as a food crop so their cultivation and utilization ought to be encouraged (Sharma *et al*., 2013). The physio-morphological and organic chemistry responses of chickpea plants exposed to zero, 25, fifty or one hundred mg Cd (Cd) per metric weight unit of soil. Cd was given within the variety of $CdCl_2$. It absolutely was discovered that everyone the expansion parameters (length, contemporary and Arid mass), range of nodules, their contemporary and arid Mass were faded with the increasing Focus of Cd in soil at each the sampling stage i.e. sixty and ninety days once sowing (DAS). The worth of leg hemoglobin and super molecule contents of nodules was conjointly minimized in a very focus dependent style at sixty and ninety DAS, However, the chemical element content of leaf of the plants fed with lowest concentration of Cd (25 mg/kg of soil) showed a worth that is such as management. Because the level of Cd multiplied within the soil, a concomitant reduction within the chemical change attributes moreover as of leaf chemical element and root nitrate content was noted. Important, big, a major reduction within the activities of nitrate enzyme and chemical element anhydrase

was conjointly noted, and also the reduction was additional significant in a hundred mg Cd fed plants. The protein activities in a hundred mg Cd fed plants minimized considerably by thirty seven.9%, 38.0% (glutamine synthetase), 28.0%, 29.0% (glutam- ate synthase) and forty six.0%,44.0% (glutam-ate dehydrogenase) at 2 sampling phase(60 and ninety DAS), severally as contrast to manage. However, not like alternative parameters, the endogenous amino alkanoic acid level and the activities of enzyme, oxidase and enzyme showed a rise with the increasing level of cadmium (Hayat *et al*., 2013).

Protein content, as it was shown in table (2), of Radhey variety of *Cicer arietinum* L. seeds was scored a remarkable increment in the protein in (days 7th, 14th and 21st). In contrast, it was observed a significant decrement when seedlings were placed under stress treatments using heavy metal (Pb and Cd). In this category, the protein content was presented highest value at [Cd200 ppm (T8)], [Pb 200 ppm (T4)], and minimum values were obtained at [Pb25 ppm (T1)] and [Cd 25 ppm (T5)].

The crude fiber content, as it is presented in table (3) in Radhey variety of *Cicer arietinum* L. seeds was shown an elevational tendency of crude fiber on (day 7th, 14th and 21st day) whereas a remarkable decline was observed when the seedlings was exposed to heavy metal stress treatments. Lowest value of crude fiber was obtained at [Cd 200 ppm (T8)] and [Pb 200 ppm (T4)], while highest value was acquired at [Pb 25 ppm (T1)] and [Cd 25 ppm (T5)].

Conclusion

Based on this study, we can conclude that there is a reduction in the biochemical parameter when seedling was subjected to heavy metal (lead and cadmium) stress treatments. An increasing tendency was shown when seedlings (protein content, amount of crude fiber, and the total carbohydrate concentration in Radhey variety of *Cicer arietinum* L.) were subjected to heavy metal stress treatments, however, a decline was achieved with moisture content of seedlings.

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Conflict of Interest:

We have no conflict of interest regarding this study

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