Harmful Effectuate of Cadmium Chloride ($CdCl_2$)on black gram (*Vigna mungo* L.)

P. V. Sivakumar, K. Palanisamy and M. Lenin
Asst. Professor, Department of Botany, Tiru, Kollnjiappar Government Arts College, Virudhachalam, 606001. Tamilnadu, India
Asst. Prof. PG & Research. Dept. of Botany Arignar Anna Government Arts College, Namakkal-2 Tamilnadu, India
Guest Lecturer, PG &Research Dept. Of Botany, Govt.Arts college, Dharmapuri-5 Tamilnadu, India

Abstract

The toxicity of Heavy metals(HMs) is one of the most inevitable environmental impacts, and is dangerous because of the accumulation of life in the food chain and plant products for human exploitation. As a result, heavy metal contamination of soil and plants has become an increasing problem. So the present research work addresses the toxic effect of cadmium chloride ($CdCl_2$) on the growth of black gram seedlings. The test plants were grown in pots, potting soil with different amounts of ($CdCl_2$) in the test system like *viz.*, control, 0.5, 1.0, 1.5, 2.0 and 2.5 g kg^{-1} soil. Five replicates were maintained for each close attention. The morphological parameters like root and shoot length, number of leaves, nodule number, total leaf area and fresh and dry weight of black gram seedlings were recorded at 7th day seedlings. The $CdCl_2$behavior at all concentration dropped among these parameters.

Keywords: $CdCl_2$, black gram, root nodules, total leaf area and fresh & dry weights.

Introduction

The major environmental pollutants of heavy metals and their harmful are the complexity of the effects of increasing biological, evolutionary, nutritional and environmental reason. HMs is widely distributed in most plant tissues in soil and animals in the environment. Environmental pollution by HMs by linked to human activity. HMs is included in the main category of environmental pollutants because they can be in the environment for long time and their accumulation is dangerous to humans, animals, soil and plants (Jayakumar*et al.*, 2008; Abdul Jaleel *et al.*, 2009). Soil contaminants include HMs, acid rainfall and organic matter. Due to the emission properties of HMs soils, they have been intensively studied in the recent years. The content of HMs in agricultural topsoil may be influenced by native soil matter and human resources. In other words, those heavy metals may naturally live in the soil, but due to the action of man, a considerable amount will be added to the soil. In fact, human behavior can lead to accumulation of heavy metals in the soil. Reaction rate plants in two ways under conditions of absorption of HMs; the first technique is the avoidance mechanism, whereby plants avoid adding the transporting HMs into their organs. These plants are non-aggregates. The second technique is the metal accretion mechanism, in which plants have a great potential to assemble metals by roots and transport and store them in the plant body. Those plants are called the thrilling collector (Baker and Whiting 2002).Common effects of various HMs on plants, Cadmium: decline seed germination, lipid content and plant enlargement, but induce the creation of phytochelatins. Phytochelatin is a metal binding peptide and has an important role in cadmium detoxification in plants. Chromium: Causes reduce in enzyme activity and plant development, and create membrane injure, chlorosis and root damage. Copper: break offphotosynthesis, plant augmentation and reproductive processes, and shrink thylakoid surface area. Mercury: assist to accumulate phenol, but diminish the photosynthetic-activity, water uptake and antioxidant enzymes. Nickel: drop offseed germination, protein production, chlorophyll and enzyme creation, and accretion of dry mass, but enhance the amount of free amino acids. Lead: condense thechlorophyll making and plant growth, but expand superoxide dismutase (metal including antioxidant enzyme). Zinc: reduce nickel noxious and seed germination, but enlarge plant growth and ATP/chlorophyll ratio at reasonableapplication (Gardea-Torresdey *et al*, 2004;Shanker *et al.*, 2005; Mukesh*et al.*, 2008; Hoseini and Zargari 2013).

There is anincredibleaddition level of toxic elements in aquatic and terrestrial ecological unit in the last century due to hurriedindustrializeddevelopment. This has resulted in buildup of HMs in soil where these may impede with bio-chemical process in soil and get entrance into food chains (Hall *et al.*, 2002). Cadmium (Cd)is the large number of universal pollutants in farming soils. The potential resources of these metals in our soils are mostly automobile exhausts, plastic industries, and some industrial effluents irrigation with sewage water and fertilization practices (Lone *et al.*, 2003; Ahmad *et al.*, 2011). While these metals are still not present at toxicity rank in our agricultural soils but the very extensive resident life of these metals can raise their concentrations up to hazardous intensity (Khan and Frankland, 1983; Khan *et al*., 2009).And Cadmium (Cd) istopmost damage to plant growth, moreover, its uptake and accumulation in plants educe many stress indication in plants, such as decrement of growth, especially root enlargement, disturbances in mineral nutrition and carbohydrate metabolism, andmay thus sturdilydiminishseed germination and biomass production (Iqbal and Mehmod 1991;Munzuroglu and Geckil, 2002).These can come in human body by uptake of food and fodder crops via herbivores (Ahmad *et al.*, 2011).

Black gram *Vigna mungo* L. is family fabaceae, is an annual and main short time pulse crop resident to middle Asia. It is staple crop in central and south east asia. But, it is expansively used only in India. The most favorable temperature for better growth of black gram range between 25 to 35ºC, but it can tolerate upto 42ºC, which permit to cultivate during summer and winter seasons. It respected for its high digestibility and freedom from flatulence effect (Fery, 2002). It is summer pulse crop with short duration (90 -120) days and high nutritive value (Karamany, 2006). Black gram is used for human food, green manure, a cover crop, forage, silage, hay and chicken pasture. It is sown on most of the soils but it can grow better on heavier soils (pH 5.5 - 7.5) and an annual rainfall of 600 - 1000mm. For legume, nitrogen is more useful since it is the major component of amino acid as well as protein. As awonderful source of plant protein, black gram is enormouslyaccessible to nitrogen (Imrie, 2005; Kulsum *et al.*, 2007).So the present research work,therefore investigates howtoxic effects of cadmium chloride on black gram seedlings.

Materials and Methods

Seed

Blackgram (*Vigna mungo L.*) seeds were collected from Tamilnadu Agriculture University (TNAU) Seeds Section, Coimbatore, Tamilnadu.The seeds with uniform size, colour and weight werechoosing for experimental analysis.

Pot culture experiment

The experimental seedswere grown in pots in normal soil (control) and other handlingin soil with different deliberation of $CdCl_2$had been practical at (5, 1.0, 1.5, 2.0and 2.5g kg^{-1} soil). The inside exterior of pots were creased with a polythene sheet. Each one pot contained 2.5 kg of air dried soil. The $CdCl_2$ was used to the exterior soil and scientifically mixed with the soil. Every pots ten seeds were sown. All pots were watered to filledcapacityday by day. Each handling includethe control was replicated five times.

Sample collection

The plant samples were collected at 7thDAS for the quantityof different morph metricalfactors such as germination percentage, root and shoot length, fresh and dry weight, number of leaves, total leaf area and root nodules. Five plants from each replicate of a pot wereanalyzed for its different parameters and the average value was calculated.

Morphological parameters

The different morphological factors such as Root Length (RL), Shoot Length (SL), Number of Nodules (NN), Total Leaf Area (TLA), Fresh and Dry Weight (g.fr.wt and g.dr.wt)of shoot per plant were determined for sample. The leaf areas were calculated by measuring the length and breadth and multiplied by a correlation factor (0.69), derived from the method of (Kalra and Dhiman 1977).

Result and Discussion

The results obtainfrom the experiment the effect of different application of $CdCl_2$treated seedlings were summarized and discussed as follows. The results showed that the germination percentage of black gram seedlings (Table. 1).The highest seed germination profit (95 ± 4.75, 95 ± 4.75, 93 ± 4.65 and 96 ± 4.8) % for the all varieties (CO-6, TMV, UDID-T9 and IPU-941) wasdocumentation at control plants. The lowest seed germination profit (34 ± 1.7, 35 ± 1.75, 34 ± 1.7 and 50 ± 2.5) % were confirmation for the all the varieties (CO-6, TMV, UDID -T9 and IPU-941) at 2.5 g/kg $CdCl_2$focusing.

The abatement of seed germination profit among the all varieties of black gram seedlings under the $CdCl_2$ handling compared with control seedlings.The main reason maybe cadmium chloride causes decline in the seed germination root and shoot maturation. The quick restrict of root function was evident in terms of demotion in both ion and water uptake this might be in total surprising since roots are the first to come in contact with the injurious cadmium. These results are in accordance with reports indicating impede of water conductance in roots by toxic metals (Kastori *et al.*, 1992; Sandalio *et al.*, 2001), the other reasons various types of stress, including $CdCl_2$, induce the assimilation of lignin into the cell walls of maize roots with the result that cell-wall strictness,augmentation and cell wall expansion is reduced (Hall 2002; Boominathan *et al.*, 2003; Guo *et al.*, 2007; Khan *et al.*, 2009).

Table.1 Effectuate of Cd Cl_2 on seed germination (%) of *Vigna mungo* (L.) Hepper

Cd Cl_2 Treatments	**Seed Germination (%) (7th DAS)**			
	CO – 6	**TMV**	**UDID-T9**	**IPU-941**
Control	95 ± 4.75	95 ± 4.75	93 ± 4.65	96 ± 4.8
0.5 g/kg	84 ± 4.2	83 ± 4.15	84 ± 4.2	90 ± 4.5
1.0 g/kg	80 ± 4	78 ± 3.9	76 ± 3.8	82 ± 4.1
1.5 g/kg	74 ± 3.7	71 ± 3.55	70 ± 3.5	75 ± 3.75
2.0 g/kg	61 ± 3.05	62 ± 3.1	60 ± 3	67 ± 3.35
2.5 g/kg	34 ± 1.7	35 ± 1.75	34 ± 1.7	50 ± 2.5

The extremity of shoot length (13.4 ± 0.67,13.4 ± 0.67, 12.8 ± 0.64 and 14.2 ± 0.71cm/plant) for the varieties (CO-6, TMV, UDID-T9 and IPU-941) was recorded at control seedlings. The bottom level of shoot length (3.2 ± 0.16, 3 ± 0.15, 3.1 ± 0.155 and 5.2 ± 0.26cm/plant) for black gram for all varieties (CO-6, TMV, UDID-T9 and IPU-941) was recorded at 2.5 g/kg$CdCl_2$ applications(Table 2).The shoot length is decline with increment in (Cd) concentration. This is due to decline in mitotic incidence and metal accumulation in cell wall components especially pectic substances and hemicelluloses (Chosden*et al.*, 2004).HMs was also description to hold up cell division and differentiation and also reduce their elongation thus affect the plant sprouting and development (Kastori *et al.*, 1992; Garmash and Golovko 2009; Wani *et al.*, 2012).The anther main reason of reduced shoot and seedling length of black gram seedlings due to cadmium chloridehandling could be the decline in meristematic cells present in this region and some enzyme restricted in cotyledon and endosperm. Cells become active and begin to digest and store food which is converted into the soluble form and transported to the radicle and plumule tips *e.g.*, enzyme amylases renovate starch into sugar and protease act on protein. So when the actions of different enzymes were precious, food did not reach to the radicle and plumule and in this way shoot and seedling length were affected(Wani *et al.*, 2007 and Ahmad *et al.*, 2011).

Table.2 Effectuate of Cd Cl_2 on shoot length (cm) of *Vigna mungo* (L.) Hepper

Cd Cl_2	**Shoot length (cm) (7th DAS)**			
Treatments	**CO – 6**	**TMV**	**UDID-T9**	**IPU-941**
Control	13.4 ± 0.67	13.4 ± 0.67	12.8 ± 0.64	14.2 ± 0.71
0.5 g/kg	11.6 ± 0.58	11.2 ± 0.56	12 ± 0.6	13.8 ± 0.69
1.0 g/kg	9.5 ± 0.475	9.2 ± 0.46	8.3 ± 0.415	10.2 ± 0.51
1.5 g/kg	7.2 ± 0.36	7.2 ± 0.36	6.2 ± 0.31	9 ± 0.45
2.0 g/kg	6.0 ± 0.3	5.4 ± 0.27	5 ± 0.25	7.5 ± 0.375
2.5 g/kg	3.2 ± 0.16	3 ± 0.15	3.1 ± 0.155	5.2 ± 0.26

Table.3 Effectuate of Cd Cl_2 on root length of *Vigna mungo* (L.) Hepper on 7th DAS

Cd Cl_2	**Root length (cm) (7th DAS)**			
Treatments	**CO – 6**	**TMV**	**UDID-T9**	**IPU-941**
Control	5.8 ± 0.29	5.7 ± 0.285	5.5 ± 0.275	6.2 ± 0.31
0.5 g/kg	5 ± 0.25	5.1 ± 0.255	5 ± 0.25	5.5 ± 0.275
1.0 g/kg	4.1 ± 0.205	4 ± 0.2	3.9 ± 0.195	4.8 ± 0.24
1.5 g/kg	3.2 ± 0.16	3 ± 0.15	3.9 ± 0.195	4.2 ± 0.21
2.0 g/kg	2.4 ± 0.12	2.5 ± 0.125	2.6 ± 0.13	3.8 ± 0.19
2.5 g/kg	1.6 ± 0.08	1.8 ± 0.09	1.7 ± 0.085	3 ± 0.15

Table.4 Effectuate of Cd Cl$_2$ on number of leaves of *Vigna mungo* (L.) Hepper

Cd Cl$_2$ Treatments	**Number of leaves (7th DAS)**			
	CO – 6	**TMV**	**UDID-T9**	**IPU-941**
Control	2 ± 0.1	2 ±0.1	2 ± 0.1	3 ± 0.15
0.5 g/kg	2 ± 0.1	2 ± 0.1	2 ± 0.1	2 ± 0.1
1.0 g/kg	2 ± 0.1	2 ± 0.1	2 ± 0.1	2 ± 0.1
1.5 g/kg	2 ± 0.1	2 ± 0.1	2 ± 0.1	2 ± 0.1
2.0 g/kg	2 ± 0.1	2 ± 0.1	2 ± 0.1	2 ± 0.1
2.5 g/kg	2 ± 0.1	2 ± 0.1	2 ± 0.1	2 ± 0.1

Table.5 Effectuate of Cd Cl$_2$ on total leaf area of *Vigna mungo* (L.) Hepper

Cd Cl$_2$ Treatments	**Total Leaf Area (cm^2) (7th DAS)**			
	CO – 6	**TMV**	**UDID-T9**	**IPU-941**
Control	6.8 ± 0.34	6.8 ± 0.34	6.5 ± 0.325	7.2 ± 0.36
0.5 g/kg	5.7 ± 0.285	5.9 ± 0.295	4.8 ± 0.24	6.8 ± 0.34
1.0 g/kg	4.1 ± 0.205	4 ± 0.2	4 ± 0.2	5.5 ± 0.275
1.5 g/kg	3.4 ± 0.17	3.6 ± 0.18	3.4 ± 0.17	4.6 ± 0.23
2.0 g/kg	3 ± 0.15	3.2 ± 0.16	3.2 ± 0.16	3.8 ± 0.19
2.5 g/kg	3 ± 0.15	3 ± 0.15	3.2 ± 0.16	3.6 ± 0.18

Table.6 Effectuate of Cd Cl$_2$ on root nodules of *Vigna mungo* (L.) Hepper

Cd Cl$_2$ Treatments	**Root nodules (7th DAS)**			
	CO – 6	**TMV**	**UDID-T9**	**IPU-941**
Control	10.4 ± 0.52	10 ± 0.5	10.8 ± 0.54	12.5 ± 0.625
0.5 g/kg	8.9 ± 0.445	8.4 ± 0.42	8.6 ± 0.43	9.8 ± 0.49
1.0 g/kg	8 ± 0.4	7.5 ± 0.375	8 ± 0.4	8.5 ± 0.425
1.5 g/kg	5.6 ± 0.28	5 ± 0.25	5.6 ± 0.28	7.4 ± 0.37
2.0 g/kg	4.8 ± 0.24	4 ± 0.2	4.4 ± 0.22	5.5 ± 0.275
2.5 g/kg	0	0	0	3 ± 0.15

Table.7 Effectuate of Cd Cl_2 on Fresh weight of *Vigna mungo* (L.) Hepper

Cd Cl_2 Treatments	**Fresh weight (g.fr.wt) (7th DAS)**			
	CO – 6	**TMV**	**UDID-T9**	**IPU-941**
Control	10.8 ± 0.54	10.2 ± 0.51	10.4 ± 0.52	12.7 ± 0.64
0.5 g/kg	9.5 ± 0.47	9.1 ± 0.45	9.1 ± 0.45	10.5 ± 0.53
1.0 g/kg	7.3 ± 0.36	7 ± 0.35	6.8 ± 0.34	8.2 ± 0.41
1.5 g/kg	6 ± 0.3	5.2 ± 0.26	5 ± 0.25	6 ± 0.3
2.0 g/kg	5.2 ± 0.26	4.8 ± 0.24	4.4 ± 0.22	5.2 ± 0.26
2.5 g/kg	4.4 ± 0.22	4 ± 0.2	3.8 ± 0.19	4.8 ± 0.24

Table.8 Effectuate of Cd Cl_2 on Dry weight of *Vigna mungo* (L.) Hepper

Cd Cl_2 Treatments	**Dry weight (g.dr.wt) (7th DAS)**			
	CO – 6	**TMV**	**UDID-T9**	**IPU-941**
Control	4.75 ± 0.24	4.48 ± 0.22	4.6 ± 0.23	5.32 ± 0.26
0.5 g/kg	3.58 ± 0.17	3.41 ± 0.17	3.45 ± 0.17	4.3 ± 0.22
1.0 g/kg	2.35 ± 0.12	2.2 ± 0.11	2.3 ± 0.12	3.12 ± 0.15
1.5 g/kg	0.98 ± 0.05	0.87 ± 0.04	1.08 ± 0.05	2.05 ± 0.11
2.0 g/kg	0.76 ± 0.04	0.69 ± 0.03	0.87 ± 0.04	1.2 ± 0.06
2.5 g/kg	0.43 ± 0.02	0.4 ± 0.02	0.42 ± 0.02	0.98 ± 0.04

The next table 3 showed that the root length of black gram seedlings. The utmost of root length (5.8 ± 0.29, 5.7 ± 0.285, 5.5 ± 0.275 and 6.2 ± 0.31cm/plant) for the varieties (CO-6, TMV, UDID-T9 and IPU-941) was recorded at control seedlings. The lowest root length (1.6 ± 0.08, 1.8 ± 0.09, 1.7 ± 0.085 and 3 ± 0.15 cm/plant) of black gram varieties (CO-6, TMV, UDID-T9 and IPU-941) was recorded at 2.5 g/kg$CdCl_2$ of attentiveness.

The decrement of root length in allthe $CdCl_2$ dealingsfor few varieties of black gram seedlings. The main reasons for the reduction of root length suppress of root growing can be attributed in part to theinhibition of mitosis, the reduced synthesis of cell-wall components,damage to the Golgi apparatus, and changes inthepolysaccharide metabolism, while browning is caused bysuberin deposits (Punzand Ieghardt, 1993; Fabrizo *et al.*, 2003;Maria *et al.*, 2013). In many plantspecies, it has been observed that although cell division did not cease as the result of $CdCl_2$ dealings with the development of thecells was obstructed. This slow down of cell growth after $CdCl_2$ management ofappeared to be caused by the formation of strongercross-binding between the pectin molecules in the cell walland by a lowering in the size of the intercellular space(Prasad, 1995; Gill *et al.*, 2012). Various types of stress, including $CdCl_2$,induce the incorporation of lignin into the cell walls of maizeroots, with the result that cell-wall rigidity intensification and cellwall expansion is reduced (Degenhardt and Gimmler, 2000; Chaudhary 2014).

The highest number of leaves (3 ± 0.15) for the variety (IPU-941) was recorded at control seedlings on 7th DAS. The slightestnumber of leaves (2 ± 0.1) for black gram varieties(IPU-941) was recorded at 2.5 g/kg tunnel vision of $CdCl_2$. (Table 4).Restrict of leaf maturation also supply to a decline in water sufferers. Thus a fall off in leaf surface is a well-known non-specific response to water stress, which isinduced by much unfavourable reason. Concentratedcytokinin content in $CdCl_2$care forplants might also be liable for their germination reaction.The capacity of this haslately been shown to pressure the movement of development (proteins involved in the control of cell expansion) (Downes and Crowell, 1998; Kumari *et al.*, 2011;Gomes and Soares 2013).As a result stifled of leaf development of seedlings treated with Cadmium chloride might be due to an HMsinduceddecline in cytokinin content. This assumption is supported by the fact that inthis study the hinder effect of $CdCl_2$ on leaf development was lower in plants whichwere pre-treated with Zeatin. The minimized in the growth inhibitory effect of $CdCl_2$ inplants treated with exogenous cytokinin is in accordance with the literature (Gadallahand El-Enany, 1999; Mijovilovich*et al.*, 2009; Peyvandi *et al.*, 2016).Thus, the abate in cytokinin content in plants treated with $CdCl_2$, which mightbe a result of acceleration of cytokinin metabolism caused by Cadmium induced activationof cytokinin oxidase, is likely to be responsible for curtail transpiration and leafmaturation. These effects might lead to limited $CdCl_2$ flow drawn by transpiration flow, whichmight protect plants from its injurious effects until induced syntheses of $CdCl_2$binding substances, makes them resistant to the action of this HMs. (Veselov *et al.*, 2003; Gill 2014).

Table 5 exhibit that the upper limit range of total leaf area (6.8 ± 0.34, 6.8 ± 0.34,6.5 ± 0.325 and 7.2 ± 0.36 cm^2) for the varieties (CO-6, TMV, UDID-T9 and IPU-941) were recorded at control seedlings. The least oftotal leaf area (3 ± 0.15,3 ± 0.15, 3.2 ± 0.16 and 3.6 ± 0.18 cm^2) for black gram varieties (CO-6, TMV, UDID-T9 and IPU-941) were recorded at 2.5 g/kg of$CdCl_2$ applications. The diminution of leaf area in reaction to HMsconduct toward was also correlated to addition of $CdCl_2$ in leaves, wherever the sizes of the leaf also shrink. Even though such dangerous regulatory systems areprobable to function in seeds at the start of imbibitions, little is known about how stress tolerance is revising at different stage of germination(Madhavi and Rao, 1999; Rahman *et al.*, 2005).

The maximum root nodules (10.4 ± 0.52, 10 ± 0.5, 10.8 ± 0.54 and 12.5 ± 0.625) for the varieties (CO-6, TMV, UDID-T9 and IPU-941) were recorded at control seedlings. The lower limitroot nodule (3 ± 0.15) of black gram verity(IPU-941) was recorded at 2.5 g/kg $CdCl_2$attentiveness (Table 6).The escalating$CdCl_2$content in shootsduring ontogenesis explains that more $CdCl_2$ bled out ofthe root into the shoots. This fact as well as the conventional browning of roots means that the role of theroot system was troubled to some area. It is complicatedto inspect the environment of thisturbulence in theroot system when plants are grown in pot experiments. We may assumethat in $CdCl_2$amuse with plants the purposefulactionof the root system is worried, for the reason that of declining ofprotein content and various macro and micronutrientattentiveness (Vassilev *et al.*, 1994; Metwally *et al.*, 2003;Lu *et al.*, 2010).

The most fresh weight (10.8 ± 0.54, 10.2 ± 0.51, 10.4 ± 0.52 and 12.7 ± 0.64) for the varieties (CO-6, TMV, UDID-T9 and IPU-941) was recorded at control seedlings. The lowest fresh weight (4.4 ± 0.22, 4 ± 0.2, 3.8 ± 0.19 and 4.8 ± 0.24) for black gram varieties (CO-6, TMV, UDID-T9 and IPU-941) was recorded at 2.5 g/kgCd Cl_2applications (table 7).The (table 8) showed that the maximum dry weight (4.75 ± 0.24, 4.48 ± 0.22, 4.6 ± 0.23 and 5.32 ± 0.26) for the varieties (CO-6, TMV, UDID-T9 and IPU-941) was recorded at control seedlings. The minimum dry weight (0.43 ± 0.02, 0.4 ± 0.02, 0.42 ± 0.02 and 0.98 ± 0.04) for black gram varieties (CO-6, TMV, UDID-T9 and IPU-941) was recorded at 2.5 g/kg$CdCl_2$concentration.

A slow down enlargement in $CdCl_2$care plants match up the control was inspected. One of the explanations for the concealed improvement was later emergence of $CdCl_2$care for plants. It wasprobably due to the unconstructive $CdCl_2$result on recruitment offood reserves in the seeds as accounted by (Bishnoi *et al.*,1993; Gabrijel *et al.*, 2009; Zhang *et al.*, 2010). The results showed deplete in the dry mass accumulation in plants treated with $CdCl_2$. The effect of $CdCl_2$ on the dry mass accumulation was a little moreobvious in plants. The reasonably$CdCl_2$consequence on the dry mass accretion at later stageof foliage could probably be due to an adaptation ofplants to this metal(Jin *et al.*, 2008).

Conversely, the explanation for the majorvariation in the dry mass accretion between the controls and $CdCl_2$appliance plantsduring the early phenological phase is their diversespeed of growth. Because of the retarded development by the time of analysis they had accumulated a reduced amount ofdry mass compared to the control seedlings.The developments of adaptation in plants carry on on different structural and functional levels of molecular, cellular, whole plant, and subsequentunlikesystem.At the whole plant level it is possible that the adaptationis connected to the pattern of $CdCl_2$sharing in plantorgans throughout ontogenesis (Vassilev *et al.*, 1998; Devi *et al.*, 2007;Katoch and Singh 2014).

Conclusion

From this study, some minimum concentrations of $CdCl_2$ suppresses seed germinations, seedling growth (root and shoot), number of leaves, total leaf area, fresh and dry weights of black gram(*Vigna mungo* L.)seems to be more sensitive to Cd Cl_2pressure.

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