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The effects of different concentrations of Nickel on seed germination and growth of Coriander *(Coriandrum sativum)*

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ABSTRACT

Heavy metal pollution is a major environmental stress than can affect plant growth. The toxic effects of nickel on germination and growth of Coriander (*Coriandrum sativum*) seedling were investigated for 8 days. Growth of seedling parts especially radicle was greatly reduced for concentration at and above 50 mg/l.

Figure : 00 References : 18 Table : 01

KEY WORDS : *Coriandrum sativam*, Heavy metal, Nickel, Toxicity,

Introduction

One of the major challenges in the environment is gradually increase in the concentration of heavy metals in soils that can lead to reduce growth and production of reactive oxygen species. Heavy metals are one group of elements with a density greater than 5 grams per cubic centimeter, and they are one the most important environmental contaminants that are increasing. This[3,14] type of pollution is mainly caused by industrial activities such as metal mining, metal refining, metallurgy, fuel, use of fertilizer, pesticide and recycling of waste[8]. When heavy metals absorbed by plants and accumulate in tissues, then they cause toxicity in two ways: 1). Indirectly through competition with other essential nutrients and degradation enzymes and pigments. 2). Directly damage the cell structure. The presence of heavy metals cause oxidative stress and increased production of reactive oxygen species (ROS), which in turn can cause various toxic effects on plants, such as reduced growth, reduced chlorophyll contents, inhibit the activity of enzyme, damage to biomolecules as lipids, proteins and nucleic acids[1,4,9-11]. Heavy metal ions when present in large amounts in the environment absorbed by plant roots and transfer to the shoots that result in impaired metabolism and reduced growth[12,13,15].

In addition, large amounts of heavy metals in soil can result in decreased performance, the quality of products and increase in its concentration in agricultural production which is dangerous to human health or animal consumption[6]. Fifty three elements found in nature are known as heavy metals that among them nickel is one of the natural elements which has various forms in the environment[6,18]. Soil and sediment are the primary source of nickel[16,17].

Studies have shown that nickel is toxic to the respiratory tract and immune system of animals and creats a negative impact on women's fertility and fetal development[5,16,17]. Studies have shown that the required amount of nickel for human is less than 100 micrograms per day[7]. Nickel plays an important role in plants. At low concentrations, there are no toxic effects on plants. But in high concentrations is toxic to plants[2]. The amount of

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TABLE-1 : Effect of Nickel Pretreatment to seed on dry weight changes (mg) in dark grown seedlings of *Coiandrum sativum*

Days After Radicle Emergence

Parameter	-	-	4	-	-	6	-	-	8
Organ	**Nickel Concentration mg.**								
	0	10	50	0	10	50	0	10	50
Radicle	7.50	10.10	5.10	15.00	15.30	11.40	22.50	28.60	19.00
Epicotyl	6.00	8.25	5.50	14.30	17.00	11.40	22.00	25.00	16.20
Cotyledon Pair	163.00	153.70	165.20	141.40	131.20	100.00	115.00	105.50	131.10

nickel in the soil is between 5 to 500 g per kg.

Materials and Methods

Studies were undertaken on the effects of different concentrations of Ni (as $NiCl_2.6H_2O$) on seedling growth of some important vegetable crop plants. Two types of nickel treatments were given. In the first type *i.e.* for pretreatment seeds were imbibed in different concentrations of Ni for required/specific period and thereafter transferred to distilled water moistened filter paper in petriplates for seedling growth in dark. In the second type *i.e.* Post radical emergence treatment seeds were imbibed in distilled water for their specific imbibitions periods and after radical emergence transferred to Nickel chloride solution of different concentrations for seedling growth studies.

In both the types of treatments, seedling growth was studies (in terms of length measurement) at a suitable day. On the basis of dose response curves for *Coriandrum sativum* concentrations of Nickel chloride of seedling growth (in terms of length and dry weights) at 3rd, 5th and 7th day after radical emergence. For this seeds of test plant was pretreated in different concentrations of nickel chloride.

(Ni Pretreatment Vs Seedling growth)

Uniformly selected seeds of vegetable plants were imbibed for 12 to 24 hrs (depending upon the cultivars) in Nickel chloride solutions containing 10 mg/L, 50 mg/L Nickel chloride and in distilled water as control. Thereafter seeds were thoroughly washed with water and transferred to distilled water moistened filter papers in petriplates for subsequent growth in dark. At a suitable day (*e.g.* 5 days after radical emergence) seedlings were dissected into parts and their lengths were measured.

In general, all the concentrations used were inhibitory to seedling growth but for lower most concentration *i.e.* 10 mg/L was nearly ineffective. Further with increasing concentration there was greater decrease in the length of seedling parts, with maximum inhibition at the highest concentration.

Results and Discussion

The present investigation was undertaken to assess the effect of various concentrations of nickel chloride on seed germination and seedling growth. Based on doses response curve obtained from studies of concentrations of $NiCl_2$ was selected.

The investigations were carried out and the finding suggest that:

(i) Pretreatment as well as post radicle emergence treatment with various concentrations of nickel chloride (1, 5, 10, 25, 50 and 100 mg Ni/l) have promotory and inhibitory effect on growth respectively at the lower (1, 5 and 10 mg Ni/l) and higher (25, 50 and 100 mg Ni/l) concentrations of nickel.

(ii) Seedling growth is inhibited by phasic pretreatment in all the regime of phasic pretreatment, however it is maximum in mid phase treatment set.

(iii) Growth and yield of certain vegetable crop plants grown on nickel amended soil is promoted at 10 mg Ni/Kg soil and inhibited at 50 mg Ni/Kg soil. There are cultivar and Organ specific differences in response to these two nickel concentrations. With environmental condition the effects are partly modified.

(iv) Growth and yield of test crop plants irrigated by polluted water is enhanced. This polluted water is generally used for irrigation in local area which constitutes a deceptive type of pollution. The growth

of vegetable crop plants is increased by polluted water irrigation. This gives satisfaction to farmers and consumers. But this practice is responsible for heavy metal accumulation in the edible parts of plant which is highly hazardous.

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