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RESEARCH NOTE

Effect of CuSO4 on the growth of *Brassica juncea* L.

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Seeds of Black Mustard (*Brassica juncea*) were sowed in a paper cup with copper sulfate at different concentration. This experiment aimed to determine the effect of the variation in concentration of copper sulphate on the germination and growth of seeds of *Brassica juncea*. We wanted to establish which is the highest concentration of copper that the seeds of Black Mustard can tolerate. Seedlings growth investigation and measurements were made after 5 days. The seed germination rate was low to no for the high concentration and for control that increased dramatically with the decrease in concentration. At high concentration, no growth was seen.

Keywords: *Brassica juncea* L; phytochemistry; $CuSO_4$

Introduction

Copper is a widespread pollutant of the industrial world originating from electric power plants, metal smelting plants, cars, agrochemicals such as pesticides, and sewage sludge (Verkleij, 1994). It is therefore of interest to know how organisms respond to a range of concentrations. Plants cannot flee unfavorable conditions and therefore are probably more exposed to local pollution. A major part of the studies of the effects of copper on plants has been conducted in solution cultures. Such studies provide relative toxicities of different toxicants, but results are difficult to extrapolate to natural growth media because of the high affinity of copper to chelate strongly to the organic fraction of the soil and because this chelation is pH dependent (Adriano, 1986). Toxic concentrations of copper affect plants in many ways. Copper can either cause deficiencies of other essential ways. Copper can either cause deficiencies of other essential nutrients by competitive exclusion at uptake sites (Lin and Wu, 1994) or it can be directly toxic.

Null Hypothesis: There is no significant effect of $CuSO_4$ on growth of *Brassica juncea*

Alternate Hypothesis: There is significant effect of $CuSO_4$ on growth of *Brassica juncea*

Materials and Methods

An experiment was conducted in Lab at room temperature 26–29 °C and humidity about 76% to measure the effects of copper on growth of Black Mustard. Copper sulfate was applied to paper pots with cotton at base. A series of pots supplied with $CuSO_4$ in concentration 0.5%, 1.0%, 5%, and a control (Fig. 1).

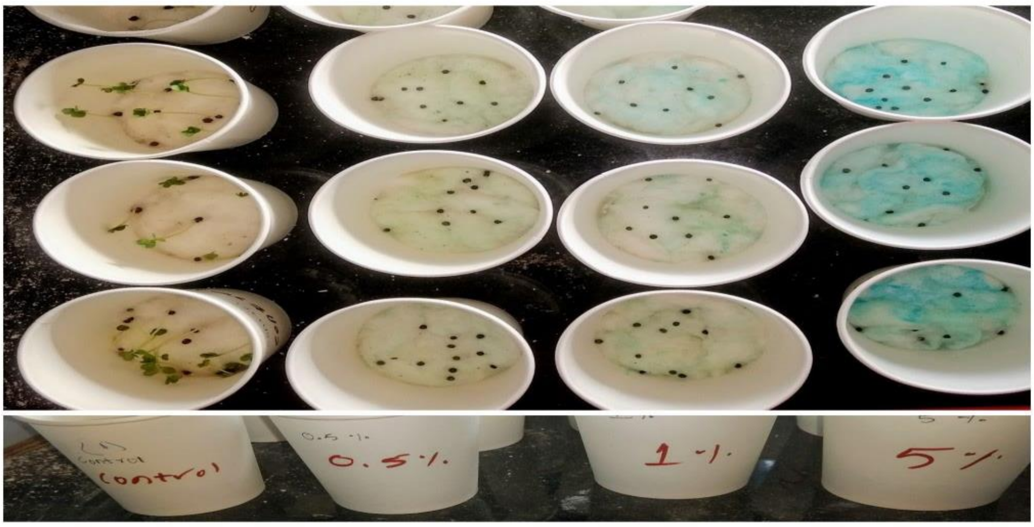

Fig. 1. Set up of the experiment conducted in lab.

Each concentration/ control consists of 5 pots and 4 Black Mustard seeds were sowed in each pot at significant distance. The seeds of Black mustard were soaked in Distilled water for 24 hours prior to the experiment. Cotton was spread in 60 cups and labelled. $CuSO_4$ was added in cups. Then 4 seeds of *Brassica juncea* L. in each cup were sowed. The pots were hydrated with respective concentrations and distilled water for control after alternate days. The experiment was carried out for 5 days. In Observation the length of shoot was recorded on 6th day.

Table 1. Shoot length of the *Brassica juncea* was measured.

S. No.	Control (cm)	Conc. 0.5% (cm)	Conc. 1% (cm)	Conc. 5% (cm)
1	6.5	3.7	0.6	0.0
2	5.4	2.6	0.3	0.0
3	6.0	3.0	0.1	0.0
4	4.5	2.7	0.2	0.0
5	6.2	2.5	0.4	0.0
6	4.2	3.1	0.4	0.0
7	4.9	2.9	0.3	0.0
8	6.1	3.2	0.7	0.1
9	5.8	3.9	0.6	0.1
10	3.7	2.6	0.4	0.1
11	6.0	1.7	0.1	0.0
12	5.9	2.1	0.1	0.0
13	4.6	1.9	0.2	0.2
14	5.4	3.2	0.4	0.0
15	5.7	2.8	0.3	0.0
16	6.1	3.9	0.3	0.0
17	5.5	4.1	1.0	0.0
18	5.5	4.0	0.9	0.1
19	5.7	3.1	0.6	0.2
20	4.5	3.2	0.8	0.1

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ONEWAY /VARIABLES= ShootLength BY Concentration
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Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
ShootLength	Control	20	5.41	.76	.17	5.05	5.77	3.7	6.5
	0.5%	20	3.01	.68	.15	2.69	3.33	1.7	4.1
	1%	20	.44	.27	.06	.31	.56	.1	1.0
	5%	20	.05	.07	.02	.01	.08	.0	.2
	Total	80	2.23	2.24	.25	1.73	2.72	.0	6.5

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
ShootLength	14.01	3	76	.000

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
ShootLength	Between Groups	374.34	3	124.78	444.99	.000
	Within Groups	21.31	76	.28		
	Total	395.65	79			

Fig. 2. Analysis of variance using PSPP.

The tabulated F value at 0.5% significance level is 444.46514 Hence, the Null hypothesis is rejected and alternate hypothesis is accepted.

Results and Discussion

The effect of $CuSO_4$ had adverse effect on the growth of plants as we can see the difference in following Table 1 as the concentration of $CuSO_4$ increased the growth has significantly decreased comparing to control. With concentration of 0.5% the mean shoot length decreased by 50% from the mean shoot length of control. Following increase in concentration of CuSO4 led to decrease by 70% comparing to control and 90% for 5% conc. of $CuSO_4$. The calculated F=444.46 is highly significant with p=0.000, which is higher than the observed F value 2.76, hence the null hypothesis is rejected. The variation in shoot length was not the matter of chance, $CuSO_4$ concentration showed significant effect on the length of shoot (Fig. 2).
There is a significant negative effect of $CuSO_4$ on growth of *Brassica juncea*. Therefore $CuSO_4$ from industrial waste should be processed prior to direct exposure in environment.

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