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Effect of city waste water of Bareilly on Mung Bean (*Vigna radiata* (L.) Mill.sp.) with Nitrogen content, high yielding and induced mutant In M_1, M_2 and M_3 generations

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Abstract

In agriculutural economy of India pulses play very important role because of their ability to be in symbiosis with rhizobia and to fix atmospheric nitrogen. Among the different pulses green gram or mung bean (*Vigna radiata*) is an important pulse grown in fields.

The city waste water is major water pollutant goes to the adjoining fields of Bareilly city. It contains heavy metals as Cd, Cu, Zn and Pb which cause phytotoxicity.The concentration of these metals present in city waste water was 0.204,7.500,7.270 and 3.740 mg/l respectively. Seeds of two varieties viz.NM-1 (Narendra mung-1) and PTM-2 (Pantnagar mung-2) were obtained from Pantnagar university,Pantnagar.Different concentrations (80,90 and 100%) of city waste water were prepared by addition of tap water for irrigation of seeds in pots.Distilled water taken as control.

A marked reduction in nitrogen content is observed in both varieties except some treatments in M_1 generation.Some high yielding mutants were also isolated in both varieties with increase yield about 2 and 3 times than that of control in M_2 generation. Some mutant plants showed resistant against the city waste water in M_3 generation which are high yielding and with high protein content as compare to their respective controls and does not show any phytotoxic effect of city waste water.

These induced mutants of mung bean can be recommended for cultivation in adjoining areas of Bareilly city.

The main source of water pollution is the city waste water which goes to the adjoining fields of Bareilly.It contains many types of heavy metals present in toxic amount. Heavy metals occurs naturally in the ecosystem with large variations in concentrations. The term heavy metal refers to any metallic chemical element that has a relatively high density & toxic at low concentration.A very important factor which influence the availability of heavy metal in aquatic system is the hydrogen ion concentration[6]. City waste water contains considerable quantities of toxic elements. Of the various elements Cd, Cu, Zn & Pb are most likely to cause phytotoxicity when waste is applied to agricultural field or land.

The following materials & methods were adopted for the study of phytotoxic effect of city waste water.

Effluent collection:

The effluent of city waste water (C.W.W) was obtained from the outlet of the B.D.A. colony nallah of Bareilly city situated near Gulabrai Inter College. Many heavy metals *i.e.* Cd, Cu. Zn and Pb etc. were found to be present in toxic amount in this liquid waste. The concentration of these metals present in city waste water was 0.204, 7.500, 7.270 and 3.740 mg/l respectively

Varieties of Green Gram:

Two varieties of *Vigna radiata* (L) Millsp. *i.e.* Narendra mung-1(NM-1) & Pantnagar mung-2 (PTM-2) were obtained from Pantnagar Seed Department, Pantnagar University, Pantnagar.

Field preparation:

The field should be firmed,well levelled and free from any type of weed.The field preparation should consists of one cultivation with soil turning plough during summer (utilizing premonsoon showers) followed by two or three ploughings and planking.

Seed treatment:

Clean, plump & uniform sized seeds free from any kind of damage by insects, pests or diseases.The seeds were sown & irrigated with different concentrations of city waste water (80%,90% & 100%) & distilled water (control) at the interval of 3 days.

Effect of City waste water on Nitrogen content in M_1 generation:

The phytotoxic effects of city waste water were observed on fifteen days old seedlings.The observations clearly indicate that the percentage of nitrogen content decrease with increase in the concentrations of the city waste water in both the varieties at 15 days old seedlings except in 80% and 90% treatment in variety PTM-2.The maximum reduction was observed in 100% treatment in both varieties. The nitrogen content calculated by A.O.A.C. (1960) method. (Table-1)

Table-1. Effect of City waste water on Nitrogen content

Nitrgen content		
NM-1		
80%	17.36+1.24	89.2*
90%	16.50+1.17	84.7*
100%	14.18+1.09	73.0**
PTM-2		
80%	17.91+1.19	97.6
90%	16.81+1.13	91.5
100%	15.93+1.08	83.3*
CONTROL		
NM-1	19.46+1.62	-
PTM-2	18.36+1.53	-

*Significant at 5% level of significance
**Significant at 1% level of significance

Copper is considered as a micronutrient for plants[2]. It plays a important role in Co_2 assimilation and ATP synthesis. It is also an essential component of various proteins. But it becomes toxic when present in undesired quantity. Cadmium disturb the chloroplast metabolism by inhibiting chloroplast biosynthesis and reducing the activity of enzymes involved in Co_2 fixation.[7] Zinc toxicity in plants Earliar workers have been also reported the same. Mishra & Behera[5], Habib *et al*[3]. According to Sharma & Habib[8] the protein content exhibited overall decrease in leaf, stem & leaves. Protein content has been found to be positively correlated to total nitrogen.Protein break down into amino acid is also adversely affected by effluent toxicity[1]. Hence poor availability of nitrogen may be a causative factor for reduction in crude protein content in different treatments, limited the growth of both root and shoot[4].

High yielding mutant in M_2 generation :

The seeds of M_1 plants were sown on plant to row progeny basis to raise M_2 generation.

Plants with a significant increase in the total grain yield were isolated from city waste water mutagenic treated population of varieties NM-1 and PTM-2, the increase is not significant. The highest yield was recorded in mutant isolated from the 100% city waste water in NM-1 which is 4.65 gm/ plant more as compare to control which is 10.65gm/plant. In variety PTM-2 also maximum yield was observed in the 100% treatment of the city waste water and it was 15.12 gm/plant against the control *i.e.*10.59 gm/plant.It is significant in all the mutants of NM-1 but not in PTM -2.

The protein content also increased in all the mutants but it is significant only in the 80% of $ZnSO_4$ in the variety NM-1. It also increased in all the treatments of the variety PTM-2 but it was not significant. (Table-2)

Table-2. Performance of High Yielding Mutants in M_2 Generation

High Yielding Mutants

NM-1				
80%$ZnSO_4$	62.00±4.92	472.2±45.77	13.53*±1.85	23.15*±1.35
90%$ZnSO_4$	57.90±2.21	467.2±41.00	13.53*±0.94	22.82±1.96
90%$PbNO_3$	54.20±2.60	465.0±60.28	13.16*±0.35	22.70±1.87
100%C.W.W.	60.4±5.29	524.2±30.97	15.30*±0.17	22.40±1.92
PTM-2				
100%$ZnSO_4$	60.0±5.49	398.4±10.79	12.60±0.50	22.06±1.09
100%$PbNO_3$	58.2±5.57	394.6±10.11	12.58±0.50	22.40±1.34
90%C.W.W.	55.6±2.72	385.0±30.25	12.37±0.38	22.17±1.07
100%C.W.W.	60.0±5.49	398.4±10.79	15.12±0.28	22.50±2.03

*Significant at 5% level of significance

Induced mutants In M_3 generation:

To evaluate the stability ,productivity and resistence of the high yielding mutants observed in M_2 generation,against the city waste water, were treated with city waste water in M_3 generation.

In M_3 generation most of the mutants showed reduction in total grain yield and protein content but some mutant plants did't showed any significant reduction in total grain yield and protein content.It means there was some kind of mutation occurred,make it resistant against city waste water.

An increase in total grain yield was observed in all the mutants of both the varieties.The increase was significant in all the mutants except 80% & 90% treatment of ZnSo4 in variety of NM-1.The highest yield was recorded in 100% city waste water treatment in NM-1 & PTM-2 which was 6.76 gm & 5.45 gm more than control respectively. (Table-3)

Table-3. Effect of C.W.W on productivity of Induced mutants in M_3 generation

Types of Mutants	Treatment	Normal mutants		Mutants irrigated with city waste water	
		Total grain yield	Protein content	Total grain yield	Protein content
NM-1					
High yielding mutant	100% City waste water	15.90*+0.98	23.95*+0.05	15-86±0.69	23.92±0.05
Tall mutant	90% $ZnSO_4$	13.85*±1.35	22.99±1.09	9.99±0.09	21.02±0.02
Tall mutant	80% $PbNO_3$	13.45*±1.46	22.93*±1.09	10.02±0.96	20.92±1.07
Early maturing	80% $CuSO_4$	13.96*±0.92	23.62*±0.36	13.93±1.09	23.60±0.36
Early maturing	80% $ZnSO_4$	12.79±0.68	22.99*±1.09	10.09±0.72	21.92±1099
Synchronous maturing	90% $ZnSO_4$	12.72±2.92	22.99*±1.69	10.72±0.66	20.00±1.02
PTM-2					
High yielding mutant	100% City waste water	15.46*±0.78	21.96±0.05	15.46±0.79	21.92±0.05
Tall mutant	80% $PbNO_3$	12.81*±2.85	21.92±1.02	10.09±1.86	20.90±1.09
Early maturing	80% $PbNO_3$	18.39±0.30	22.92*±1.06	18.35±0.69	22.90±1.90
Synchronous	90% City	11.99*±0.90	23.99*±2.90	9.90±1.89	22.09±1.08
maturing	Waste Water				

*Significant at 1% level.

The heavy metals present in city waste water are mutagenic,so they may have induced the mutations which may have been tolerant to the pollution causing agents *i.e.* city waste water from where they have evolved. Thus showing that heavy metal induced mutation in the mung bean which can withstand against the hazardous effects of the city waste water and such mutants after propagation can be recommended for cultivation in the adjoining area of the city.

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