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GENETIC VARIATION AND SCOPE OF SELECTION FOR HIGH YIELDING MUTANTS IN MUNGBEAN

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Seeds of mungbean (*Vigna radiata* (L.) Wilczek) – a self-fertilized crop var. NM-1 were treated with hydrazine hydrate (0.01% and 0.02%) and data were recorded on biological damage in M_1 and on quantitative characters in M_2 and M_3 generations. The percentage of seed germination and seedling height decreased with an increase in concentration of the mutagen. Quantitative characters like fertile branches/plant, pods/plant, 100-seed weight and total plant yield expressed high values of genotypic variability and genetic advance in M_2 and M_3 generations, suggesting the possibilities of effective selection and further improvement of these characters in future generations.

Keywords: High yielding mutants; Hydrazine hydrate; Mungbean; Selection.

Mungbean – an important pulse crop of arid and semi-arid regions of the world has low variability with respect to various economic characters. Mutation breeding has been considered as one of the gizmo of the atomic age and a much promising breeding short cut, which could be beneficially utilized for tailoring the desired varieties of different crop plants. It is an important supplement to other conventional methods of breeding for improvement of crops by developing new plant type with superior biochemical composition and better adaptation potentiality[1]. Broadening the genetic base to augment and recreate wide genetic variability for crop improvement can be achieved through induced mutagenesis[2,3]. Hydrazine - a base specific chemical mutagen directly acts on thymine base of DNA and brings about simultaneous mutations of homologous loci[4]. In tomato and rice, hydrazine is known to induce homozygous recessive mutations[5,6]. The objective of the present study was to evaluate genetic variation induced by hydrazine hydrate (HZ) for yield and yield components in mungbean in M_2 and M_3 generations.

Dry, uniform and healthy seeds of mungbean (*Vigna radiata* (L.) Wilczek) var. NM-1 were presoaked in distilled water for 9 hours prior to treatment with 0.01% and 0.02% HZ prepared in phosphate buffer of pH 7 for 6 hours. Seeds soaked in distilled water were used as control. Control and treated seeds were sown in the field in a complete randomized block design (CRBD) to raise M_1, M_2 and M_3 generations for isolation of mutants. Thirty seeds from each treatment and control were spread over moist cotton in petriplates and kept in B.O.D. incubator, in order to determine the percentage of seed germination and seedling growth. The germination counts were taken one week after treatment and the seedling growth depression was calculated on 10 days old seedlings by measuring their root and shoot length. Two mutants which showed significant deviations in mean values in the positive direction from the mean values of control particularly for yield and yield components were isolated in M_2 at 0.02% of HZ treatment. These mutants breed true in M_3 generation. The mean, genotypic coefficient of variation (GCV) and genetic advance (GA) were estimated for plant height, days to maturity, fertile branches/plant, pods/plant, seeds/pod, 100-seed weight (g) and total plant yield (g) of M_2 and M_3 mutants by the method suggested by Singh and Chaudhary[7] and Johnson *et al.*[8]

It is clear from Table 1 that with an increase in concentration of hydrazine hydrate a consistent decrease in percentage of seed germination and seedling growth were observed in M_1 generation. The inhibition in seed germination and seedling growth may be due to gross injury caused at cellular level either due to gene controlled biochemical processes or acute chromosomal aberrations or both[9-11]. The mean performance of different quantitative characters of M_2 and M_3 mutants indicated that a shift in mean values in the positive direction is evident for fertile branches/plant, pods/plant, 100-seed weight and total plant yield (Table 2). The improvement in the mean values of these characters may be attributed to frequent occurrence of mutations with positive effects[12,13]. Rajput[14] also reported an increase in the mean values for days to maturity and pods/plant in the selected mutant lines in gamma

Table 1. Effect of HZ on seed germination and seedling growth in M_1 generation.

Treatment	Seed germination (%)	Seedling growth (cm) Root Mean±S.E.	Shoot Mean±S.E.	Total Mean±S.E.	Shift in $\overline{X}$	Seedling growth injury (%)
Control	100	2.25±0.07	9.24±0.14	11.49±0.21	-	-
0.01 % HZ	86.66	1.65±0.12	7.75±0.23	9.40±0.35	-2.09	18.18
0.02% HZ	73.33	1.54±0.10	6.90±0.20	8.44±0.30	-3.05	26.54

Table 2. Comparison of quantitative characters of control (parent variety NM-1) and high yielding mutants of mungbean.

Characters	Control (Two plants)			M_2 (Two mutants)			M_3 (Ten mutants)		
	Mean±S.E.	GCV (%)	GA (% of $\overline{X}$)	Mean±S.E.	GCV (%)	GA (% of $\overline{X}$)	Mean±S.E.	GCV (%)	GA (% of $\overline{X}$)
Plant height (cm)	42.02±0.39	4.05	6.55	41.89±0.41	4.09	6.62	42.76±0.43	4.15	6.91
Days to maturity	67.70±0.36	1.37	1.54	67.33±0.33	1.53	1.85	67.40±0.38	1.66	2.07
Fertile branches/plant	6.07±0.06	3.29	4.35	8.63±0.20*	12.15	22.50	10.27±0.22*	14.99	33.06
Pods/plant	35.50±0.26	2.06	2.50	54.26±0.65*	8.57	18.99	57.10±0.81*	11.32	26.34
Seeds/pod	8.03±0.07	1.90	1.61	8.10±0.08	2.01	1.71	8.30±0.09	2.09	1.91
100-seed weight (g)	3.67±0.02	1.59	2.29	4.86±0.06*	9.86	21.55	4.97±0.07*	10.45	24.13
Total plant yield (g)	9.06±0.10	3.67	5.85	13.41±0.19*	11.06	25.15	14.40±0.23*	11.48	26.12

* Significant at 5% level; GCV=Genotypic coefficient of variation; GA = Genetic advance; $\overline{X}$= Mean

irradiated mungbean. Among the characters, fertile branches/plant, pods/plant, 100-seed weight and total plant yield showed higher genotypic coefficient of variability and genetic advance. This suggests that gain from selection based on these characters would be higher and continued selection would be helpful in modifying the mean performance of these mutants. Genetic advance is an indicative of the expected genetic progress for a particular trait under suitable selection procedure and consequently carries much significance in self-fertilized crops[15,16]. The characters like plant height, days to maturity and seeds/pod exhibited almost same genetic advance as control plants, hence selection for these characters may not be useful. The studies thus suggest that hydrazine hydrate can be successfully used in inducing mutations and to enlarge the range of genetic variability for yield and its contributing traits due to its unique mode of action.

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