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Research Article

Chemically induced mutagenesis in Blackgram(*Vigna mungo* (L.)Hepper)

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Abstract :
The present investigation was carried out to study the extent of variability existed in the rice fallow blackgram varieties namely VBN3 and ADT 3 after induction of mutation through chemical mutagens namely EMS and colchicine. The results of M_1 generation revealed that there was a shift in the mean for the characters *Viz.*, plant height, number of branches per plant, number of clusters per plant, number of pods per plant,100 seed weight and seed yield per plant towards positive /negative directions.In M_2, chlorophyll mutants namely, albina, xantha, chlorine, viridis and few viable mutants like giant plant, bushy plant, unifoliate leaf, narrow leaf, crinkled leaf, glabrous pod, short pod ,brown seeded, sterile plant and pigmented mutants were recorded.A significant increase in number of branches per plant, number of clusters per plant, number of pods per plant and seed yield per plant was noticed in M_2 generation.The PCV and GCV showed significantly higher values in yield component characters such as number o f branches per plant, number of pods per cluster, number of pods per plant and seed yield per plant in M_2 generation.The yield attributing traits like number of branches per plant, number of pods per cluster,100 seed weight and seed yield per plant recorded high heritability coupled with high genetic advance as per cent of mean in M_2 generation.

Key words:
Black gram, chemical mutagen, EMS, colchicines, heritability

Introduction

Blackgram (*Vigna mungo* (L.) Hepper) is an important pulse crop of our country. It belongs to the family leguminosae and subfamily papilionaceae. The chromosome number of this crop is 2n=2x=22 (Bhatnagar et al., 1974). It is a highly self pollinated crop with cleistogamous nature. Creation of variability through pollination and artificial hybridization is very difficult as the flowers are cleistogamous and very delicate to handle. Even if hybridization is carried out the seed set is less than 5 per cent .Also, this crop lacks proper male sterility system commercially to be utilized for hybridization. Hence, the present investigation aims at creation of variation through induction of mutation through chemical mutagens.

Materials and methods

Two blackgram genotypes namely, Vamban 3 and ADT 3 were selected to study the effect of chemical mutagenesis to induce variability in biometrical and morphological characters. The study was carried out at the plant breeding farm, Department of Agricultural Botany, Faculty of Agriculture, Annamalai University during the year 2007-2009.

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Two chemical mutagens namely, EMS and Colchicine were used for inducing mutation in blackgram. Six sets containing 200 well filled seeds were selected for treatment. Seeds were soaked in water for three hours. Then soaked seeds were treated with chemicals *viz.,* EMS and Colchicine for eight hours. After soaking the seeds in the chemical, they were thoroughly washed under tap water 3-5 times. The seeds were then subjected to germination test. Based on the effect of chemical on germination, LD 50 was obtained. Three concentrations namely 0.2,0.4 and 0.6 per cent were fixed for EMS treatment and 0.4,0.6 and 0.8 was fixed for colchicine treatment. After the treatments the seeds were thoroughly washed in tap water for eight to ten times.

The seeds subjected to treatment were sown in the field along with control in Randomized Block Design with three replications. A total of 100 seeds were sown in each treatment. All the treatments including the control were raised in the field with a spacing of 30 cm between row and 10 cm between plants within rows. Nine morphologically distinct mutants which were identified in M_1 generation in both the genotypes along with control were advanced to M_2 generation.

Eighteen M_2 population (from Vamban 3 and ADT 3) along with control were raised .Out of 18 M_2

population, only 4 population recorded high flowering and more pod set and ultimately high yield. Therefore four mutant population *viz,* 0.4 per cent EMS of Vamban 3 (population 1),0.4 per cent EMS of ADT 3 (population 2),0.6 per cent colchicine of Vamban 3 (population 3) and 0.6 per cent of colchicine of ADT 3 (population 4) were advanced to further studies and biometric observations such as seed germination, plant survival, plant height, number of branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant,100 seed weight and seed yield per plant were recorded. Various statistical parameters like PCV, GCV, Heritability and genetic advance as per cent of mean were calculated inM_2 generation for various economic characters studied.

Results and discussion

In the present investigation a wide spectrum of chlorophyll mutants was observed in the M_2 mutagenic populations. chlorophyll mutants like albina, xantha, chlorina and viridis were observed maximum in population 1.However the frequency of chlorina mutants was found to be low. This may be due to zygotic inviability. Similar results were reported by Singh *et al.* (1987), and Ilayaraja (2002).Also, a wide spectrum of viable mutants was observed in M_2. The spectrum of viable mutants were plant type (giant bushy, Unifoliate leaf, narrow leaf, crinkled leaf, glabrous leaf, short pod and brown colour seed).The narrow leaf mutants was mostly observed in population 4.The gene responsible could be 'nl'. Pigmentation was observed in leaf, stem, pods and seeds. The gene that is responsible for pigmentation may be 'R' gene complex. Similar mutants were observed by Gautam and Mittal (1998) in their studies on black gram.

In the present study 0.4 per cent EMS of VBN 3 (population 1) was found to be more effective than other populations. According to Konzak *et al* .(1965),the greater efficiency of low concentration of mutagen appeared in relation to the fact that lethality and injury increase with increase in concentration at faster rate than mutations. On the basis of lethality and injury the efficiency was more in the population 1 (VBN 3) which was treated with 0.4 per cent EMS.

It is also noted that the mean for different characters shifted both in positive and negative directions due to mutagenic treatments. Such a shift in mean on both the directions is influenced by the trait, genotype and dose of mutagen (Juliet Hepziba and Subramanian, 1994; Ilayaraja, 2002).The mutant with positive in one or more yield component characters resulted in high yielding mutant in black gram. The trait number of pods per plant and seed yield per plant showed positive shift of mean and increased range of mean on both the directions. The maximum shift towards the positive direction was observed by population 1 followed by population 4 of M_2 generation. Similar shift towards the positive direction was observed by Malik *et al.* (1998), Charumathi *et al.* (1992) and Pawar *et al*. (1988).The positive shift in mean values of both the characters indicated that there was scope for improvement and the parental materials were the potential source in this respect **(Table 1).**

Variation in growth parameters is essential for the selection of productive lines. The variability in quantitative characters increases considerably by treating the biological material with different mutagenic agents. Heritability estimates along with GA as per cent of mean are normally more helpful in predicting the gain under selection than heritability estimates alone. In the present study ,significant variation has been observed in the mutant population for both number of pods per plant and seed yield per plant. Variations in the treated population in M_2 (where population is heterozygous and heterogenous) may be caused in one or a set of characters by point mutations, by enhancing the recombination rate and by chromosomal damage so as to release the total variability in blocks of linked genes. This offers the same advantage as generally expected from intermating in early segregating generations (Katoch *et al.,* 1992).

High to moderate GCV and moderate heritability and genetic advance was noted for seed yield per plant and number of pods per plant **(Table 2).** The reason for this variability by irradiation was suggested as increased mutation and recombination of polygenes (Juliet Hepziba and Subramanian,1994).It is noted that the population 1 of M_2 recorded high GCV ,PCV ,heritability and genetic advance for both the characters *viz.,* number of pods per plant and seed yield per plant. Hence, mutants isolated with high mean, high heritability and GA as per cent of mean for these traits *viz.,* number of pods per plant and seed yield per plant may be useful in utilizing them in crop improvement programme.

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Table 1.Mean performance for Number of Pods per Plant and Seed Yield in M_2 Generation of Blackgram

Population		Range		Mean		Percent of decrease/increase over control	
		Number of pods per plant	Seed yield per plant(g)	Number of pods per plant	Seed yield per plant(g)	Number of pods per plant	Seed yield per plant(g)
control	VBN 3	09.00-20.00	2.10-4.40	10.25	3.05		
	ADT 3	10.00-22.00	2.00-5.10	11.42	3.10		
1		11.00-23.00	2.05-4.95	19.21	4.09	87.40	34.10
2		10.00-22.30	2.00-4.80	17.18	3.80	50.40	22.6
3		13.00-21.00	2.10-5.05	16.30	3.86	59.00	26.60
4		12.00-26.00	2.00-5.10	18.95	4.08	65.90	31.60

Table 2.Variability, Heritability and Genetic advance for number of pods per plant and seed yield in M_2 generation of black gram

Population	GCV (per cent)		PCV (per cent)		h^2 (per cent)		GA as per cent of mean	
	Number of pods per plant	Seed yield per plant(g)	Number of pods per plant	Seed yield per plant	Number of pods per plant	Seed yield per plant	Number of pods per plant	Seed yield per plant
Vamban 3 ©	18.65	22.00	36.70	27.07	24.78	49.44	16.19	17.38
ADT 3 ©	20.16	24.65	32.40	28.65	26.43	53.25	10.01	11.00
1	29.26	30.15	40.20	32.43	36.12	65.82	24.32	15.04
2	24.10	27.15	34.20	34.37	31.05	54.32	27.94	22.09
3	27.25	27.79	35.60	28.72	33.40	53.90	22.04	24.07
4	29.10	29.55	41.25	31.35	35.80	64.35	24.32	23.22