Indian J.Sci.Res.1(2) : 37-39, 2010

ESTIMATES OF GENETIC PARAMETERS FOR YIELD AND YIELD COMPONENTS IN MUNGBEAN VARIETY ASHA

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ABSTRACT

A study was carried out to investigate the yield and yield components of isolated mutants of a mungbean variety Asha in M_3 generation. All these mutants isolated for higher plant yield have also shown higher values for the number of fertile branches and pods per plant as compared to control. Coefficient of variations (Phenotypic and genotypic), heritability and the genetic advance for the number of fertile branches, number of pods and the total plant yield also revealed a higher value in all the mutants.

KEYWORDS: Genetic parameters, isolated mutants, quantitative character, mungbean

Pulses constitute a major part of the human diet of nearly all sections of people because of their most vital role being either that of supplying most of the proteins or in balancing the deficiencies of the cereal proteins. Pulses being rich source of proteins (17 to 25 percent) form an important component in the Indian diet where most of the population is vegetarian.

Most of the plant attributes of interest to a plant breeder are quantitative characters which are controlled by a polygenic interaction. In such situation the efficiency of selecting the desired mutant is generally lower than that for specific characters which are controlled by a single gene. Micromutations produce genetic variability in quantitative characters of the crop plant. Such mutations should be useful for improving quantitative inherited traits (i.e grain yield) without disturbing the major part of the genotypic and phenotypic architecture of crop.

The possibility offered by mutagenic agents to induce new genetic variation is, therefore of extreme interest. It might in many cases be the only answer to problems posed upon the practical aspects to breeder. A mutation event is indeed very important even at times when it has a small effect for a specific morphological or physiological character, because it changes the balance established by natural selection in co-adapted blocks of genes and therefore, offers new situations for natural or artificial selection.

An attempt has been made to evaluate quantitative characters in the isolated mutants of mungbean in M_3 generation with Sodium azide (SA) and Ethylmethane sulphonate (EMS).

MATERIALS AND METHODS

Indian variety of mungbean (*Vigna radiata* (L.) Wilczek) namely Asha has been used in the present investigation. Variety is well adapted to agroclimatic conditions of Uttar Pradesh (including Aligarh, the site of this study) and is popular for cultivation in this region. This variety is semi-erect in growth habit.

Variety Asha

Variety was released in 1991 for general cultivation in irrigated areas of Haryana State. The variety is especially suitable for Kharif season. The seeds are medium smooth and shinning in colour. It matures in 70-75 days and average yield is 9- 11 q/ha.

Mutagens Used

i. Ethylmethane sulphonate (EMS)- $CH_3SO_2OC_2H_5$

It is monofunctional alkylating agent, causes de-purination, transition and formation of triesters in the backbone of DNA molecule.

ii. Sodium azide (SA) –NaN_3

It is used as respiratory inhibitor. During duplication of DNA by base transition mechanism, it causes point mutation.

M_3 Generation

For raising the M_3 generation of mutagenic treated population, two treatments each of chemical mutagen for variety Asha were selected which gave the maximum total

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plant yield in M_2 generation. The selected treatments were 0.1 and 0.2 percent of EMS and 0.01 and 0.02 percent of SA. For each of these treatments, ten such M_2 progenies were selected which showed significant deviations in mean values in the positive direction from the mean value of control, particularly for yield and yield components under study. Fifty seeds from each selected M_2 plant were sown in the field. Seeds were taken only from the normal looking M_2 plants. Observations were recorded for the quantitative characters on 30 normal looking plants in each progeny and harvested individually at maturity.

Statistical analysis

While analysis of variance, (ANOVA) as a test of significance was applied to the data according to Singh and Choudhary (1985), the Heritability $(h)^2$ was on the other hand estimated by the formula suggested by Johnson et al. (1955). The estimates of genetic advance (Gs) with 1% selection intensity were based on the formula derived by Allard (1960) and as modified by Khan (1979).

RESULTS

The data on mean values, range, shift in mean, coefficient of phenotypic and genotypic variations, heritability and genetic advance of different mutants and their parents in M_3 generation has been presented in Table 1.

Selection from M_2 generation for a higher mean yield in M_3 generation showed a range of 14.02-16.37 g (Asha-A) and 15.00-17.15g (Asha-B) yield per plant in comparison to the control which ranged from 8.15-10.35g (var- Asha).

All these mutants isolated for higher plant yield have also presented higher values for the number of fertile branches and pods per plant as compared to the control. Coefficient of variations on (phenotypic and genotypic), heritability and the genetic advance for the number of fertile branches, number of pods and the total plant yield also recorded a higher value in all the mutants.

Table 1: Estimates of genetic parameters for various quantitative characters of the mutants isolated form the var. Asha in M_3 generation

Strain Number	Treatment	Range	Mean ± S.E	Shift in x	CVp(%)	Cvg (%)	h^2 (%)	Gs(%of x)	L.S.D
Fertile branches / plant									
	(control)	4-8	5.10. ± 0.39	0.00	9.16	3.79	17.48	4.03	
1. Asha- A	0.01%S.A	8-12	9.27 ± 0.05	+4.17	22.29	15.42	47.75	27.59	5% =0.11
2. Asha-B	0.2% EMS	9-12	9.90 ± 0.04	+4.80	29.15	24.37	69.96	53.04	1% = 0.17
Pods/ Plant									
	(control)	40-55	46.83 ± 0.19	0.00	3.61	1.12	9.56	0.85	
1. Asha-A	0.01%SA	60-72	75.50 ±1.57	+28.97	18.10	10.19	31.70	14.80	5% = 0.10
2. Asha-B	0.2%EMS	62-92	81.60 ± 0.58	+34.77	21.24	18.21	73.47	40.93	1% = 0.15
Total Plant Yield (g)									
	(Control)	8.15 -10.35	9.83 ± 0.06	0.00	1.20	0.52	25.55	0.67	
1.Asha-A	0.01%SA	14.02 -16.37	15.59 ± 0.05	+5.76	9.25	6.37	47.49	11.45	5% = 0.17
2. Asha-B	0.2%EMS	15.00-17.15	16.02 ± 0.08	+6.19	10.21	8.29	65.90	17.47	1% = 0.24

± S.E – Standared error

C_{vp}- Phenotypic coefficient of variations

C_{vg}- Genotypic Coefficient of variations

DISCUSSION

Heritability is a measure of the value of selection for particular character and also as an index of transmissibility of a character where as genetic advances is indicative of the expected genetic progress for a particular trait under suitable selection produce (Kaul 1980).

In the present study, a wide range of variability has been observed for various parameters viz., the number of fertile branches, number of pods and seed yield per plant of the mutants isolated in M_3 generation. A perusal the data indicates that the mean values of these characters significantly increased in different mutant lines in comparison to the control and offered a unique possibility of creation of new germplasm for crop improvement . A similar view has been reported by various authors from time to time (Kumar et al., 2004; Mensah et al., 2005.; Brock, 1977; Konzak, 1987). All these three characters revealed a considerable increase in the values of genotypic coefficient of variation, heritability and genetic advance, indicating thereby that these characters can be transmitted to future generations and further improvement of these quantitative characters is possible in subsequent generations. Frey (1969) has also reported that the mutagen derived variability for quantitative characters in a crop plant is heritable and the response to selection is good. The similar results were also reported earlier by Khan and Siddiqui (1993, 1997), Kumar and Mishra (2004) and Singh (2006).

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