Research Paper

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Genetic variability, correlation and path analysis for yield and yield attributing traits in mutant populations of mungbean *(Vigna radiata (L). Wilczek)*

Agriculture

KEYWORDS : Mutation, Heritability, Genetic advance, Mungbean, Correlation, Path analysis.

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ABSTRACT

In the present investigation, the genotypic and phenotypic coefficient of variations, heritability, genetic advance, correlation and path coefficient analysis were made for yield and its contributing characters in M4 populations of mungbean genotypes. High heritability (broad) along with high genetic advance as per cent of mean was observed for the trait plant height, number of pods per plant, number of seeds per pod, 100 seed weight and single plant yield indicating that these characters would be amenable for phenotypic selection. From the correlation studies the number of pods per plant were high positive and highly significant with single plant yield. Based on path coefficient analysis, the number of pods per plant followed by number of seeds per pod were the important characters for increasing yield in mungbean.

INTRODUCTION

Mungbean (*Vigna radiata* (L.) Wilczek) known as greengram is one of the most important pulse crops of India. It is a self-pollinated crop. It has an ability to fix atmospheric nitrogen and it is cultivated both in summer and spring seasons. Induced mutations have been used to enhance genetic variability, which was utilized not only to increase crop productivity but also for basic studies in various crops. Hence, in general, induced mutation provided a modem and fruitful tool in crop plants for creating genetic variability (Swaminathan, 1969; Gottschalk, 1972 and Khan, 1979). Genetic variation among genotypes and relationships between major yield contributing characters are important in breeding programmes that aim to produce elite cultivars in crops like mungbean. Identification of important yield components and information about the nature and magnitude of their direct and indirect contributions towards the manifestation of grain yield is very essential for devising successful crop breeding strategy in any crop. The correlation and path-coefficient analysis provide information about the relative importance of various yield components in the expression of yield and thus, help in formation of appropriate selection strategy. In agriculture, path analysis has been used by plant breeders to assist in identifying traits that are useful as selection criteria to improve crop yield (Dewey and Lu, 1959). Keeping this in view the present study was conducted to evaluate the extent of genetic variation and also to find out the association between yield and yield components in mungbean.

MATERIALS AND METHODS

The experiment for the present investigation was conducted at Agricultural research station, Vaigai Dam, Tamil Nadu, India during 2010-2013. The greengram variety viz., CO (Gg) 7 was chosen for the study to evaluate the genetic variation and association analysis on quantitative characters in M_4 generation. Induced mutagenesis (300Gy, 400Gy, 500Gy, 600Gy and 700Gy) was performed with gamma irradiation (Cobalt 60) using 100 uniform healthy seeds of CO (Gg) 7. Seeds of each treatment were sown in three replications to raise M_1 generation. The recovered mutants were advanced to M_2 and M_3 generations while promising lines isolated were advanced to M_4 generation. After exclusion of chlorophyll and morphological macro-mutants, mutated plants in each treatment were observed and were selected on the basis of higher yield. Totally, 723 M_4 populations were raised in a Randomized Block Design with three replications along with the parents. Observations viz., days to 50 per cent flowering, days to maturity were taken on row basis. For other characters viz., plant height (cm), number of pods per plant, number of seeds per pod, 100 seed weight (g), and single plant yield (g) were recorded on five randomly selected plants from each row. Phenotypic and genotypic coefficient of variation (PCV and GCV) were computed using the formula adopted by Burton (1952). Heritability (h^2) was computed using the formula of Lush (1940). Genetic advance was estimated, adopting the method suggested by Johnson et al. (1955). The genotypic and phenotypic correlation coefficients were calculated according to Singh and Chaudhary (1985) and path coefficient analysis was done as per method suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSIONS

Heritability (h^2) and Genetic advance (GA)

Development of high yielding varieties requires a deep knowledge of the existing genetic variation for yield and its component characters. High heritability plays a major role in selecting suitable types based on their phenotypic performance. Genetic advance is indicative of the expected genetic progress for a particular trait under suitable selection procedure (Kaul and Garg, 1982). In the present study, the estimates of genotypic and phenotypic coefficients of variation, heritability and genetic advance of various characters of mungbean genotypes are presented in Table 1 and Figure 1.

Table 1. Genetic variability, Heritability and Genetic advance as per cent of mean for various quantitative traits in M_4 generation

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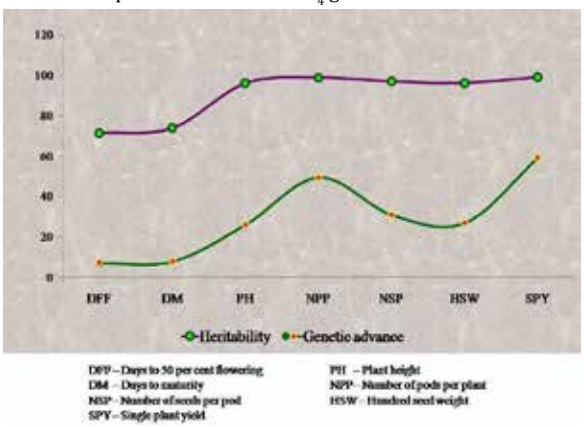
Traits	GCV	PCV	h^2	GA (% of mean)
Days to 50 per cent flowering	4.08	4.83	71.50	7.11
Days to maturity	4.39	5.10	74.03	7.78
Plant height	12.91	13.16	96.14	26.07
Number of pods per plant	24.15	24.29	98.90	49.48
Number of seeds per pod	15.21	15.44	97.04	30.86
100 seed weight	13.31	13.56	96.32	26.91
Single plant yield	28.85	28.97	99.17	59.18

GCV – Genotypic co-efficient of variation; h^2 – Heritability;
PCV – Phenotypic co-efficient of variation;
GA (% of mean) – Genetic advance as per cent of mean.

Figure 1. Heritability and Genetic advance (per cent of mean) for various quantitative traits in M_4 generation



The genotypic correlation coefficients were higher in magnitude than the corresponding phenotypic correlation coefficients for all the characters. High heritability was recorded for single plant yield (99.17), number of pods per plant (98.90), number of seeds per pod (97.04), 100 seed weight (96.32), plant height (96.14), days to maturity (74.03) and days to 50 per cent flowering (71.50). High genetic advance was noticed in single plant yield (59.18), number of pods per plant (49.48), number of seeds per pod (30.86), 100 seed weight (26.91) and plant height (26.07), then low genetic advance was observed in two traits namely days to maturity (7.78) and days to 50 per cent flowering (7.11). From the above discussion, the traits *viz*., single plant yield, number of pods per plant, number of seeds per pod, 100 seed weight and plant height possessed high heritability with high genetic advance indicating the preponderance of additive gene effects and rigorous selection may be posed on these traits for yield improvement. Same findings were also reported by Sharma (1999) and Natarajan and Rathinasamy (1999). High heritability with low genetic advance was present in days to 50 per cent flowering and days to maturity, so it indicated that non-additive gene action controlled these traits. This result was close agreement with Suresh *et al.* (2010).

Correlation and Path analysis

The inability to visually recognize small differences in quantitative traits among single plants led to frequent attempts to find associated traits more amenable to visual selection. The correlation coefficient provides a measure of the relationship between traits and serves to assess the chance for mutual improvement of two traits by common selection. The estimates of correlation coefficients between different characters of mungbean genotypes are presented in Table 2, single plant yield had highly significant positive correlation with number of pods per plant. It clearly revealed that this trait had significant effect on seed yield in mungbean. Similar results were also reported by Kingshlin and Vannirajan (2000).

Table 2. Genotypic (r_g) and phenotypic (r_p) correlation co-efficient of various quantitative traits in the mutants of CO 7 in M_4 generation

Traits	Correlation	Days to 50 per cent flowering	Days to maturity	Plant height	Number of pods per plant	Number of seeds per pod	100 seed weight	Single plant yield
Days to 50 per cent flowering	r_p	1.000	0.577**	0.045	0.002	0.063	-0.011	-0.001
	r_g	1.000	0.790**	0.048	0.001	0.074*	-0.023	0.000
Days to maturity	r_p		1.000	0.070	-0.017	0.055	-0.057	0.003
	r_g		1.000	0.088*	-0.020	0.066	-0.064	0.006
Plant height	r_p			1.000	0.223**	0.170**	-0.012	-0.038
	r_g			1.000	0.228**	0.177**	-0.012	-0.040
Number of pods per plant	r_p				1.000	0.072	0.042	0.248**
	r_g				1.000	0.075*	0.042	0.250**
Number of seeds per pod	r_p					1.000	0.036	0.057
	r_g					1.000	0.039	0.059
100 seed weight	r_p						1.000	-0.003
	r_g						1.000	-0.003
Single plant yield	r_p							1.000
	r_g							1.000

*Significant at 5% level, **Significant at 1% level.

r_g - Genotypic correlation co-efficient and r_p - phenotypic correlation co-efficient.

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The traits plant height had high positive significant correlation with number of pods per plant and number of seeds per pod. Likewise the days to 50 per cent flowering had highly significant positive association with days to maturity. The genotypic correlation for days to 50 per cent flowering and number of pods per plant had positive significant association with number of seeds per pod. Similar findings were reported in greengram by Baisakh *et al.* (1989), Seth *et al.* (1989) and Momin *et al.* (2004).

Path analysis of the component traits partitioned into direct and indirect effects that reflected on the nature of their associations and the relative importance of the component traits in determining the yield. Path coefficient analysis revealed that number of pods per plant had moderate direct effect on seed yield (Table 3). Remaining traits noticed negligible effect on single plant yield. Generally the indirect effects of all the traits were negligible. This was in accordance with earlier findings of Baisakh *et al.* (1989) and Seth *et al.* (1989).

Traits	Days to 50 per cent flowering	Days to maturity	Plant height	Number of pods per plant	Number of seeds per pod	100 seed weight	Single plant yield
Days to 50 per cent flowering	**-0.03317**	0.03416	-0.00547	0.00021	0.00435	0.00037	0.000
Days to maturity	-0.02620	**0.04324**	-0.01015	-0.00543	0.00386	0.00105	0.006
Plant height	-0.00158	0.00382	**-0.11495**	0.06245	0.01040	0.00020	-0.040
Number of pods per plant	-0.00003	-0.00086	-0.02625	**0.27342**	0.00441	-0.00069	0.250
Number of seeds per pod	-0.00245	0.00284	-0.02030	0.02048	**0.05887**	-0.00064	0.059
100 seed weight	0.00076	-0.00279	0.00139	0.01161	0.00230	**-0.01629**	-0.003

Residual effect: 0.28

CONCLUSION

In the conclusion, based on the variability parameters high heritability coupled with high genetic advance was governed by additive genetic effects to a great extent and improvement of it would be effective through selection. The traits namely days to 50 per cent flowering expressed non-additive gene interaction, hence it needs to be complex selection process and heterosis breeding would be recommended. Based on the correlation and path analysis, it is concluded that number of pods per plant and number of seeds per pod appeared to be the major yield contributing traits and it may be given due weightage during selection process to get increased yield in mungbean.

REFERENCE

Baisakh B, Mohapatra BK, Misra RC (1989). Variability and correlation and path coefficient analysis in mutant lines of greengram. Andhra Agric. J., 36: 182-186. | Burton GN (1952). Quantitative inheritance in grasses. Proceedings of 6th International Grassland Congress, 1: 277-283. | Dewey DR, Lu KH (1959). A correlation and path analysis of components of crested wheat grass seed production. Agron. J., 51: 515-518. | Gottschalk W (1972). Combination of mutated genes as an additional tool in plant breeding In: Induced mutations and plant improvement. Proc. Symp. IAEA, Vienna. | Johnson HW, Robinson HW, Comstock RE (1955). Estimates of genetic and environmental variability in soybean. Agron. J., 47: 314-318. | Kaul MLH, Garg R (1982). Radiation genetic studies in garden pea. I. Genetic variability, interrelationships and path analysis in protein rich genotypes. Biol. Zbl., 101: 271–82. | Khan IA (1979). Studies on mutagenesis in greengram (Phaseolus aureus Roxb.) Ph.D. Thesis, Osmania university, Hyderabad. Unpubl. | Kingshlin M, Vannirajan C (2000). Crop Res., 19: 102-105. | Lush JL (1940). Intrasire correlation and regression of offspring on dams as a method of estimating heritability of characters. Proc. American Soc. Animal Prod., 33: 293-301. | Momin BW, Misra RC (2004). Induced variability, character association and path co-efficient analysis in mutant cultures of greengram. Enviro. and Ecolo., 22(3): 608-611. | Natarajan C, Rathinasamy R (1999). Genetic variability, correlation and path analysis in blackgram. Madras Agric. J., 86(4-6): 228-231. | Sharma RN (1999). J. Interacademica, 3(1): 6-10. | Singh RK, Chaudhury BD (1985). Biometrical methods in quantitative genetic analysis. Kalyani Publishers, New Delhi, India, pp: 57-78. | Seth S, Chaudhary BD (1989). Irradiation for branching in mungbean (Vigna radiata). Indian J. Heredity, 21(1-2): 40-42. | Suresh S, Jebaraj S, Juliet Hepziba S (2010). Genetic studies in mungbean (Vigna radiata (L). Wilczek). Electronic Journal of Plant Breeding, 1(6): 1480-1482. | Swaminathan MS (1969). Role of mutation breeding in changing agriculture In: Induced mutations in plants (Proc. Symp. Pullman, 1969) IAEA, Vienna: 719-734.