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Variability Studies in M_2 of Sesame (*Sesamum indicum* L.)

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ABSTRACT: *Variability studies on yield and yield components of sesame genotype TMV 4 (Mutated with EMS and Sodium azide) in M_2 generation was carried out. Observations were recorded on five traits* viz., *days to flowering, plant height, number of branches, number of capsules per plant and seed yield per plant. Characters like plant height, number of capsules per plant and seed yield per plant exhibited high heritability coupled with high genetic advance revealing that these characters were controlled by additive gene action. High GCV and PCV were observed for number of branches, number of capsules per plant and seed yield per plant. The low and moderate PCV and GCV respectively were observed for days to flowering and plant height in the mutated population. The enhanced genetic variability that observed for seed yield characters in the M_2 generation of the present study indicated the scope for effective selection.*

Key words: *Sesame, Induced mutations, Genetic variability, Heritability.*

INTRODUCTION

Sesame (*Sesamum indicum* L.) is a traditional edible oilseed crop containing about 50-55 per cent oil, a balanced fatty acid with more or less equal per centage of 48 per cent of oleic acid and linoleic acid each. Low yield of sesame has been blamed mainly on limited genetic variability available in nature. In an effort to address this problem, induced mutation techniques have been applied to enhance genetic variability in the working collections. The genetic variability offered by the mutagenic agents is of extreme importance in plant breeding. Improvements in quantitative characters have been achieved through accumulation of genes affecting their expression in a positive or negative direction and thus, increasing the variability. An estimation of the extent of variability induced in M_2 generation will be of great value to provide useful information for carrying out further selection. Among different methods available to detect the induced variability in the mutated population, mean and components of variance serve as a suitable statistical parameters (Scossiroli, 1977). The genetic coefficient of variation together with heritability estimate would give the best picture of the amount of advance to be expected from selection. Hence, the present investigation was attempted to gather information on the impact of different mutagenic treatments on mean and components of variance in various quantitative characters.

MATERIAL AND METHODS

Sesame variety TMV4 was treated with chemical mutagens *viz.,* EMS (0.6, 0.8 and 1.0 %) and Sodium azide (5, 10 and 15 mM). The treated seeds along with their respective controls were sown immediately in the field to raise the M_1 generation at TNAU, Coimbatore during January – April, 2009. Each M_1 plant was harvested individually and raised as M_2 progeny in separate rows during July – October, 2009. The spacing between rows and plants were 30 and 30 cm, respectively. Recommended cultural operations were adopted at appropriate stages during the entire crop growth period. Data on five quantitative characters *viz.,* days to flowering, plant height (cm), number of branches, number of capsules per plant and single yield per plant (g) from all the plants of each M_2 family were recorded and the mean and variance were calculated. The method adopted by Sivasubramanian and Madhava Menon (1973) was used to calculate phenotypic and genotypic co-efficient of variation. Heritability in the broad sense was derived based on the formula given by Robinson *et al.* (1949). Genetic advance was obtained by the formula prescribed by Johnson *et al.* (1955).

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Table 1
Mean and Variability Parameters of Various Treatments for Different Quantitative Traits in M_2 Population of TMV 4

Treatment	Days to flowering				Plant height (cm)				Number of branches				Number of capsules				Seed yield per plant (g)			
	Mean	*GCV*	*h^2*	*GAM*	*Mean*	*GCV*	*h^2*	*GAM*	*Mean*	*GCV*	*h^2*	*GAM*	*Mean*	*GCV*	*h^2*	*GAM*	*Mean*	*GCV*	*h^2*	*GAM*
EMS																				
0.6%	42.8	1.4	58.9	2.2	91.6	15.2	59.1	24.1	5.2 a	17.0	32.9	20.1	44.0[a]	51.0	90.2	99.8	1.3a	98.4	95.4	198.0
0.8%	43.5	2.1	77.2	3.8	92.1	14.4	56.7	22.3	5.1[a]	23.9	48.2	34.2	40.9[a]	44.4	85.7	84.7	1.5[a]	92.3	95.7	186.0
1.0%	43.0	3.3	88.7	6.3	85.8[a]	16.8	60.7	27.0	5.2[a]	13.6	23.9	13.8	45.3[a]	34.9	82.0	65.1	1.4[a]	97.9	95.8	197.4
SA																				
5mM	44.3	2.9	86.9	2.5	88.9	13.7	52.2	20.3	5.4[a]	12.1	21.2	11.4	47.7[a]	32.2	81.2	59.8	1.4[a]	86.7	94.7	173.9
10mM	44.1	3.1	88.3	2.7	89.7	9.6	35.4	11.8	4.4	26.9	47.0	38.0	38.9[a]	45.3	84.9	86.0	1.1[a]	178.4	97.9	363.5
15mM	44.0	2.8	86.2	2.4	88.3	9.4	33.8	11.3	4.6[a]	26.2	47.6	37.3	32.0	44.5	78.6	81.3	1.1[a]	122.3	96.0	246.9
Control	41.8				73.8				5.8				44.3				1.4			

* Significantly higher than control (TMV 4) (P=0.05) a - Significantly on par with control TMV 4 (P=0.05)

RESULTS AND DISCUSSION

The effect of mutation can be adjudged simply from the mean values as it gives a direct measure about the induction of mutagens. In this study, the mean value for different characters of the treated population was found to be shifted in both positive and negative directions from the control due to mutagenic treatments (Table 1). The mean values for days to flowering and plant height were more than the control whereas, the mean values for number of branches, number of capsules per plant, seed yield per plant decreased below the control in most of the treatments.

Borojevic (1971) stated that the positive shift in mean values might be due to the effect of natural selection and elimination of chromosomal aberrants. Similarly the negative shift may be due to more frequent occurrence of detrimental mutants than the favourable ones as observed by Bhatia and Swaminathan (1962).

Seed yield is a complex character and influenced by many other quantitative characters. Most of these characters have a complex genetic determination involving a large number of genes interacting with one another. Consequently, variation in both directions is to be expected. The another reason for the shift in mean value for both positive and negative directions for various characters may be due to the increase in genes with positive effects over that of negative effects and vice versa. The positive shift in the mean values of different characters indicated the potentialities of mutant population for further improvement.

The genotypic co-efficient of variation were high for seed yield/plant, number of branches and number of capsules/plant and high genotypic co-efficient of variation suggest that these characters are under the influence of genetic control. Therefore, these characters can be relied upon and simple selection can be practiced for further improvement. Similar results were reported by Sheeba *et al*. (2004), Parameshwarappa *et al.* (2009) and Vasline and Ganesan (2008). The low and moderate GCV were observed for days to flowering and plant height in the mutated population. It indicated that the creation of genetic variation for these traits are low/moderate and improvement upon selection will be low/moderate.

In the present study, seed yield per plant recorded higher GCV followed by number of capsules per plant. Such pronounced variability for yield and yield attributes was already recorded in sesame by Prabhakar (1985) and Govindarasu and Ramamoorthi (2000). The enhanced genetic variability that observed for seed yield characters in the M_2 generation of the present study indicated the scope for effective selection.

Among the characters investigated in the present study, high heritability accompanied with high genetic advance as per cent of mean was observed for traits plant height, number of capsules per plant and seed yield per plant. This is in conformity with Gandhara (2005), Kumhar *et al*. (2008) and Parameshwarappa *et al.* (2009). This indicated that these characters are governed largely by additive gene effect, which may favourably be exploited in the M_2 generation through selection.

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