GENETIC ANALYSIS OF THE INDUCED MUTANT, INVOLVING MONOSTEM / SHY BRANCHING IN SESAME (SESAMUM INDICUM L.)

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Abstract: Five diverse sesame genotypes *viz*., TMV 4, TMV 7, VRI 2, Thilak and TNY Local were treated with both physical (γ-rays) and chemical (EMS) mutagens separately. Five doses of γ-rays (300, 350, 400, 450 and 500 Gy) and four doses of EMS (0.7, 1.0, 1.4, 1.6%) were applied to each of the five genotypes involving branching and semi branching types. Observations were recorded on days to 50% flowering, days to maturity, plant height, number of branches per plant, number of capsules per plant, capsule length, number of seeds per, 100 seed weight, seed yield per plant and oil content. The traits, number of branches per plant, number of capsules per plant and seed yield per plant showed high PCV and GCV estimates. There is enough scope for selection based on these characters, and the diverse genotypes can provide materials for a sound breeding programme. High heritability combined with high genetic advance (as per cent of mean) observed for plant height, number of branches, number of capsules and seed yield per plant showed that these characters were controlled by additive gene effects and phenotypic selection for these characters would likely to be effective. The characters, plant height, number of branches per plant, number of capsules per plant, days to 50% flowering, days to maturity and 100 seed weight showed significantly positive correlation with seed yield per plant. The trait number of seed per capsule showed significantly negative association with seed yield per plant.

Keywords: Monostem/Shy branching. Induced Mutant. Heritability. Association Analaysis.

Introduction: Sesame is one of the important and world's oldest edible oilseed crops. Though sesame occupies a place of prominence among oilseeds, its production has been relatively low as compared to other oilseed crops. The major constraints identified for most of the countries including India are, instability in yield, shattering, lack of wider adaptability, drought, non – synchronous maturity etc. The branched varieties need more space per plant and hence maintenance of population is very difficult in the commercial planting. This also poses serious problem in the countries where mechanical harvesting is restored. It is preferable to have uniculm / monostem / shybranching lines for high-density population for productivity improvement per unit area. Development of improve variety is one of the best methods to increase the yield in sesame. The success of any crop improvement programme essentially depends on the nature and magnitude of variability present in the crop. The knowledge onnature and magnitude of genetic variability is ofimmense value for planning effective breedingprogramme to improve the yield potential of the genotypes. The study of interrelationship of yield components is imperative to enable the selection of sesame genotypes. The present investigation was carried out to gather information on variability, heritability and genetic advance and to design the association between yield and yield components in mutants.

Materials and methods: Experimental material for the present study consisted of five sesame genotypes involving five branched/semi branched TMV 4, TMV 7, VRI 2, Thilak and TNY Local were treated with mutagenic treatments crossed in line x tester mating design . The resulting 30 hybrids along with their parents were raised during kharif 2005 at Department of oilseeds, Centre for Plant Breeding and Genetics, TNAU, Coimbatore, in a randomized block design with three replications. Each plot consisted of three rows of 4m length spaced at 45 cm between rows and 30 cm between plants. Normal recommended cultural practices and plant protection measures were followed. Ten competitive plants were randomly selected for recording biometrical observations on days to 50% flowering, days to maturity, plant height, number of branches per plant, number of capsules per plant, capsule length, number of seeds per capsule, 100 seed weight, single plant yield and oil content. The data were subjected to statistical analysis. The phenotypic and genotypic coefficient of variability was computed as per Burton, 1952. Heritability in broad sense was computed by the formula suggested by Lush (1940).Genetic advance was worked out as per the formula given by Johnson et al., (1955). Correlation coefficients for yield and yield components were evaluated utilizing the formula suggested by Aljibouri et al., (1958).

Result and Discussion : Analysis of variance revealed highly significant differences among genotypes for all the characters except capsule length indicating considerable amount of genetic variation present in the material. High magnitude of variation in the experimental material was reflected by high values of mean and range for almost all the characters.The minimum number of branches was observed for the mutants, VRI 2 and TMV 7 which is ranged from 2-4 branches. The monostem /

shybranching of isolated mutant Thilak and TMV 4 showed 0 to 2 numbers of branches only. The maximum numbers of branches were shown by the branched type parent Tirunelveli Local. The estimates of genetic parameters like genotypic coefficient of variation, heritability and genetic advance are presented in table 1. Perusal of the data indicates that the traits plant height, number of capsules per plant and seed yield per plant recorded highest phenotypic and genotypic variation than the other characters studied. Coefficient of variation: The phenotypic coefficient of variation (PCV) was greater than genotypic coefficient of variation (GCV) for all the characters studied, indicating that the environment had an important role in the expression of these characters. The traits, number of branches per plant, number of capsules per plant and seed yield per plant showed high PCV and GCV estimates. There is enough scope for selection based on these characters, and the diverse genotypes can provide materials for a sound breeding programme. Saravanan et al., (2003) and Solanki and Deepak Gupta (2003) reported high coefficient of variation for number of branches per plant and number of capsules per plant. High coefficient of variation for number of capsules per plant was also reported by Anitha vasline (2000).

Plant height showed moderate PCV and GCV and the other traits recorded low PCV and GCV. Sudhakar et al. (2007) and Shadakshari et al. (1995) reported low phenotypic and genotypic coefficient of variation for the characters days to fifty per cent flowering, days to maturity and oil content. Low coefficient of variation for number of seeds per capsule was reported by Thangavel et al., (2000).

Heritability: The heritability estimates obtained were high for all the characters studied except capsule length, which recorded very low heritability for the selected mutant hybrids and parents. Estimates of heritability and genetic advance in combination are more important for selection than heritability alone. High heritability combined with high genetic advance (as per cent of mean) observed for plant height, number of branches, number of capsules and single plant yield showed that these characters were controlled by additive gene effects and phenotypic selection for these characters would likely to be effective. Similar results were reported by Reddy et al. (2001) and Krishnaiah et al. (2002).The improvement of the characters days to fifty per cent flowering, days to maturity, number of seeds per capsule and 100 seed weight also possible since these characters had high heritability and moderate genetic advance as per cent of mean. The traits capsule length and oil content showed high heritability with low genetic advance. These results are in conformity with the findings of Reddy et al. (2001) and Sudhakar et al. (2007). The trait capsule breadth showed low heritability and low genetic advance such situation may arise due to non additive gene action.

Association analysis: Yield is a complex quantitative trait, greatly influenced by environmental fluctuations. Hence, selection based on yield performance alone may indicate a biased result and leads to ambiguity. A study of nature and degree of association of component characters with yield assumes greater importance for fixing up characters that play a decisive role in influencing yield. Selection would therefore be more effective, if it is based on component characters rather than directly on yield. Correlation coefficient analysis measures the mutual relationship between various characters and is used to determine the component character on which selection can be done for improvement in yield.

The characters plant height, number of branches per plant, number of capsules per plant, days to 50% flowering, and 100 seed weight showed significantly positive correlation with seed yield per plant (Table 2). The trait days to maturity and oil content showed significantly negative association with single plant yield . Similar results were reported by Pawar et al. (2002); and Deepa Sankar and AnandaKumar (2003) for plant height; Ramireddy Kumar and Sundaram (2002) and Deepa Sankar and Ananda Kumar (2003) for number of branches; Ramireddy Kumar and Sundaram (2002), Pawar et al. (2002) and Deepa Sankar and Ananda Kumar (2003) for number of capsules per plant. The trait plant height showed significantly positive correlation with the traits number of branches per plant, number of capsules per plant, days to 50% flowering, days to maturity and 100 seed weight. Earlier reports of Ramireddy kumar and Sundaram (2002) and Deepa Sankar and Ananda kumar (2003) revealed the positive association of plant height with number of branches pre plant and number of capsules per plant. The trait, number of branches per plant showed significantly positive inters correlations with number of capsules per plant, days to 50% flowering, days to maturity, 100 seed weight. Reddy et al., (2001) and Pawar et al., (2002) reported the positive association of number of branches per plant with number of capsules per plant. Similarly, the trait, number of capsules per plant recorded positive correlation with 50% flowering, days to maturity, 100 seed weight but it showed negative significant association with capsule length. Days to 50 per cent flowering showed positive association with days to maturity and negative association with capsule length, days to maturity revealed positive association with 100 seed weight and number of seeds per capsule showed positive association with capsule length. The present study indicated that the selection based on the characters, plant height, number of branches per plant, number of capsules per plant, and seed yield per plant would

be effective for the development of superior sesame variety through recombination breeding.

Figure 1. Monostem observed in M_2 generation

Table 1. Estimation of genetic parameters for different traits of selected mutants (monostem type) in M_3 generation (gamma rays) of Thilak

Characters	Mean	Range	PV	GV	PCV	GCV	h^2 (%)	GA % mean
Days to first flowering	29.85	28.00 - 39.00	6.13	5.20	8.29	7.64	84.83	14.49
Plant height (cm)	93.34	70.80 - 112.00	115.47	102.55	11.51	10.85	88.81	21.06
Number of capsules per	46.60	25.00 - 62.00	92.48	32.83	20.64	12.30	35.50	15.09
Capsule length (cm)	3.20	2.80 - 3.90	1.85	1.03	42.52	31.73	55.68	48.76
Number of seeds per	41.40	32.00 - 53.00	41.66	28.32	15.59	12.85	67.99	21.83
Days to maturity	80.85	78.00 - 90.00	6.47	6.07	3.15	3.05	93.82	6.08
Oil content (%)	44.69	39.50 - 48.45	7.79	7.46	6.24	6.11	95.81	12.32
1000 seed weight (g)	3.42	2.77 - 4.00	0.12	0.08	10.09	8.48	70.59	14.67
Single plant yield (g)	3.09	1.91 - 4.29	0.51	0.36	23.02	19.34	70.61	33.48

Table 2. Genotypic correlation coefficients among different characters of selected mutants (monostem and high yielding mutants) in M_3 generation (gamma rays) of Thilak

Characters	Days to first flowering	Plant height (cm)	Number of capsules per plant	Capsule length (cm)	Number of seeds per capsule	Days to maturity	Oil content (%)	1000 seed weight (g)	Single plant yield (g)
Days to first flowering	1.000	-0.291	0.132	0.356	-0.208	0.745**	0.023	0.043	0.114
Plant height (cm)		1.000	0.583**	0.442*	0.697**	0.038	-0.069	0.597**	0.682**
Number of capsules per plant			1.000	0.494*	-0.079	-0.301	0.203	0.228	0.398*
Capsule length (cm)				1.000	0.561**	0.045	-0.097	0.209	0.417*
Number of seeds per capsule					1.000	-0.358	0.065	0.531*	0.623**
Days to maturity						1.000	-0.018	-0.133	-0.502*
Oil content (%)							1.000	-0.029	-0.094
1000 seed weight (g)								1.000	0.433*
Single plant yield (g)									1.000

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