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ANALYSIS OF GENETIC VARIABILITY, ASSOCIATION AND PATH ANALYSIS IN THE HYBRIDS OF SESAME (*SESAMUM INDICUM L*)

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ABSTRACT

A field experiment was conducted with thirty hybrids produced by line x tester mating design from eleven sesame genotypes involving five branched and six monostem / shy 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, capsule breadth, number of seeds per plant, 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 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. Seed yield per plant showed significantly positive correlation with plant height, number of branches per plant, number of capsules per plant, days to 50% flowering, days to maturity and 100 seed weight. Capsule breadth showed significantly negative association with seed yield per plant.

Key words: Sesame, variability, co-efficient of variation, heritability and Genetic Advance

INTRODUCTION

Sesame is one of the important and world's oldest edible oilseed crops. It is the 6th most important oilseed crop grown in India. 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, lack of wider adaptability, drought, non – synchronous maturity etc. As sesame's world production has to be maintained and even expanded, several key breeding objectives must be attained. Efforts to develop enhanced germplasm for use by the breeders in crop improvement are therefore a necessity. It is essential to generate more variability. The success of any crop improvement programme essentially depends on the nature and magnitude of variability present in the crop. 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 determine the association between yield and yield components in hybrids and parents including branched and single stemmed genotypes of sesame.

MATERIALS AND METHODS

Experimental material for the present study consisted of eleven sesame genotypes involving five female parents, CO 1, Paiyur 1, TMV 3, TMV4, TMV5, (branched) and six male parents viz., MT 34, Cordebergea, KS 990812, KS 99037, KS 990813 and KS 99153 and were 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 measurements on days to 50% flowering, days to maturity, plant height, number of branches per plant, number of capsules per plant, capsule length, capsule breadth, number of seeds per plant, 100 seed weight, seed yield per plant 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 ad-

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vance 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 Al-jibouri *et al*, (1958).

RESULTS AND DISCUSSION

Analysis of variance revealed highly significant differences among genotypes for all the characters except capsule breadth (Table 1) 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 estimates of genetic parameters like genotypic coefficient of variation, heritability and genetic advance are presented in table 2. Data indicate 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.

Table 1. Analysis of variance for different characters in sesame

Sl. No	Characters	Mean squares		
		Replication	Treatment	Error
1	Plant height (cm)	406.02	1345.88**	105.07
2	No. of primary branches per plant	8.31	25.14**	3.93
3	No. of capsules/ plant	536.46	6508.04**	317.43
4	Days to 50% flowering	108.11	50.80**	14.78
5	Days to maturity	58.12	82.62**	3.23
6	No. of seeds/ capsule	136.72	98.11**	31.83
7.	100 seed weight (g)	0.00019	0.0018**	0.0003
8.	Capsule length (cm)	0.00098	0.0632**	0.0096
9.	Capsule breadth (cm)	0.005	0.0033	0.0029
	Oil content(%)	1.008	4.145**	0.5351
10.	Seed yield/ plant	24.78	144.68**	12.97

*Significant at 5% ** Significant at 1%

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 and Nadarajan (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 *et al.,* (2000). Plant height showed moderate PCV and GCV and the remaining 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 co efficient of variation for number of seeds per capsule was reported by Thangavel *et al*., (2000).

HERITABILITY

The heritability estimates obtained (Table 2) were high for all the characters studied except capsule breadth, which recorded very low heritability for these 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 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. 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 is also possible since these characters had high heritability and moderate genetic advance as per cent of mean. 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. Capsule breadth showed low heritability and

low genetic advance which may be 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 give 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.

Seed yield per plant showed significantly positive correlation with plant height, number of branches per plant, number of capsules per plant, days to 50% flowering, days to maturity and 100 seed weight (Table 3). Capsule breadth showed significantly negative association with seed yield per plant. Similar results were reported by Pawar *et al*. (2002); and Sankar and Kumar (2003) for plant height; Ramireddy Kumar and Sundaram (2002) and Sankar and Kumar (2003) for number of branches; Ramireddy Kumar and Sundaram (2002), Pawar *et al*. (2002) and Sankar and Kumar (2003) for number of capsules per plant.

Plant height showed significantly positive correlation with 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 Sankar and Kumar (2003) revealed the positive association of plant height with number of branches per plant and number of capsules per plant. Number of branches per plant showed significantly positive inter - 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

Table 2. Estimates of parameters of variability for yield and its components

Characters	Mean	Range	Genotypic variance	Phenotypic variance	Genotypic coefficient of variation	Phenotypic coefficient of variation	Heritability %	Genetic advance as percent of mean	SE
Plant height (cm)	121.26	48.6-153.7	413.60	448.63	16.77	17.47	92.2	33.17	8.37
No. of primary branches / plant	6.66	0.33-11.87	7.07	8.38	39.94	43.48	84.4	75.56	1.62
No. of capsules/ plant	152.85	21.1-22.6	2063.54	2169.35	29.72	30.47	95.12	59.71	14.55
Days to 50% flowering	46.28	35.3-52.3	12.01	16.93	7.49	8.89	70.90	12.99	3.14
Days to maturity	86.15	74.3-94.3	26.46	27.54	5.97	6.09	96.1	12.06	1.47
No. of seeds/ capsule	56.63	40.6-65.2	22.09	32.70	8.93	10.87	67.6	15.12	4.61
100 seed weight (g)	0.33	0.29-0.38	0.0005	0.0006	6.81	7.39	84.9	12.91	0.01
Capsule length (cm)	2.58	2.33-2.97	0.02	0.02	5.18	5.62	84.9	9.82	0.08
Capsule breadth (cm)	0.72	0.67-0.80	0.0011	0.0011	1.57	4.57	11.75	1.10	0.04
Oil content (%)	41.59	39.3-43.73	1.38	1.38	2.64	2.83	87.1	5.07	0.59
Seed yield/ plant (g)	21.04	5.8-30.9	48.23	48.23	31.49	33.00	91.0	61.89	2.94

Table 3. Genotypic correlation coefficients between different characters in sesame

Characters	Plant height	No. of branches/ Plant	No. of capsules/ plant	Days to 50% flowering	Days to maturity	No. of seeds/ capsule	100 seed weight	Capsule length	Capsule breadth	Oil content	Seed yield /plant
Plant height	1.000	0.949**	0.860**	0.872**	0.894**	-0.163	0.632*	-0.323	-0.333	0.407	0.824**
No. of primary branches		1.000	0.833**	0.919**	0.976**	-0.349	0.701**	-0.3628	-0.415	0.241	0.835**
No. of capsules/ plant			1.000	0.741**	0.772**	-0.1855	0.601	-0.2834	-0.786**	0.293	0.92**
Days to 50% flowering				1.000	0.947**	-0.2358	0.429	-0.595*	-0.1900	0.308	0.682**
Days to maturity					1.000	-0.3523	0.547	-0.4153	-0.548*	0.366	0.766**
No. of seeds/ capsule						1.000	-0.204	0.594*	0.2814	0.434	-0.031
100 seed weight							1.000	-0.2392	-0.883**	0.094	0.566**
Capsule length								1.000	0.0074	-0.205	-0.263
Capsule breadth									1.000	-0.477	-0.953**
Oil content										1.000	0.413

Significant at P = 0.05** * Significant at P = 0.01**

Table 4. Direct and indirect effects of different characters towards grain yield at genotypic level in Sesame

Characters	Plant height	No. of primary branches	No. of capsules/ plant	Days to 50% flowering	Days to maturity	No. of seeds/ capsule	100 seed weight	Capsule length	Capsule bredth	Oil content
Plant height	**1.22**	1.15	1.04	1.06	1.08	-0.20	0.77	-0.39	-0.404	0.494
No. of primary branches	-2.98	**-3.14**	-2.61	-2.88	-3.06	1.096	-2.20	1.14	1.30	-0.76
No. of capsules/ plant	0.44	0.42	**0.51**	0.38	0.39	-0.094	0.30	-0.14	-0.398	0.15
Days to 50% flowering	0.83	0.87	0.71	**0.95**	0.90	-0.22	0.41	-0.57	-0.18	0.294
Days to maturity	1.12	1.22	0.97	1.18	**1.25**	-0.44	0.68	-0.52	-0.69	0.46
No. of seeds/ capsule	0.03	0.06	0.03	0.04	0.06	**-0.16**	0.032	-0.09	-0.045	-0.07
100 seed weight	0.33	0.37	0.32	0.23	0.29	-0.12	**0.53**	-0.12	-0.47	0.05
Capsule length	-0.13	-0.14	-0.11	-0.24	-0.17	0.24	-0.095	**0.398**	0.003	-0.08
Capsule breadth	0.06	0.074	0.14	0.03	0.098	-0.05	0.16	-0.001	**-0.179**	0.09
Oil content	-0.09	-0.05	-0.06	-0.07	-0.08	-0.092	-0.02	0.043	0.101	**-0.21**
Seed yield /plant	0.82	0.83	0.92	0.68	0.77	-0.03	0.57	-0.26	-0.96	0.42

Residual effect = 0.5154 Bold figures are direct effects

plant. Similarly, number of capsules per plant recorded positive correlation with 50% flowering, days to maturity, 100 seed weight but showed negatively significant association with capsule breadth. Days to fifty 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. Path analysis (Table 4) revealed that plant height, number of capsules per plant, days to fifty per cent flowering, days to maturity, 100 seed weight and capsule length showed positive direct effect to seed yield. While number of branches, number of seeds per capsule, capsule breadth and oil content showed only negative direct effect on seed yield. Positive association of number of branches per plant on seed yield is due to the indirect effect of plant height, capsules per plant, days to flowering and maturity.

The present study suggested 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 sesame through breeding.

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