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LINE X TESTER ANALYSIS IN SESAME (Sesamum indicum L.)

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ABSTRACT

In a line x tester analysis involving 15 lines and 4 testers in sesame (**Sesamum indicum** L.), combining ability was estimated for nine traits. Predominance of SCA variance over GCA variance indicated that these traits might be controlled predominantly by non additive gene action. Biparental mating followed by recurrent selection might hasten the rate of genetic improvement of these traits in sesame.

KEY WORDS : Sesame, Combining ability.

Combining ability studies reveal the nature of gene action and lead to identification of parents with high general combining ability effects and the cross combinations with high specific combining ability effects. This in turn helps in choosing the parents to be included in a hybridization or population breeding programme. Among the different biometrical methods employed to study combining ability, the one proposed by Kempthorne (1957) known as the line x tester analysis was followed in this analysis.

MATERIALS AND METHODS

Fifteen lines (Anand 74, Gujsel 38, C6, C7, VS2, VS16, VS 81, TSS 3, TSS 4, TSS 5, DPI 1474, DPI 1484, TNAU 6, TNAU 11 and TNAU 12) and four testers (Co 1, TMV 3, TMV 5 and TMV 6) maintained at the School of Genetics, Tamil Nadu Agricultural University, Coimbatore were utilized for the study.

The study was conducted at the garden lands of the college farm, Agricultural College and Research Institute, Madurai. In the hybridization block, fifteen lines and four testers were raised and crossed. In the selfing block all the ninteen parents were raised and selfed. The resultant sixty hybrids and nineteen parents were raised in single rows in a randomized block design with two replications at ten plants per row. Observations on yield and other traits such as plant height, number of primary branches, number of secondary branches, photosynthetic efficiency (measured with the help of ADC infra red carbon dioxide analyser - Model LCA 2 under open air system), number of capsules per plant, 1000 seed weight, days to maturity and dry matter production were recorded.

Analysis of mean and variance was done for all the characters and the significance was tested (Panse and Sukhatme, 1964). For estimating the general and specific combining ability effects, the method described by Kempthorne (1957) was adopted.

RESULTS AND DISCUSSION

The variance of the genotypes for the nine traits studied were highly significant which indicated wide variability among the genotypes for the different traits (Table 1). The variances due to lines, due to testers and due to line x tester interaction were significant which showed that both additive and non additive gene actions might be involved in the inheritance of the traits studied (Table 2).

A high *gca* effect for a particular trait of a parent indicates the additive gene effect

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Table 1. Analysis of variance for parents and hybrids.

Source	df	Plant height	No.of primary Branches	No.of secondary branches	Photo sythetic efficiency	No.of capsules per plant	No.of days to maturity	Thou sand seed weight	Seed Yield/ plant	Dry matter production
Replications	1	7.42	0.0063	0.08	17757.11	1.68	0.02	0.0058	0.00072	0.84
Genotypes	78	265.51**	4.24**	7.57**	1560687.27**	521.40	24.53**	0.50**	9.51**	105.55**
Error	78	2.37	0.0088	0.02	3037.56	0.60	0.02	0.004	0.00015	0.05

*, ** Significant at 1 percent levels

for the trait governed by the genes in the parent concerned. It could be expected that when parents possessing high *gca* effects were combined by hybridization, a large proportion of progenies would have high value for the trait concerned facilitating easy selection for the trait. Based on the *gca* effects of the parents, a score chart was prepared. The total score for each parent over the characters was worked out for the classificaton of the parents as high or best combiner and low or poor combiner (Thenmozhi, 1983). Among the lines, TSS 5 was found to be best combiner for all the nine traits studied. With regard to the testers, TMV 3 was the best combiner as it recorded high ratings for six traits.

The genetic nature of a trait could be evaluated under the genetic backgrounds of parents chosen in the study. With regard to traits such as plant height, number of primary branches, number of secondary branches, photosynthetic efficiency, number of capsules per plant, 1000 seed weight and dry matter production, the hybrids which registered superior *per se* performance had parents with high positive *gca* effects as well as with high positive *sca* effects. The early maturing hybrids combined in them high negative *gca* effects of the parents and their high negative *sca* effects (Tables 3 and 4).

It was also obvious that the hybrids with the highest *per se* performance did not record the highest *sca* effect in them. This could be expected since the *gca* effects are only the estimates. Further, the *sca* effect in a cross represented a deviation from the average *gca* effects of its two parents and the large *sca* effect need not necessarily result in exceptional performance of a cross as reported by Chandramohan (1979).

These results indicated that both additive and interaction effects might govern the inheritance of the nine traits studied. However, these traits appeared to be controlled predominantly by non additive gene action as evidenced by the high SCA variance compared to GCA

Table 2. Analysis of variance for combining ability

Source	df	Plant height	No.of primary Branches	No.of secondary branches	Photo-synthetic efficiency	No.of capsules per plant	No.of days to maturity	Thou-sand seed weight	Seed Yield/ plant	Dry matter produc-tion
Replications	1	7.42	0.0063	0.08	17757.11	1.68	0.02	0.0058	0.00072	0.84
Crosses	59	226.01**	4.39**	8.25**	1731879.94**	612.30**	31.46**	0.48**	11.29**	113.28**
Lines	14	626.06**	3.20**	15.64**	5240645.83**	2242.93**	87.70**	0.86**	33.53**	353.74**
Testers	3	287.73**	10.48**	3.27**	173138.88**	80.11**	22.94**	0.70**	7.41**	8.69**
Lines x Testers	42	88.25**	4.12**	6.15**	673629.96**	106.77	13.32**	0.33**	4.16**	40.60**
Error	78	2.37	0.0088	0.02	3037.56	0.60	0.02	0.0041	0.00015	0.05

*, ** Significant at 1 percent levels

Table 3. Means performance and combining ability effects of lines, testers and hybrids for yield and related traits.

Traits		Plant height	No.of primary branches	No.of secondary branches	No.of capsules per plant	P.E. (mg Co_2 m^{-2} hr^{-1})	Seed Yield/ plant	1000 seed weight	Days to maturity	Dry matter production (g)
Range of performance	Lines	78.52 to 107.63	3.38 to 6.00	0.10 to 4.35	21.80 to 89.40	13.50 to 4481.25	2.25 to 11.02	2.27 to 3.45	80.95 to 92.50	8.63 to 31.55
	Testers	86.53 to 93.25	3.60 to 5.04	1.80 to 2.50	32.09 to 34.35	1994.16 to 2172.50	3.89 to 4.89	2.78 to 3.11	84.19 to 86.00	15.33 to 16.47
	Hybrids	60.80 to 114.20	2.00 to 8.00	0.0 to 6.7	16.30 to 100.40	937.50 to 5812.50	1.43 to 14.02	1.49 to 4.20	77.30 to 92.70	4.70 to 34.10
goa	Lines	-10.56 to 18.55	-0.97 to 1.65	-2.09 to 2.15	-11.83 to 55.76	-743.34 to 2387.92	-2.14 to 6.62	-0.53 to 0.55	-4.29 to 7.25	-5.59 to 15.71
	Testers	-2.55 to 4.17	-0.74 to 0.07	-0.40 to 0.30	-1.54 to 1.71	-99.20 to 79.17	-0.50 to 0.49	-0.12 to 0.20	-1.05 to 0.75	-0.50 to 0.64
sca		-15.58 to 17.17	-3.06 to 3.21	-3.40 to 3.22	-14.50 to 14.94	-754.17 to 1368.75	-3.50 to 3.03	-0.99 to 0.60	-10.30 to 5.39	-6.68 to 12.15

*, ** Significant at 1 percent levels

variance. Besides, the performance of dominance genetic component over the additive component was recorded for all the traits (Table 5). That the SCA variance was more than the GCA variance was reported for plant height by Shrivas and Singh (1978) and Krishnadoss (1984), for number of primary branches and secondary branches by Singh *et al.* (1983), for number of capsules per plant, seed yield per plant by Reddi *et al.* (1982) and Krishnadoss (1984), for 1000 seed weight and days to maturity by Krishnadoss (1984).

Improvement of the traits studied might be possible by the simultaneous exploitation of both additive and non additive genetic compouents. Hence,

Table 4. Superior hybrids based on the per se performance

Trait	Cross	g_i	g_j	sca	par se performance
Plant height	TNAU 12 x TMV 5	12.17**	4.17**	8.76**	114.20**
No. of primary branches	VS 81 x TMV 5	0.15**	0.70**	2.80**	8.0**
	TSS 5 x TMV 5	1.65**	0.70**	1.30**	8.0**
No. of secondary branches	Gujsel 38 x TMV 3	1.35**	0.30**	2.84**	6.7**
Photosynthetic efficiency	DPI 1474 x TMV 5	2387.92**	32.50	1298.75**	5812.50**
No. of capsules/plant	DPI 1474 x TMV 5	55.76**	1.71**	9.29**	100.40**
Seed yield per plant	DPI 1474 x TMV 3	6.62**	0.49**	2.49**	14.02**
Thousand seed weight	TSS 5 x TMV 3	3.38**	3.11*	0.60**	4.20**
Days to maturity	C7 x TMV 5	-4.29**	-0.39**	-3.26**	77.30**
Dry matter production	DPI 1474 x TMV 5	15.71**	-0.38**	2.93**	34.10**

g_i - gca of female parent g_j - gca of male parent

Table 5. Genetic components of additive and dominance variances for yield and yield components

Characters	σ^2A		σ^2A	
	F = 0	F = 1	F = 0	F = 1
Plant height	9.48	4.74	693.32	150.83
No. of primary branches	0.016	0.008	12.20	3.05
No. of secondary branches	0.12	0.06	15.80	3.95
Photosynthetic efficiency	72727.72	36363.86	3591592.40	897898.10
No. of capsules/plant	34.76	17.38	1398.56	349.64
Seed yield per plant	0.48	0.24	27.00	6.75
Thousand seed weight	0.0096	0.0048	1.16	0.29
No. of days to maturity	1.24	0.62	74.72	18.68
Dry matter production	5.00	2.50	236.92	59.23

σ^2A - additive variance σ^2D - f emale parent F - inbreeding coefficient

biparental mating followed by recurrent selection might hasten the genetic improvement of these traits in sesame.

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GENETICS OF YIELD AND ITS COMPONENTS IN MAIZE (*Zea mays* L.)

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ABSTRACT

Combining ability for yield and yield components in all ten characters were studied in a set of 10 inbred lines and their all possible direct single crosses. Non additive gene action was predominant for plant height, ear height, ear length, ear girth, number of rows per ear, number of grains per row, number of grains per ear, 1000 grain weight, grain weight of 5 ears and yield per plot, though both GCA and SCA variances were significant. Three inbreds **viz.**, X 102, A-670 and H - 98 were found to be good general combiners for grain yield. Single crosses 1 x 4, 8 x 9 and 2 x 8 had exhibited high sca effects as well as high yields. The selection of inbreds may be made based on their **gca** and **sca** effects simultaneously and breeding approaches which exploit both these genetic parameters may be practised in the materials reported.