

Combining Ability and Heterosis for Quantitative Characters in Sesame

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Abstract: Line x tester analysis involving 10 female and 3 male lines from diverse origin revealed that additive gene action was predominant. Variety RT-127, among the male parent, was the best general combiner for all the characters, except early flowering. Among the female parents, SI-718 for seed yield, EC-371832 for capsules per plant, ES-1-2-84 for 1000-seed weight, EC-351819 for plant height and capsules bearing plant height, ES-123-1-84 for early maturity were the best general combiner. The crosses EC-370823 x RT-127, EC-370663 x RT-127, EC-351832 x RT-305 and SI-718 x RT-305 were the best for seed yield and its component characters. Hybridization systems, such as reciprocal recurrent crossing, which exploit both additive and nonadditive gene effects simultaneously, could be useful in the genetic improvement of the characters studied.

Key words: Combing ability, heterosis, sesame.

The study of the nature and magnitude of gene action governing various characters is essential for formulating efficient breeding program for increasing productivity. The knowledge of combining ability, together with per se performance of the parents and hybrids, and heterotic response helps the breeders in selecting suitable parents and crosses for their use in a systematic breeding program. In view of the limited information available on these aspects in sesame (*Sesamum indicum* L.), the present investigation has been undertaken.

Materials and Methods

Ten female parents, viz., ES-123-1-84, ES-319-2-84, EC-351832, EC-370663, EC-370823, SI-718, RT-281, EC-351819, RT-326 and ES-1-2-84 and 3 male parents, viz., RT-127, RT-46 and RT-305, along with 30 F_1 's were grown in randomized block design with 2 replications at Agricultural

Research Station, Mandore in 1999. Each plot consisted of single 2 m row. The observations were recorded on 5 random plants from each plot. The analysis of combining ability was done as suggested by Kempthorne (1957).

Results and Discussion

The analysis of variance for 8 characters revealed that variance due to the female and male parents were significant for all the characters (Table 1). However, mean square due to the male parents were greater than those due the females for all the characters, indicating large diversity among the males than in females. The lower magnitude of variance in the female x male interactions suggested greater uniformity among the crosses than the parent lines.

The variance components of general combining ability and specific combining ability were significant for most of the

Table 1. Analysis of variance for parents and combining ability of eight different characters in sesame

Source of variation	Df	Seed yield plant ⁻¹	Days to flowering	Days to maturity	Plant height	Capsules bearing plant height	Branches plant ⁻¹	Capsules plant ⁻¹	1000-seed weight
Lines	9	4.04**	18.93**	18.93**	338.14**	316.53**	3.09**	814.8**	92.5**
Tester	2	11.25**	26.6**	43.4**	2409.3**	1964.9**	20.35**	2685.9**	293.1**
Line x Tester	18	2.13**	3.17**	2.96**	78.75**	102.9**	1.17**	229.8**	235.7**
Error	29	0.04	0.84	0.76	6.92	10.13	0.07	6.02	37.3
Component of variance									
GCA variance		1.47	2.34	99.6	79.8	79.8	0.81	134.2	13.0
SCA variance		1.43	1.1	35.9	46.4	46.4	0.55	111.9	11.6
σ^2 GCA/ σ^2 SCA		1.03	2.12	2.77	1.72	1.72	1.47	1.2	1.12

* and ** significant at P = 0.05 and P = 0.01 level, respectively.

characters, indicating role of both additive and non-additive gene actions in the inheritance of these characters. However, additive gene effects showed predominance. Similar findings were earlier reported by Yingzhong (1999); Backiyarani *et al.* (1997) and Macharo *et al.* (1995). However, the results clearly reflected the additive and

non-additive gene action, controlling the characters studied. Hence, hybridization systems, such as reciprocal recurrent crossing, could be useful in the genetic improvement of the characters studied.

Table 2 revealed that among the male parent variety RT-127 was the best general combiner for all the characters except early

Table 2. Selected parents/hybrids possessing desirable significant gca effect for eight characters in sesame

Characters	Parents showing significant gca effects	
	Lines	Tester
Seed yield per plant	ES-319-2-84, SI-718	RT-127, RT-46
Days to flowering	EC-370663, EC-370823, ES-1-284	-
Days to maturity	ES-123-1-84, ES-1-2-84	RT-127
Plant height	ES-319-2-84, EC-351832, EC-351819	RT-127, RT-46
Capsules bearing plant height	EC-370663, EC-370823, EC-351819	RT-127, RT-46
Branches per plant	EC-370823, SI-718, EC-351819	RT-127, RT-46
Capsules per plant	EC-351832, EC-370823, SI-718, EC-351819	RT-127, RT-46
1000-seed weight	ES-319-2-84, EC-351832, EC-370823, SI-718	RT-127, RT-46

Table 3. Best specific crosses and heterosis for eight quantitative characters in sesame

Character	Cross combination	Per se performance	Sca effect	% heterosis over Bp
Days to flowering	ES-1-2-84 x RT-46	33.0	-2.4**	-5.71*
	SI-718 x RT-127	34.0	-1.37*	-5.56*
Days to maturity	ES-123-1-84 x RT-127	73.0	-3.0**	-6.41**
	ES-1-2-84 x RT-127	74.0	-1.7**	-5.13**
Plant height	EC-351819 x RT-305	97.5	15.9**	35.5**
	EC-370663 x RT-127	91.2	6.5**	40.3**
	ES-123-1-84 x RT-46	87.4	6.4**	29.9**
	ES-319-2-84 x RT-305	77.4	5.6**	9.94*
	ES-1-2-84 x RT-127	88.5	5.32**	36.2**
Capsules bearing plant height	SI-718 x RT-127	57.0	131.1**	41.8**
	EC-370663 x RT-127	69.2	10.0**	72.1**
	RT-326 x RT-46	60.7	6.9**	21.4**
	EC-351819 x RT-46	75.2	5.5**	107.7**
	EC-370663 x RT-46	66.0	5.6**	75.5**
Branches per plant	SI-718 x RT-305	5.0	1.13**	13.6**
	EC-370663 x RT-305	5.0	1.00**	31.6**
	ES-319-2-84 x RT-127	5.3	0.66**	47.2**
	EC-351832 x RT-127	5.5	0.62**	52.8**
	EC-351819 x RT-46	5.6	0.48**	64.7**
Capsules per plant	SI-718 x RT-305	63.0	18.4**	45.8**
	EC-370663 x RT-305	66.2	16.4**	77.2**
	ES-319-2-84 x RT-127	61.8	11.1**	40.5**
	EC-370823 x RT-127	72.8	10.2**	89.6**
	EC-351819 x RT-46	62.0	6.06**	67.6**
1000-seed weight	RT-281 x RT-127	3.6	0.48**	51.9**
	ES-123-1-84 x RT-46	3.1	0.48**	31.7**
	EC-351832 x RT-305	3.3	0.41**	44.4**
	ES-1-2-84 x RT-305	3.5	0.35**	62.8**
	EC-370823 x RT-127	3.8	0.32**	71.7**
Seed yield per plant	EC-370663 x RT-123	5.4	1.42**	94.9**
	ES-319-2-84 x RT-305	4.7	1.21**	74.0**
	EC-370823 x RT-127	5.3	1.07**	91.4**
	EC-351832 x RT-305	4.0	0.94**	49.8**
	SI-718 x RT-305	5.0	0.88**	85.6**

**Significant at P = 0.01.

flowering, and RT-46 was good general combiner for all the characters except early flowering and maturity. Among the female parents, SI-718 was the best general combiner for seed yield and also good general combiner for branches per plant and capsules per plant. Genotype EC-371832 and ES-1-284 for capsules per plant and 1000-seed weight, whereas genotype EC-351819 for plant height and capsules bearing plant height were the best general combiner. Genotype EC-370663 and ES-123-1-84 were the best general combiners for early flowering and maturity. These parents may be used for hybridization for obtaining desirable segregates. Desirable sca alone is of no practical value unless the per se performance of the hybrids exceeds the BP. Hence, the best cross combinations were judged on the basis of sca effects, per se performance and BP heterosis for seed yield and its components (Table 3). The crosses found to be best on the basis of per se performance, sca effects and heterotic response were EC-370823 x RT-127 for seed yield per plant, capsules per plant and 1000-seed weight, whereas EC-370663 x RT-127 was for seed yield per plant, capsules per plant, capsules bearing plant height and plant height. The crosses EC-351832 x RT-305 and SI-718 x RT 305 were found to be good for seed yield.

A comparison of the sca effects of the crosses with gca effects of the crosses of the parents involved in the best five crosses for seed yield revealed that all the crosses showing high sca effects had high x low combiners except EC-370823 x RT-127, indicating the presence of additive x dominance type gene action. The cross EC-370823 x RT-127, having high sca effects and involving high x high combiners, indicated presence of additive type of gene interaction.

The results of the present study suggest that heterosis coupled with high sca effects may be considered as criterion for selecting the best cross combinations for further improvement of seed yield and other characters in sesame.

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