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STUDIES OF COMBINING ABILITY FOR SEED YIELD AND ITS IMPORTANT COMPONENT TRAITS IN SESAME (*SESAMUM INDICUM* L.)

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Abstract

Combining ability analysis in sesame through Line × Tester mating design with seven lines and three testers were evaluated for yield and important yield contributing characters for eight traits *viz.,* days to 50 per cent flowering, plant height, number of branches per plant, number of capsules per plant, capsule length, number of seeds per capsule, 1000 seed weight and seed yield per plant. The variance due to SCA was higher than the corresponding variance due to GCA for all the characters. Combining ability analysis revealed that the following three *viz.,* L_1 (GT 10) and L_3 (ACM 14-007 SI-2) were the best combiner for yield contributing traits. Among the hybrids, $L_3 \times T_1$ (ACM 14- 007 SI-2 × TMV 5), $L_1 \times T_3$ (GT 10 × TMV7) and $L_4 \times T_2$ (ACM 14-010 SI-9 × TMV 6) exhibited positive significant *sca* effects for yield and its contributing traits.

Key words : Sesame, Line × Tester, Combining ability, *gca* and *sca.*

Introduction

Sesame (*Sesamum indicum* L.) belongs to the family pedaliaceae. It is called as the "Queen of oil seeds" because of its excellent qualities of the seed, oil and meal. Sesame seeds contain two unique substances namely sesamin and sesamolin known to have a cholesterol lowering effect in human and to prevent high blood pressure (Anilakumar *et al.,* 2010). As the productivity is very low in sesame, which evidently indicates the potentiality of this crop for improvement in yield through various breeding tools. Combining ability analysis is most widely used as biometrical tool by Line × Tester analysis to identify the best combiners which may be hybridized either to exploit heterosis or to build up the favourable fixable genes. The present investigation was carried out on combining ability in sesame for identification of good general combiners and specific cross combinations for yield and its component traits through line × tester analysis.

Materials and Method

The present investigation on combining ability analysis in sesame (*sesamum indicum* L.) through line × tester analysis was carried out at Plant Breeding Farm, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, India during the year 2017-2019. The experimental material consists of seven lines *viz.,* GT 10, SVPR 1, ACM 14-007 SI-2, ACM 14-010 SI-9, ORM 14, ORM 17 and Paiyur 1 and three testers *viz.,* TMV 5, TMV6 and TMV7 were crossed in Line × Tester design and produced 21 hybrids during march - may (2018). Hand emasculation was followed in the crossing block. The flower bud which is expected to open in the next day morning is selected in the previous day evening between 3 P.M. to 6 P.M. During the next day morning, between 7 A.M. and 9.A.M., pollen from the desired male parents were dusted gently on the surface of the stigmas of the emasculated flower buds. The crossed seeds are harvested separately after reaching physiological maturation and shade dried until the capsules shed seeds. The resulted 21 hybrids and 10 parents were sown in randomized block design with three replications during Oct - Dec (2018). The observations were recorded on ten randomly selected plants for both in parents and hybrids in each replication for the following traits namely, days to 50 per cent flowering, plant height, number of branches per plant, number of capsules per plant, capsule length, number of seeds per capsule, 1000 seed weight and seed yield per plant. The analysis of variance for combining ability was made based on method developed

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Table 1: Analysis of variance for eight characters.

Source	df	Days to 50 Per cent Flowering	Plant height (cm)	Number of branches per plant	Number of capsules per plant	Capsule length	Number of seeds per capsule	1000 seed weight	SeedYield per plant
Replication	2	3.4810	1.2745	0.0174	1.4704	0.0021	3.0220	0.0180	0.2627
Hybrids	20	47.0165**	460.8541**	3.1858**	635.1918**	0.0536**	76.7020**	1.16103**	12.6800**
Lines	60	38.9549**	582.6426**	2.9678**	795.2892**	0.0594**	85.9221**	1.5616**	15.2405**
Testers	2	125.7636**	940.9732**	10.4112**	2170.2710**	0.0879**	114.3639**	2.1099**	48.3752**
Lines × Testers	12	37.9228**	319.940**	2.0906**	299.2965**	0.0449**	65.81**	0.8014**	5.4506**
Error	60	1.1202	24.0814	0.0192	19.2075	0.0038	7.1424	0.044	0.1154

*-Significant at 5% level, ** -Significant at 1% level.

Table 2: Estimation of General Combining Ability (GCA) effect associated with parents for various characters.

S.No.	Parents	Days to 50% flowering	Plant height (cm)	No. of branches per plant	Number of capsules per plant	Capsule length	No. of seeds per capsule	1000 seed weight	Seed yield per plant
1	GT 10	0.98**	11.05**	0.52**	12.89**	0.11**	1.24	0.66**	1.63**
2	SVPR 1	-4.53**	-0.29	-0.48**	-1.20	0.10**	3.21**	-0.62**	-1.15**
3	ACM 14-007 SI-2	-0.28	5.67**	0.98**	8.13**	0.03	2.89**	0.18**	1.52**
4	ACM 14-010 SI- 9	1.00**	-8.85**	-0.08	-10.33**	0.01	-0.21	0.15*	-0.93**
5	ORM 14	1.34**	-2.29	-0.06	5.48**	-0.03	-4.63**	-0.12	0.62**
6	ORM 17	1.24**	-10.90**	-0.67**	-12.37**	-0.13**	-3.74**	-0.37**	-1.62**
7	Paiyur 1	0.24	5.62**	0.21**	-2.60	0.07**	1.26	0.13	-0.08
8	TMV 5	-2.82**	5.76**	0.71**	5.48**	0.07**	-2.69**	-0.33**	0.78
9	TMV 6	1.55**	-7.34**	-0.70**	-11.73**	-0.05**	1.18	0.02	-1.75**
10	TMV 7	1.27**	1.58	-0.01	6.25**	-0.03*	1.51*	0.31**	0.97**

*-Significant at 5% level, ** -Significant at 1% level.

Table 3: Estimation of specific combining ability (SCA) effect associated with each cross for various characters.

S.No.	Name of crosses	Days to 50% flowering	Plant height (cm)	No. of branches per plant	Number of capsules per plant	Capsule length	No. of seeds per capsule	1000 seed weight	Seed yield per plant
1	GT 10 × TMV 5	-16.56**	10.21*	24.67**	12.19**	9.75**	-6.02	18.96**	27.94**
2	GT 10 × TMV 6	-6.24**	1.76	-7.14**	-12.26**	1.92	0.64	1.78	-32.42**
3	GT 10 × TMV 7	-15.10**	20.04**	30.53**	13.06**	13.19**	9.04**	20.48**	29.49**
4	SVPR 1 × TMV 5	-14.82**	16.34**	4.08	-14.01**	5.08*	-3.51	-59.41**	-17.61**
5	SVPR 1 × TMV 6	4.92*	-15.79**	-24.41**	-27.66**	-2.47	14.06**	-28.24**	-39.30**
6	SVPR 1 × TMV 7	8.43**	-6.02	10.71**	8.52*	0.27	2.01	-17.81**	-4.42
7	ACM 14- 007 SI-2 × TMV 5	-10.23**	17.47**	39.01**	16.05**	12.91**	11.90**	14.38*	16.16**
8	ACM 14- 007 SI-2 × TMV 6	-9.10**	-1.40	3.00	-4.84	0.96	-7.68*	-14.38*	-20.34**
9	ACM 14- 007 SI-2 × TMV 7	9.54**	-1.84	32.44**	-13.79**	1.24	6.88*	-12.98	25.90**
10	ACM 14-010 SI-9 × TMV 5	1.62	3.67	7.46**	-24.67**	3.43	-5.78	-20.87**	-0.66
11	ACM 14-010 SI-9 × TMV 6	7.11**	-29.07**	20.40**	-27.87**	9.48**	6.88*	16.54*	-34.46**
12	ACM 14-010 SI-9 × TMV 7	-10.06**	-8.33	-14.15**	-10.52**	-0.82	-4.01	-12.98	-19.41**
13	ORM 14 × TMV 5	-1.47	-15.38**	35.88**	-3.31	3.30	-11.19**	-47.96**	8.25**
14	ORM 14 × TMV 6	-0.21	10.65*	-2.87	-16.85**	6.32**	-5.92	-16.28*	-3.73
15	ORM 14 × TMV 7	2.57	-7.34	-18.61**	8.88*	-2.88	-5.77	16.67*	-10.95
16	ORM 17 × TMV 5	-7.03**	-8.15	10.45**	-20.63**	2.88	-11.74**	-32.54**	-19.41**
17	ORM 17 × TMV 6	8.96**	-24.67**	-22.63**	-36.79**	-3.57	-1.35	-12.47	-36.84**
18	ORM 17 × TMV 7	-1.69	-7.71	-8.29**	-12.30**	-3.98	-5.77	-11.07	-19.61**
19	Paiyur 1 × TMV 5	-13.58**	9.77*	15.55**	8.08*	9.20**	-6.52*	-19.21**	-18.06**
20	Paiyur 1 × TMV 6	-0.15	-8.59	-17.72**	-31.55**	-1.24	1.26	-20.48**	-19.58**
21	Paiyur 1 × TMV 7	7.34**	12.89**	8.03**	-14.26**	11.13**	8.99**	20.10**	9.53**

*-Significant at 5% level, ** -Significant at 1% level.

by Kempthorne (1957). Combining ability was evaluated for the hybrids and parents.

Results and Discussion

The analysis of variance for the eight traits were studied and presented in Table 1. All the twenty one hybrids and ten parents showed significance for all the characters such as days to 50 per cent flowering, plant height, number of branches per plant, number of capsules per plant, capsule length, number of seeds per capsule, 1000 seed weight and seed yield per plant. The interaction effect (Line × Tester) was also significant for all the characters, which indicating the existence of substantial amount of vigour in hybrids. Dhillon (1975) pointed out that the combining ability gives useful information on the choice of parents. Singh and Nanda (1976) suggested to select at least one parent with high *gca* effect as a selection index for parental evaluation.

Among the lines, line L_1 (GT 10) recorded positive and maximum significant *gca* effect for the yield attributing characters *viz*., number of branches per plant, number of capsules per plant, capsule length, 1000 seed weight and seed yield per plant. L_2 (SVPR 1) showed negative significant *gca* effect for days to 50 per cent flowering and also had significant and positive *gca* effect for capsule length and number of seeds per capsule. The similar result was reported by Vimala and Parameshwarappa (2017). The line L_3 (ACM 14-007 SI-2) also had significant and positive *gca* effects for the traits *viz*., plant height, number of branches per plant, number of capsules per plant, number of seeds per capsule, 1000 seed weight and seed yield per plant. The line L_5 (ORM 14) recorded positive and significant *gca* effect for the characters like number of capsules per plant and seed yield per plant.

Among the testers, T_1 (TMV 5) possessed desirable *gca* effects for the characters such as plant height, number of branches per plant, number of capsules per plant, capsule length and with negative significant *gca* effect for days to 50 per cent flowering. The next best tester was T_3 (TMV 7) recorded desirable positive significant *gca* effects for the traits *viz*., number of capsules per plant, number of seeds per capsule, 1000 seed weight and seed yield per plant. Based on *gca* effects of parents, L_1 (GT 10), L_2 (SVPR 1), L_3 (ACM 14-007 SI-2), L_5 (ORM 14) among the lines and T_1 (TMV 5) and T_3 (TMV 7) among the testers were concluded as best parents. (Table 2).

The specific combining ability is the deviation from the performance predicted on the basis of *gca* (Allard, 1960). Therefore, the *sca* effect is an important criterion for the evaluation of hybrids. Among the hybrids, the hybrid $L_3 \times T_1$ (ACM 14- 007 SI-2 × TMV 5) identified as positive significant *sca* effects for the characters *viz*., plant height, number of capsules per plant, capsule length, number of seeds per capsule, 1000 seed weight and seed yield per plant. The hybrid, $L_1 \times T_3$ (GT 10 × TMV7) registered positive significant effects for the traits *viz*., plant height, number of branches per plant, number of seeds per capsule, capsule length, seed yield per plant and with negative significant effect for days to 50 per cent flowering, this result is in accordance with Mungala *et al.,* (2017).

Also the cross, $L_4 \times T_2$ (ACM 14-010 SI-9 × TMV 6) registered positive significant effects for the characters like number of branches per plant, capsule length, number of seeds per capsule and seed yield per plant. Based on *sca* effects, the hybrids $L_3 \times T_1$ (ACM 14- 007 SI-2 × TMV 5), $L_1 \times T_3$ (GT 10 × TMV7) and $L_4 \times T_2$ (ACM 14-010 SI-9 × TMV 6) were adjusted as best hybrids. (Table 3).

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