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Research Note

Combining ability analysis for yield and its component traits in sesame (*Sesamum indicum* L)

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Abstract
Combining ability analysis was carried out in 8 x 8 half diallel mating system for ten quantitative characters in sesame (*Sesamum indicum* L). The present study revealed the importance of both additive as well as non-additive genetic components for yield and its contributing characters. Among the parents, JLT-9707-2 was one of the best general combiners as it depicted high *gca* for length of capsule, number of seeds per capsule, 1000 seed weight, and oil content. Another parent VRI $(sv)_2$ was found to be good general combiner for plant height, number of branches per plant and number of capsules per plant. These parents displayed good *per se* performance for most of the characters suggesting scope for their use in further breeding programme. The cross JLT-408 x VS- 07-23 evinced significant *sca* effects for most of the yield and yield contributing characters. This revealed that high x high *gca* combinations need not necessarily result in high *sca* effects. The presence of additive and non additive genetic components for yield and its contributing characters was observed.

Key words
Sesame, gca, sca, half diallel

Sesamum is one of the most traditional and important oil seed crop grown in India. Critical choice of parents in breeding programme is important particularly if the aim is to improve quantitative characters like yield and its components. The concept of combining ability analysis give precise estimates of nature and magnitude of gene actions involved in the inheritance of quantitative characters which facilitate the identification of parents with good general combing ability effects and crosses with good specific combing ability effects and also helps in the selection of suitable breeding method. Therefore the present study was conducted to study the combining ability in sesamum.

The experimental material comprised of eight genotypes *viz*., JLT-408, JLS- 116, JLS-120, JLT-9707-2, VRI (SV_2), VS- 07-23, JLSel-05-3 and JL Sel-07-2 which were crossed in 8 x 8 half diallel mating design excluding reciprocals during *kharif*-2011. The resulting 28 cross combinations along with parents were grown in a randomized block design with three replications at Post Graduate Research Farm of Department of Botany, Mahatma Phule Krishi Vidyapeeth, Rahuri during *kharif*-2012. Each plot consisted of single row of 4m length spaced at 45 cm. and plant to plant distance 10 cm. The observations were recorded on ten competitive plants for the characters *viz*., days to 50% flowering, days to maturity, plant height (cm), number of branches per plant, number of capsules per plant, length of capsule (cm), 1000 seed weight (g), yield per plant (g) and oil content (%). The combining ability analysis was done as per Model -I, Method-II of Griffing (1956).

The analysis of variance for combining ability indicated the existence of significant differences for general combining ability among the parents and specific combining ability among the hybrids for all the characters. The magnitude of g. c. a. variances was higher as compared to s. c. a. variances for the characters *viz.*, days to 50 per cent flowering, days to maturity, plant height, number of branches per plant, number of capsules per plant, 1000 seed weight, length of capsule and oil content. Similar results were also reported by Vidhyavathi, *et al*., (2005), Durai *et al*. (2007) and Sumathi and Muralidharan (2008). The higher magnitude of g.c.a. variances than s.c.a. indicated the predominance of additive effects in the expression of these traits.

However, the s. c. a. variances were higher than g. c. a. variances for the traits number of seeds per capsule and yield per plant. Such higher magnitude of s. c. a. effects than g. c. a. effects for these characters were also reported by Durai *et al*. (2007), Sumathi and Muralidharan (2008), in their studies. Looking into the general combining ability effects of various parents, it was observed that JLT-9707-2 was one of the best general combiners as it showed high significant *gca* in desirable direction for four characters (Table 1) out of ten *viz*. length of capsule (0.115),

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number of seeds per capsule (1.758), 1000 seed weight (0.090), and oil content (1.026). The parent VRI $(sv)_2$ was the other best parent which showed significant high *gca* effects for plant height (6.386), number of branches per plant (0.678) and number of capsules per plant (12.24). The parent JLS-116 exhibited significant *gca* effects in desirable direction for three characters *viz.*, days to 50% flowering (-1.23), length of capsule (0.052) and 1000 seed weight (0.083). The parent, VS-07-23 expressed highly significant positive *gca* effects for two traits *viz.*, plant height (5.909) and yield per plant (0.942).

The parent JLSel-07-2 showed significant g*ca* effects in desirable direction for days to 50% flowering (-1.825) and days to maturity (-2.522), while the parent JLT-408 exerted produced significant *gca* effects for days to 50% flowering. The parent JLSel-05-3 exhibited significant *gca* effects in desirable direction for days to 50 % flowering (-0.982) and number of seeds per capsule (1.177).

The parent, JLT-408 proved to be good general combiner for days to 50 % flowering and days to maturity, while VS- 07-23, JLT-9707-2 and VRI $(sv)_2$ were poor general combiner for days to 50 % flowering and days to maturity. This suggested that the character *viz*; days to 50 % flowering and days to maturity in these crosses are under the influence of non-additive and additive gene action. The general combining ability variances play a major part in the inheritance of flowering and maturity. These results indicated that additive as well as non-additive gene action played a major role in the inheritance of earliness. These findings are in agreement with the finding of Vidhyavathi *et.al*., (2005), Raghunaiah *et.al*. (2008), Sumathi and Muralidharan (2008), Kumar and Kannan (2010). Among the 28 crosses, none of the crosses exhibited significant *sca* effect for all the characters. Whereas, the hybrid JLT-408 x VS- 07-23 evinced significant *sca* effects (Table2) for five characters *viz.*, days to 50 % flowering, days to maturity, length of capsule, 1000 seed weight and yield per plant. Another cross, JLT-408 x JLT-9707-2 exhibited significant *sca* effects for days to 50% flowering, days to maturity and number of seeds per capsule, while, JLS-120 x JLT-9707-2 displayed significant *sca* effects for plant height, Number of branches per plant and number of capsules per plant. The cross VS-07-23 x JLSel-05-3 exhibited significant *sca* effects for number of branches per plant, number of capsules per plant and oil content. Rest of the hybrids were found to be non-significant or significant for one or two traits. These crosses involved one good general combiner parent and other poor/good general combiner, which also revealed that high x high *gca* combinations need not necessarily result into high *sca* effect. This might be due to internal cancellation of the gene effects in these parents. These crosses may be expected to give transgresasive segregants in advance generations. Considering the importance of both additive and non additive gene actions for yield and its components, the genetic improvement could be achieved by population breeding approach in the form of biparental mating in early generation segregating population followed by intensive selections in advanced generations.

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Table 1. Parents showing significant gca effects for different traits in *Sesamum*

SI. No.	Genotype	No. of traits	*gca* effects	Character
1.	JLT-408	1	-0.85**	Days to 50 % flowering
2.	JLS-116	3	-1.23**	Days to 50 % flowering
			0.052*	Length of capsule (cm)
			0.083*	1000 seed weight (g)
3.	JLT-9707-2	4	0.115**	Length of capsule (cm)
			1.758**	Number of seeds per capsule
			0.090*	1000 seed weight (g)
			1.026**	Oil content (%)
4.	VRI $(sv)_2$	3	6.386**	Plant height (cm)
			0.678**	Number of branches per plant
			12.24**	Number of capsules per plant
5.	VS-07-23	2	5.909**	Plant height (cm)
			0.942**	Yield per plant (g)
6.	JLSel-05-3	2	-0.982**	Days to 50 % flowering
			1.177*	Number of seeds per capsule
7.	JLSel-07-2	2	-1.825**	Days to 50 % flowering
			-2.522**	Days to maturity

*, ** Significant at 5% and 1% level, respectively

Table 2. Hybrids showing significant *sca* effects for different traits in *Sesamum*

SI. No.	**Hybrid**	**No. of traits**	***sca* effects**	**Characters**
1.	JLT-408 x VS- 07-23	5	-6.53**	Days to 50 % flowering
			-7.25**	Days to maturity
			0.16*	Length of capsule
			4.49**	Yield per plant
			0.31**	1000 seed weight
2.	JLT-408 x JLT-9707-2	3	-4.15**	Days to 50 % flowering
			-5.55**	Days to maturity
			9.00**	Number of seeds per capsule
3.	JLS-120 x JLT-9707-2	3	11.59**	Plant height
			1.25**	Number of branches per plant
			36.01**	Number of capsule per plant
4.	VS- 07-23 x JLSel-05-3	3	1.11**	Number of branches per plant
			29.96**	Number of capsule per plant
			2.08*	Oil content
5.	JLT-408 x VRI $(sv)_2$	2	-4.54**	Days to 50 % flowering
			0.33**	1000 seed weight
6.	JLS- 116 x JLT-9707-2	2	7.10**	Yield per plant
			44.00**	Number of capsule per plant
7.	JLS-120x VRI $(sv)_2$	2	0.34**	Length of capsule
			9.99**	Number of seeds per capsule
8.	JLSel-05-3x JL Sel-07-2	2	5.79**	Yield per plant
			0.34**	1000 seed weight

*, ** Significant at 5% and 1% level, respectively