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RESEARCH ARTICLE

HETEROSIS AND ITS RELATION WITH COMBINING ABILITY IN SESAME (*Sesamum indicum* L.) FOR QUANTITATIVE TRAITS

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ABSTRACT

The eight diverse genotypes were crossed in 8 x 8 half diallel mating system. The resulting 28 crosses along with their parents were evaluated to study heterosis and sca effects for yield and its components. The study revealed that the heterosis in seed yield was influenced by high heterotic manifestation in number of branches per plant, number of capsule per plant, number of seeds per capsule and seed weight. As regards earliness, plant height, length of capsule and oil content the extent of heterosis was moderately high. The ranking of crosses on the basis of heterosis and sca effects were not similar. There was faire agreement between heterosis and sca effects. The cross combination JLS-116 x JLT-9707-2 for seed yield and capsules per plant, JLT-408 x VS- 07-23 for earliness and seed weight, JLT-408 x JLT-9707-2 for number of seeds per capsule and JLS-120 x VRI$(sv)_2$ for length of capsule manifested desirable heterosis and high sca effects. These crosses could be exploited in subsequent generations to isolate desirable segregates.

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INTRODUCTION

Sesame (*Sesamum indicum* L.) is most important ancient oil yielding crop grown in India. The productivity of this crop is very low as compared to other oil seed crops. Efforts have been made to improve the productivity by developing number of high yielding varieties. Hybrid vigor in sesamum even a small magnitude for individual component, have additive or synergistic effects on end product (Sasikumar and Sardana, 1990). Further, the exploitable heterosis also depends on general combining ability and breeding procedure adopted. Therefore, the present study was undertaken to study heterosis in relation with combining ability for yield and its components in sesame.

MATERIALS AND METHODS

Eight genotypes of sesamum *viz*., JLT-408, JLS- 116, JLS-120, JLT-9707-2, VRI $(SV)_2$, VS- 07-23, JLSel-05-3 and JL Sel-07-2 were crossed in a 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 4 m length spaced at 45 cm. having plant to plant distance 10 cm. The observations were recorded on ten competitive plants on characters *viz*., days to 50% flowering, days to maturity, plant height, number of branches, number of capsules per plant, length of capsule, 1000 grain weight, yield per plant and oil content. Heterosis was calculated over mid and better parent. Significance of heterosis was tested by using t test (Wenny, 1970). The combining ability analysis was done as per Model -I, Method-II of Griffing (1956).

RESULTS AND DISCUSSION

In the present study wide range of heterosis was observed over mid parent and better parent, for yield (4.48 to 152.61 and -3.53 to 147.45%), for number of capsules per plant (-20.17 to 65.74 and -25.09 to 61.02%), for number of branches (-21.77 to 50.77 and -25.38 to 44.17%) for number of seeds per capsule (-17.56 to 24.38 and -22.26 to 24.38%). The range of heterosis was quite considerable for days to 50% flowering, days to maturity, plant height, 1000 seed weight and oil content. The results are in agreement of Raghunaiah *et al*. (2008), Sumathi and Muralidharan (2008). The heterotic response and sca effects for promising crosses for seed yield and its components are presented in Table 1. There was fair agreement between heterosis and sca effects, indicating selection of crosses be done based on both heterotic response and sca effects. These observations are in agreement of Singh (2004), Kim-Dong Hwi *et al*. (2006), Durai *et al*. (2007), Sumathi and Muralidharan (2008), in their studies.

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Table 1. The heterotic response and sca effects for promising crosses for seed yield and its components

Sr. No.	Character	Hetero-beltiosis(%) over S.P.		*sca* effects
		Cross	Heterobeltiosis (%)	
1	No. of days for 50 % flowering	JLT-408x VS- 07-23	-21.03**	-6.53**
		JLT-408 x VRI $(sv)_2$	-14.49**	-4.54**
		JLT-408 x JLT-9707-2	-11.87**	-4.15
2	Days for maturity	JLT-408x VS- 07-23	-9.91*	-7.25**
		JLT-408 x JLT-9707-2	-8.27*	-5.55*
		JLT-408 x VRI $(sv)_2$	-3.81	-2.579
3	Plant height (cm)	JLT-408 x JL Sel-07-2	15.71**	10.44**
		JLS-120x JLT-9707-2	12.18*	11.594**
		JLS- 116x JL Sel-07-2	10.27*	5.303
4	No. of branches per plant	JLS-120x JLT-9707-2	44.17**	1.25**
		JLSel-05-3x JL Sel-07-2	32.35**	0.00
		VS- 07-23x JLSel-05-3	31.34**	1.11**
5	No. of capsules per plant	JLT-408 x JLSel-05-3	61.02**	25.122**
		JLS- 116x JLT-9707-2	53.99**	44.00**
		JLS-120x JLT-9707-2	35.06**	36.019**
6	Length of capsule (cm)	JLS-120x VRI $(sv)_2$	6.33	0.34**
		JLS-120x VS- 07-23	4.07	0.156**
		JLT-408 x VRI $(sv)_2$	3.29	0.083
7	No. of seeds per capsule	JLT-408 x JLT-9707-2	24.37**	9.00**
		JLT-9707-2 x JLSel-05-3	20.82**	6.285**
		VS- 07-23x JLSel-05-3	15.02**	5.274**
8	Seed yield per plant (g)	JLT-408 x JLSel-05-3	147.44**	3.206**
		JLSel-05-3x JL Sel-07-2	134.08**	5.78**
		JLS- 116x JLT-9707-2	98.71**	7.10**
9	1000 seed weight (g)	JLS- 116x JLT-9707-2	13.29*	0.225*
		JLS- 116 x JLSel-05-3	10.62	0.27*
		JLT-408x VS- 07-23	10.53	0.31**
10	Oil content (%)	VRI $(sv)_2$ x JL Sel-07-2	4.26	1.526
		JLT-408 x JLSel-05-3	4.25	2.215*
		VS- 07-23x JLSel-05-3	2.78	2.869**

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

Table 2. Parents showing high *gca* in desirable direction for different traits

Sr. No	Genotype	No. of traits	*gca* effects	Character
1	JLT-408	1	-0.85**	No. of days for 50 % flowering
2	JLS-116	3	-1.23**	No. of days for 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**	No. 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**	No. of branches per plant
			12.24**	No. 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**	No. of days for 50 % flowering
			1.177*	No. of seeds per capsule
7	JLSel-07-2	2	-1.825**	No. of days for 50 % flowering
			-2.522**	Days for maturity

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

In evaluation of hybrids, the crosses, JLT-408 x JLSel-05-3, JLSel-05-3x JL Sel-07-2 and JLS-116 x JLT-9707-2 produced very high heterotic effects in respect of seed yield/ plant, exhibited significant mid parent heterosis and heterobeltiosis for seed yield/ plant and some of its components. Though this study focused the scope for exploiting heterosis, but sesamum being self-pollinated crop, it can only be made use of through isolation of transgressive sergeants in subsequent generations.

The cross JLS-120 x JLT-9707-2 for number of branches/ plant, plant height and number of capsules/plant, the cross JLT-408 x JLSel-05-3 for number of capsules/plant and oil content, JLS-120 x VRI$(sv)_2$ for length of capsule, JLT-408 x JLT-9707-2 for number of seeds per capsule, days to 50% flowering and days to maturity, JLS- 116 x JLT-9707-2 for seed weight, for number of capsules/plant and seed yield per plant, the cross VRI$(sv)_2$ x JLSel-07-2 for oil content, showed significant value of heterosis. For earliness characters the cross JLT-408 x VS- 07-23 showed the highest heterosis (Table 1).

The performance of the crosses was compared on the basis of heterotic response and sca effects. Accordingly, the cross JLS-116 x JLT-9707-2 for seed yield and number of capsules per plant, JLT-408 x JLT-9707-2 for number of seeds per capsule and VS- 07-23 x JLSel-05-3 for oil content besides being heterotic also exhibited high sca effects and showed good *per se* performance (Table 2). These crosses involved both the parents having good general combing ability indicating the importance of additive x additive gene actions which is fixable and be exploited in subsequent generations to isolate desirable segergates. Whereas, the cross JLT-408 x VS- 07-23 for days to 50% flowering, days to maturity and seed yield per plant, JLS-120 x JLT-9707-2 for plant height, number of branches and number of capsules per plant, VS-07-23 x JLSel-05-3 for number of branches and the cross JLS-120 x VRI $(sv)_2$ for

length of capsule, for number of seeds per capsule and cross JLSel-05-3 x x JLSel-07-2 for seed weight and seed yield per plant involved one parent with good general combiner or both the parents with low general combiners indicating predominance role of additive x dominance or dominance x dominance types of gene actions which are non fixable. Under such circumstances, the recurrent selection would be an ideal breeding procedure to increase additive genetic variance or biparental mating in segregating population would enhance frequency of transgressive segregates.

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