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RESEARCH ARTICLE

Studies on general and specific combining ability studies in sesame (*Sesamum indicum* L.)

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SUMMARY

Combining ability analysis in sesame through 7 x 7 diallel design with 7 parents were evaluated for yield and yield contributing characters *viz.,* days to maturity, plant height, number of branches per plant, number of capsules per plant, capsule length, number of seeds per capsule, 1000 seed weight, seed yield per plant and oil yield per plant. Non additive gene action was predominant for all the traits studied. Combining ability analysis revealed that the following three parents *viz.,* DSS-9, Dhauri Local were the best combiners for seed yield per plant and oil yield per plant. Considering both *per se* performance and GCA effects the parents DSS-9 and Dhauri Local were found to be best for seed yield and oil yield per plant. The cross combinations *viz.,* Dhauri Local x DSS-9, DSS-9 x RT-54 and DSS-9 x Dhauri Local found to be best combinations for seed yield and most of yield attributing traits on the basis of SCA effects and *per se* performance were expected to produce transgressive segregants. Exploitation of hybrid vigour from these crosses through heterosis breeding method is advocated.

Key Words : Sesame, General combining ability, Specific combining ability

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Sesame (*Sesamum indicum* L.) is an important oilseed crop grown all over India. It can be grown either as a pure or mixed crop. It has attracted special attention as an important salad dressing and edible oil. India ranks first in the world in sesame cultivation in terms of (1.75 m ha) area and production (0.60m tones) (Naina Mohammed, 2001). In Tamil Nadu this crop occupies an area of 1.21 lakh ha with an average productivity of 298 kg ha-1 (GOI, 1990). This is far below the recorded high yield of 3000 kg (Weiss, 1983) and 2000 kg in Yugoslavia (FAO, 1980). A further increase in sesame productivity per unit area and unit time needs intensive research in genetics and plant breeding. Studies on combining ability are of paramount importance to select suitable parents for hybridization. In the present investigation attempts have been made to evaluate seven parents and 42 hybrids through full diallel analysis to bring out the best parents and cross combinations with good general and specific combining abilities, for seed yield and its component characters.

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MATERIALS AND METHODS

The present investigation was conducted at Plant Breeding Farm, College of Agriculture, University of Agricultural Sciences, Raichur. The experimental material for this study consisted of 7 parents *viz.*, JCT-7, DSS-9, CO-1, RT-54, Dhauri Local, Gowri-173, MT-75. The seeds were obtained from department of genetics and plant breeding, UAS Raichur. The seven parents crossed in full diallel mating design resulting in forty two hybrids.

The forty two hybrids and their seven parents were raised in a Randomized Complete Block Design with two replications during summer 2011. A spacing of 45 cm between rows and 15 cm between plants was given and 20 plants were maintained in each cross. Observations were recorded on

eight biometrical traits *viz.,* days to maturity, 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 and oil yield per plant. A fertilizer schedule of 40:25:25 kg of NPK per hectare was followed along with the recommended cultural operations and plant protection measures. The diallel analysis was carried out according to the statistical genetic model described by Griffing (1956) as Method I and Model I and assuming a fixed effects statistical model (Model 1). The statistical analysis was carried out with INDOSTAT program. The combining ability variance analysis was done based on the method developed by Griffing (1956).

RESULTS AND DISCUSSION

The estimates of GCA and SCA variances are useful to infer the type of gene action and the relative importance of the character in breeding programme. In addition, the ratio between GCA and SCA variance help to find out the extent of additive gene action. The estimates of combining ability variances showed higher values of SCA variances for all the ten traits studied. High mean value was the main criterion of selection among the breeders for a long time. The parents with good mean performance would result in good performing off springs (Gilbert, 1958). Among the parents the JCT-7 was significantly superior for seed yield, oil yield and number of capsules per plant (Table 1). DSS-9 was recorded significantly superior for number of branches per plant. Parent RT-54 was recorded significantly superior for days to maturity and plant height. For 1000 seed weight CO-1 and Dhauri Local recorded significantly superior.

Dhillon (1975) reported that combining ability of parents gives useful information on the choice of parents in terms of expected performance of the hybrids and their progenies. Singh and Nanda (1976) opined that it was logical to select at least one parent with high GCA effects. Among the parent studied DSS-9 is good general combiners for yield contributing characters *viz.,* number of capsules per plant,1000 seed weight, seed yield per plant and oil yield per plant, number of branches per plant followed by Dhauri Local . It also recoded negative GCA effects for days to maturity which indicated that this parent is suitable for earliness breeding (Table 2). RT-54 recorded negative GCA effect for plant height which indicate reduction in plant height. Considering the GCA effect of parents DSS -9, Dhauri Local and RT-54 were adjudged as superior parents.

The *per se* performance of parents was not always

Table 1: Mean performance of parents for different traits in sesame

Parents	Days to maturity	Plant height(cm)	No. of branches/plant	No. of capsule/ plant	No. of seeds /capsule	1000 S.W. (g)	Seed yield/plant (g)	Oil yield/ plant
JCT-7	100.0	119.5	3.2	48.0**	60.0	2.8	7.8*	4.1
DSS- 9	86.80	101.5	3.6	42.5	50.0	2.9	6.1	3.0
CO-1	88.30	112.5	2.9	37.0	59.0	3.0	6.5	3.0
RT -54	83.50**	93.00**	2.9	35.0	48.0	2.5	4.1	1.7
Dhauri Local	95.00	100.0	3.1	36.0	45.0	3.0	4.8	2.1
Gowri-173	84.00	94.5**	2.5	32.0	53.0	2.7	4.6	2.3
MT -75	86.50	96.5*	3.2	34.5	50.0	2.8	4.8	2.3
Mean	89.10	102.5	3.0	37.8	52.0	2.8	5.5	2.6
S.E.±	1.48	1.59	0.14	1.0	1.1	0.1	0.4	0.2
C.D. (P=0.05)	4.1	4.5	0.4	2.8	3.2	0.3	1.1	0.6
C.D. (P=0.01)	5.5	6.0	0.5	3.7	4.2	0.5	1.5	0.8

* and ** indicate significance of values at P= 0.05 and 0.01, respectively

Table 2 : General combining ability (GCA) effects of parents for 8 traits in sesame

Parents	Days to maturity#	Plant height(cm)#	No. of branches/plant	No. of capsule/ plant	No. of seeds /capsule	1000 S.W. (g)	Seed yield/plant (g)	Oil yield/ (g/plant)
JCT -7	5.41 **	3.03 **	-0.03	-1.15 **	0.35	-0.35 **	-0.98 **	-0.54 **
DSS -9	-4.18 **	4.53 **	0.54 **	3.12**	2.82 **	0.17 **	1.32 **	0.69 **
CO- 1	0.06	4.49 **	-0.30**	-0.69**	-0.21	0.11 **	0.01	-0.02
RT -54	-2.18 **	-5.11 **	0.31 **	0.48	-0.25	-0.05	0.14	0.07
Dhauri Local	0.56	-2.54 **	0.00	2.52 **	0.39	0.02	0.41***	0.22**
Gowri- 173	0.29	-2.43 **	-0.22 **	-3.08 **	-2.28**	0.05	-0.60 ***	-0.26 **
MT-75	0.03	-1.96 **	-0.30 **	-1.19**	-0.82 **	0.03	-0.31 **	-0.15 *
S.E.(gi)	0.36	0.39	0.03	0.24	0.27	0.03	0.10	0.05
C.D. (P=0.05)	0.73	0.79	0.07	0.48	0.55	0.06	0.21	0.11

* and ** indicate significance of values at P= 0.05 and 0.01, respectively , # GCA effects in negative direction was considered

Table 3 : Top two crosses exhibiting maximum SCA effects in desired direction and their per se performance

Characters	Cross	*Per se* performance	SCA Effects
Days to maturity#	Gowri-173 x JCT-7	91.3	-9.62**
	Gowri -173 x RT-54	85.3	-9.24**
Plant height #	MT-75 x RT-54	106.0	-11.5**
	JCT-7 x CO-1	100.0	-8.9**
No. of branches	DSS-9 x Dhauri Local	5.80	1.08**
	MT -75x RT-54	3.3	0.82**
No.of capsule per plant	Dhauri Local x DSS-9	71	12.50**
	DSS-9 x RT-54	49	12.48**
No.of seeds per capsule	Gowri-173 x Dhuri Local	52	8.00**
	JCT-7 x RT-54	59	7.89**
1000 seed weight	DSS-9 x JCT-7	3.1	0.70**
	RT-54 x MT-75	3.0	0.34**
Seed yield/ plant	Dhauri Local x DSS-9	15.7	3.50**
	DSS-9 x RT-54	7.5	3.45**
Oil yield/plant	Dhauri Local x DSS-9	8.1	1.77**
	DSS-9 x RT-54	3.4	1.67**

*and** indicate significance of values at P= 0.05 and 0.01, respectively, # Sca effects in negative direction was considered

reflected in high GCA effects. The high GCA effect might be due to linkage in repulsion phase (Sarsar *et al*., 1986) who opined that parents with high mean performance may not be able to transmit their superior traits into hybrids and hence, they insisted the need for combining ability of parents also. The significantly superior general combining ability effects along with high mean performance would result in the identification of parents with good reservoir of superior genes. Hence, both mean performance and GCA effects were taken into account for parental selection.

The specific combining ability is the deviation from the performance predicted on the basis of general combining ability (Allard, 1960). The SCA effect is an important criterion for the evaluation of hybrids (Table 3). Among the hybrids Dhauri Local x DSS-9 showed positive and significant SCA effect for the traits, number of capsules per plant and seed yield and oil yield per plant followed by DSS-9 x RT-54. Similar results were reported by Senthil kumar and Ganesan (2001), Ranjit Rajaram and Senthil kumar (2011). DSS-9 x Dhauri Local showed maximum positive and significant SCA effects for the trait number of branches per plant. Gowri x JCT-7 recoded negative and significant SCA for days to maturity. For the trait plant height MT-75 x RT-54 showed desirable SCA effects. Gowri 173 X JCT-7 recorded negative and significant SCA for days to maturity. Based on the SCA effects of the hybrids DSS-9 x Dhauri Local, Dhauri Local x DSS-9, Gowri - 173x JCT-7, MT-75 x RT-54 were adjuged as better hybrids. Hence, these crosses expected to produce transgressive segregantsin later generations.

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