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Heterosis and combining ability in *Abelmoschus esculentus* (L.) Moench for some important biometerical traits

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SUMMARY

Eight genotypes *viz*., NOH 303, Indol 031, Arya 351, DOV 2, Pusa A 4, DSU 1, Varsha Uphar and Hissar Unnat were mated in half-diallel fashion. The resultant 28 hybrids were studied for general combining ability of parents and specific combining ability of crosses for eight economic traits *viz*., days to 50 per cent flowering, plant height at maturity, number of branches per plant, fruit length, fruit girth, fruit weight, number of fruits per plant and fruit yield per plant. The estimates of *gca* effects of parents revealed that Hissar Unnat and Varsha Uphar were found to be superior for most of the traits including fruit yield per plant. Among the hybrids Varsha Uphar x Hissar Unnat had high mean, positive significant *sca* and high standard heterosis for five traits including fruit yield per plant.

Key words : Heterosis, Combining ability, Biochemical traits, Okera, *Abelmoschus esculentus*.

Okra *Abelmoschus esculentus* (L.) Monechis an important vegetable crop grown for its tender fruits in almost all parts of India. It is basically a self pollinated crop but natural cross pollination to an extent of 8.75% may occur (Purewal and Randhawa, 1947). The characters like growth, earliness, quality, yield and its component traits are very useful for a breeder for developing commercial variety and hybrid. The success of hybrid largely depends on the efficiency of choosing appropriate parents of good genetic potential. In the present investigation attempts have been made to evaluate eight parents and twenty eight hybrids through half -diallel analysis by determining the magnitude of the general and specific combining ability effects and heterosis for different traits.

MATERIALS AND METHODS

The experiment was carried out at the Plant Breeding Farm, Faulty of Agriculture, Annamalainagar. Eight parents *viz*., NOH 303 (P_1), Indol 031 (P_2), Arya 351 (P_3), DOV 2 (P_4), Pusa A 4 (P_5), DSU 1 (P_6), Varsha Uphar (P_7) and Hissar Unnat (P_8) were raised in a crossing block during February 2007. The F_1 generation of all crosses were raised during August 2007 in a Randomized Block Design replicated thrice. Seeds were dibbled with a spacing of 45 cm between rows and 30 cm between plants in two rows plot of 3.0 m length. Five plants were randomly selected for each genotype from each replication to measure the biometrical traits. Recommended agronomic practices were followed through out the crop period

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RESULTS AND DISCUSSION

The results obtained from the present investigation are presented below:

Analysis of variance:

The analysis of variance for combining ability revealed that the variances were significant for all the traits studied indicating the presence of substantial variation among the genotypes . In the present study, the GCA and SCA variances were found to be highly significant for all the traits indicating the importance of both additive and non-additive genetic variances. However, the non-additive variance was preponderant (Table 1).

Combining ability effects:

The values of parents with high mean and *gca* effects for various traits are presented in Table 2. The mean values of hybrids with high mean, *sca* and *gca* of the corresponding parents as well as percentage heterosis over standard parent for eight characters are presented in Table 3. The parent P_7 had superior *per se* performance for number of fruits per plant, fruit yield per plant , plant height and fruit weight . The parent P_8 had the next superior *per se* performance for number of fruits per plant, number of branches per plant and days to 50 per cent flowering. The parent P_4 showed high *per se*

Table 1 : Analysis of variances and variance of combining ability for various characters

Source	DF	Days to 50 per cent flowering	Plant height	Number of branches per plant	Fruit weight	Number of fruits per plant	Fruit yield per plant
Replication	2	0.04	32.38	0.03	0.51	173	875.0
Genotypes	35	2.67**	229.12**	0.20**	16.75**	26.11**	23613.17**
Error	70	0.36	5.85	0.01	0.18	0.49	225.63
GCA	-	1.09**	1.21**	0.01**	0.51	1.99**	1578.73**
SCA	-	2.41**	90.01**	0.06**	5.63**	5.66**	5798.02**
GCA/SCA	-	0.45	0.01	0.16	0.09	0.35	0.27

** indicates of value at P=0.01

Table 2 : Estimates of parents with high mean and general combining ability (*gca*) effects for various traits

Characters	Mean	GCA
Days to 50 % flowering	$P_{7,}$ P_8	$P_{7,}$ P_8
Plant height	P_7	$P_{2,}$ P_4
Number of branches per plant	$P_{8,}$ P_6	$P_{6,}$ P_5
Fruit length	$P_{4,}$ P_7	$P_{1,}$ P_8
Fruit girth	$P_{6,}$ P_4	$P_{4,}$ P_6
Fruit weight	$P_{7,}$ P_3	$P_{8,}$ P_4
Number of fruits	$P_{7,}$ P_8	$P_{8,}$ P_7
Fruit yield	$P_{7,}$ $P_{3,}$ P_8	$P_{8,}$ P_7

performance for fruit length. Higher *per se* performance for fruit girth was observed in the parent P_6.

The parent P_8 showed high significant *gca* effect for fruit yield per plant, number of fruits per plant, fruit weight and days to 50 per cent flowering. Highly significant *gca* effect for fruit girth was observed in the parent P_4. The parent P_1 showed high *gca* effect for fruit length. The parent P_2 had the highest and significant *gca* effect for plant height. The parents P_8 and P_7 showed high *per se* performance and significant *gca* for fruit yield, number of fruits per plant and 50 per cent

Table 3: Estimates of mean, specific combining ability (*sca*) and heterosis of best hybrids for various traits

Characters	Mean (i)	*sca* (ii)	*gca* of the corresponding parents in hybrid	Standard heterosis (iii)	Combination of criteria (i) (ii) (iii)
Days to 50 %	P_7 x P_8 (34.23**)	P_7 x P_8 (-2.56**)	S x S	P_7 x P_8 (-5.87**)	P_7 x P_8
flowering	P_2 x P_7 (34.77**)	P_2 x P_7 (-2.19**)	S x S	P_2 x P_7 (-4.4**)	P_2 x P_7
	P_2 x P_8 (35.17**)	P_4 x P_7 (-1.48**)	S x S	P_1 x P_8 (-3.02**)	P_1 x P_8
Plant height	P_2 x P_3 (115.00**)	P_2 x P_3 (23.05**)	S x S	P_2 x P_3 (22.12**)	P_2 x P_3
	P_2 x P_6 (114.00**)	P_2 x P_6 (22.93**)	S x N	P_2 x P_6 (21.06**)	P_2 x P_6
	P_1 x P_5 (109.00**)	P_1 x P_5 (12.74**)	S x S	P_1 x P_5 (15.75**)	P_1 x P_5
Number of branches	P_7 x P_8 (1.87**)	P_7 x P_8 (0.57**)	S x N	-	-
per plant	P_2 x P_6 (1.80**)	P_1 x P_5 (0.36**)	N x S		
	P_1 x P_5 (1.80**)	P_2 x P_3 (0.31**)	N x S		
Fruit length	P_6 x P_8 (17.5**)	P_1 x P_3 (2.28**)	S x S	P_6 x P_8 (19.32**)	P_6 x P_8
	P_1 x P_3 (17.4**)	P_4 x P_5 (2.27**)	N x S	P_1 x P_3 (18.86**)	P_1 x P_3
	P_1 x P_2 (17.2v)	P_6 x P_8 (2.21**)	N x S	P_1 x P_2 (17.27**)	P_1 x P_2
Fruit girth	P_3 x P_4 (6.80**)	P_3 x P_4 (0.98**)	S x S	P_3 x P_4 (19.30**)	P_3 x P_4
	P_2 x P_4 (6.60**)	P_3 x P_6 (0.73**)	S x S	P_1 x P_4 (18.71**)	P_2 x P_4
	P_1 x P_4 (6.67**)	P_1 x P_2 (0.53**)	N x S	P_2 x P_6 (12.87**)	P_1 x P_2
Fruit weight	P_2 x P_8 (22.83**)	P_7 x P_8 (4.99**)	S x S	P_7 x P_8 (39.27**)	P_7 x P_8
	P_1 x P_2 (21.43**)	P_1 x P_3 (4.26**)	S x N	P_2 x P_8 (38.66**)	P_2 x P_8
	P_7 x P_8 (19.83**)	P_2 x P_8 (2.91**)	S x S	P_1 x P_3 (36.64**)	P_1 x P_3
Number of fruits per	P_4 x P_8 (25.37**)	P_7 x P_8 (4.59**)	S x S	P_7 x P_8 (35.40**)	P_7 x P_8
plant	P_6 x P_8 (25.33**)	P_6 x P_8 (3.93**)	S x S	P_6 x P_8 (26.43**)	P_6 x P_8
	P_7 x P_8 (22.22**)	P_5 x P_6 (3.74**)	S x S	P_4 x P_8 (24.14**)	
Fruit yield per plant	P_7 x P_8 (592.92**)	P_7 x P_8 (130.94**)	S x S	P_7 x P_8 (76.21**)	P_7 x P_8
	P_4 x P_8 (563.15**)	P_1 x P_3 (118.92**)	S x N	P_4 x P_8 (67.36**)	P_4 x P_8
	P_6 x P_8 (551.03**)	P_6 x P_8 (116.12**)	S x S	P_6 x P_8 (63.21**)	P_6 x P_8

S – Significant N- Non-significant

flowering. Hence, these parents can be utilized in recombination breeding. It was observed that performance of parents bear direct relation to their respective *gca* effects. Parents, which showed highest *gca* effects for different characters were also observed to have good performance with respect to that particular character. For example, P_7 and P_8 which yielded high also showed high *gca* effects for these traits. But this was not true always. This confirmed the finding of Sharma and Mahajan (1978).

Estimates of heterosis and sca effects :

The best hybrids possessing *sca* effects in the desired direction for fruit yield per plant and yield components are presented in Table 3 along with their *per se* performance. Negative effects are considered to be desirable for days to 50 per cent flowering. Among the hybrids, the cross P_7 x P_8 showed significantly high mean values and *sca* effects for five traits like 50 per cent flowering, number of branches per plant, fruit weight, number of fruits per plant and fruit yield per plant (Table 3). The hybrid P_7 x P_8 recorded significant standard heterosis for four traits *viz*., days to 50 per cent flowering, fruit weight, number of fruits per plant and fruit yield per plant. For fruit yield per plant the hybrid P_7xP_8 was followed by P_4xP_8 and P_6xP_8 . The hybrids P_7xP_8 , P_2xP_7 and P_2xP_8 showed negatively significant *sca* and heterosis along with low mean for days to 50 per cent flowering . Therefore, these hybrids can be utilized in heterosis breeding for earliness. The hybrid P_7xP_8 recorded high mean, *sca* and standard heterosis for days to 50 per cent flowering, fruit weight, number of fruits per plant and fruit yield per plant. The hybrid P_6xP_8 recorded high mean, *sca* and standard heterosis for fruit length, number of fruits per plant and fruit yield per plant. Hence, these hybrids can be utilized in heterosis breeding for yield. The parents P_7 and P_8 had high *gca* for number of fruits per plant and fruit yield per plant and the cross P_7 x P_8 showed high *sca* and heterosis for these traits. But in the cross P_1xP_3 which showed significantly high *sca* for yield per plant one of the parents P_3 showed non-significant *gca* effect. This may be due to complementation of favorable genes for this characer (Rewale *et al*.,2003). Therefore, it cannot be generalized that the parents with high *gca* effects could only produce good hybrids. Similar result were observed by Dhankar and Dhankar (2001). The results showed that non additive gene action is an integral component of the genetic architecture of different characters in the material used.

REFERENCES

Dhankhar, B.S. and Dhankhar, S.K. (2001). Heterosis and combining ability studies for some economic characters in okra. *Haryana. J. Hort. Sci.,* **30**: 230-233.

Purewal, S.S. and Randhawa, G.S. 1947. Chromosome and Pollination studies in okra. *Indian J. agric. Sci.,* **17**: 129-136.

Rewale, V.S., Bendale, V.W., Bhave, S.G., Madav, R.R. and Jadhav, B.B. (2003). Combining ability of yield and yield components in okra. *J. Maharashtra agric. Univ.*, **28**: 244-246.

Sharma, B.R. and Mahajan, Y.P. (1978). Line and tester analysis of combining ability and heterosis for some economic characters in okra. *Scientia Hort.*, **9**: 111-118.

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