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RESEARCH ARTICLE

COMBINING ABILITY AND HETEROSIS FOR FRUIT YIELD AND ITS CONTRIBUTING CHARACTERS IN BHENDI (*Abelmoschus esculentus* L. Moench)

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ABSTRACT

Combining ability variances and effects of yield and its components traits in okra (*Abelmoschus esculentus* (L.) Moench) were studied through line x tester analysis of 40 F1 hybrids derived by crossing eight nearly homozygous germplasm lines namely TCR 852 (L_1), IC 1543(L_2), TCR 2086 (L_3), EC 306722 A3 (L_4), EC 306741 A6 (L_5), IC 7952 (L_6), IC 3340 (L_7) and EC 305651 (L_8) with five testers *viz*., Arka Anamika (T_1), Punjab Padmini (T_2), Hissar Unnat (T_3), Parbhani Kranti (T_4) and Varsha Uphar (T_5) were crossed during mid *kharif* (July-October) 2008, at experimental fields of Paambanvillai, Asaripallam, Vembanoor village, Agatheeswaran Taluk, Kanyakumari district during 2008. Eight lines and five testers and their 40 hybrids were evaluated for their genetic worthiness in breeding for fruit yield improvement in bhendi. The variance due to SCA was higher than that of variance due to GCA for all the six characters of interest. The genotypes *viz*., L_2, T_1, $T_3$and T_4 were adjudged as good general combiner for fruit yield. The cross combinations *viz*, L_2 x T_2, L_2 x T_1 and L_6 x T_4 were identified as best specific combiners for fruit yield.

INTRODUCTION

Bhendi (*Abelmoschus esculentus* (L.) Moench) is important member of family Malvaceae and commonly known as okra or ladyfinger in India. It is one of the most ancient and traditional vegetable crops grown in tropical and subtropical regions of the world (Martin and Ruberte, 1978). Bhendi is originated from tropical Africa with 2n = 8x = 72 or 130 or 144 chromosomes and is an allopolyploidy in nature (Joshi and Hardas, 1956; Suresh Babu, 1987). Martin (1982) reported that it behaves as a diploid. Under the genus *Abelmoschus,* there are 30 species in the old world and four in the new world. Out of them, *Abelmoschus esculentus,* is the only species known to be cultivated. Bhendi is being raised in India in an area of 0.44 million hectares with an average production of 4.52 mt with the productivity of 10.27 t/ha (Anonymous, 2009). A further increase in bhendi productivity needs intensive research in genetics and plant breeding. The *per se* performance of the parents themselves does not always give a correct indication of their breeding potentialities. Breeders need to examine whether productivity is enhanced mainly by genes governed by heterozygosity and homozygosity. Crop improvement through hybridization will be effective, if the information on the genetic information of the experimental population is available. The quantitative and qualitative characters which are controlled by a large number of genes, which exerts very small effect, cannot be easily identified through simple biometrical techniques. Knowledge on gene action, combining ability and heterosis helps in the selection of suitable parents for any successful breeding programme. The present study was formulated to find out best general and specific combiners with high *per se* performance and heterotic potential in bhendi through line x tester analysis was adopted with Mather and Jinks (1971).

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MATERIALS AND METHORS

Eight lines *viz.,* TCR 852(L_1), IC 1543(L_2), TCR 2086(L_3),EC 306722 A3 (L_4), EC 306741 A6(L_5), IC 7952(L_6), IC 3340(L_7) and EC 305651(L_8) were crossed with five testers *viz*., Arka Anamika (T_1), Punjab Padmini (T_2), Hissar Unnat (T_3), Parbhani Kranti (T_4) and Varsha Uphar (T_5). The resulting 40 hybrids along with 13 parents were evaluated in a randomized Block Design with three replications during 2008 to 2011. The crop was planted at a spacing of 45 x 30cm in two plots of 4.5 m length. Recommended agronomic practices and need based plant protection measures were undertaken. Data were recorded on ten randomly selected plants for the characters *viz*., Days to first flowering, Plants height at maturity, Number of branches per plant, Number of fruits per plant, Single fruit weight and Fruit yield per plant. The data were subjected to statistical analysis given by Kempthorne (1957).

RESULTS AND DISCUSSION

The analysis of variance due to lines was significant for Days to first flowering and Number of fruits per plant (Table l). The variance due to testers was significant for all the characters expect Plant height at maturity. This indicated that there exists genetic diversity among the females and males of the present investigation. The variance due to lines x tester's interaction was significant for all the characters except Plant height at maturity, there by showing their high specific combining ability. The variance due to hybrids was significant for all the six characters of interest. The relative estimates of variance due to SCA were higher than those for GCA for all characters studied (Table 2). This indicated the pre-dominance of non-additive gene action. Similar findings were earlier reported by Liou *et al.* (2002), Manivanan *et al.* (2007) and Senthilkumar (2010). The *gca* effects (Table 3) revealed that the genotype namely L_2 (IC 1543) was the best combiner for days to first flowering, number of fruits per plant, single fruit weight and fruit yield per plant. In males, T_3 (Hissar Unnat) and T_4 (Parbhani Kranti) were the best combiners for all the six characters studied. The tester *viz*., T_1 (Arka Anamika) was best combiner for five out of the six characters in the present study (Table.3). These parents could be utilized extensively in hybridization programme to exploit their maximum genetic variability and to isolate transgressivesegregants for fruit yield. The best three crosses selected based on mean, *sca* effects and standard heterosis are detailed in (Table 4). The study indicated a good agreement between these three parameters. The hybrids of L_2 x T_1 (IC 1543 x Arka Anamika) exhibited high mean, high *sca* effects and high standard heterosis for fruit yield per plant. This cross combination also exhibited negative significant *sca* effects for days to first flowering (Table 4). Similar findings were reported earlier by Singh *et al*. (2009) and Senthilkumar (2010). This cross combination could well be exploited for developing high yielding hybrids in bhendi. The female parent involved in the cross combination *viz*., L_2 x T_1(IC 1543 x Arka Anamika) was a good general combiner for fruit yield per plant. The result indicated the importance of both dominance and non- additive epistatic gene action in controlling fruit yield and its contributing traits. Hence, the improvement of fruit yield and its component characters by a simple pure line selection or

Table 1. Analysis of variance

S. No	Characters	Hybrids	Lines	Testers	Line x tester	Error
		Df=39	DF=7	Df=4	Df=28	Df=104
1.	Days to first Flowering	36.303**	51.884**	170.11**	13.300**	0.2981
2.	Plant height at maturity	1984.44**	3038.26	6739.04	1041.76	8.647
3.	Number of branches per plant	1.4295**	1.4871	4.6753**	0.9515**	0.0272
4.	Number of fruits per plant	46.026**	22.718**	224.435**	26.366**	0.2937
5.	Single fruit Weight	6.1171**	4.3057	26.9071**	3.5999**	0.059
6.	Fruit yield per Plant	22789.68**	9282.20	122669.20**	11898.04**	78.644

Table 2. Estimate of combining ability variance

S. No	Characters	GCA	SCA	GCA/SCA
1.	Days to first flowering	0.4057	4.3342	0.093
2.	Plant height at maturity	16.6281	344.3712	0.048
3.	Number of branches per plant	0.0084	0.3081	0.0271
4.	Number of fruits per plant	0.3468	8.6910	0.039
5.	Single fruit weight	0.0444	1.1801	0.037
6.	Fruit yield per plant	192.1184	3939..79	0.048

* Significant at 1% level
** Significant at 5 % level

Table 3. Based on the magnitude of GCA estimates for Lines and Tester

S. No	Characters	Lines	Tester
1.	Days to first flowering	L_2, L_3, L_5, L_7	T_2, T_3, T_4
2.	Plant height at maturity	L_4, L_7, L_8	T_1, T_3, T_4
3.	Number of branches per plant	L_1, L_6, L_8	T_1, T_3, T_4
4.	Number of fruits per plant	L_2, L_5, L_7	T_1, T_3, T_4
5.	Single fruit weight	L_1, L_2, L_3, L_4	T_1, T_3, T_4
6.	Fruit yield per plant	L_2	T_1, T_3, T_4

Table 4. Best three crosses selected based on mean, *sca* effects and standard heterosis

S. No	Characters	Mean	*sca* effects	*gca* effects	D*iii* Standard heterosis	Common Cross Combination
		L_3 x T_3	L_2 xT_1	S x NS	L_3 x T_3	
1.	Days to flowering	L_3 x T_4	L_6 x T_4	S x S	L_2 x T_1	
		L_5 x T_3	L_1 x T_2	NS x S	L_3 x T_4	
2.	Plant height of maturity	L_7 x T_3	L_1 x T_5	S x S	L_7 x T_4	
		L_8 x T_3	L_2 x T_5	S x S	L_8 x T_3	
		L_4 x T_3	L_8 x T_4	S xS	L_4 x T_3	
3.	Number of branches per plant	L_8 x T_3	L_2 x T_5	S x S	L_8 x T_3	
		L_6 x T_3	L_4 x T_1	S x S	L_6 x T_3	
		L_4 x T_1	L_1 x T_5	S x S	L_6 x T_3	
4.	Number of fruits per plant	L_4 x T_3	L_1 x T_1	NS x S	L_4 x T_3	
		L_6 x T_3	L_2 x T_2	S x S	L_6 x T_3	
		L_5 x T_3	L_8 x T_4	S x S	L_5 x T_3	
5.	Single fruit weight	L_4 x T_4	L_7 x T_5	S x S	L_4 x T_4	
		L_2 x T_1	L_2 x T_2	S x S	L_2 x T_1	
		L_6 x T_4	L_6 x T_4	NS x S	L_6 x T_4	L_6 x T_4
6.	Fruit yield per plant	L_2 x T_1	L_2 x T_2	S x NS	L_2 x T_1	
		L_6 x T_3	L_2 x T_1	S x NS	L_6 x T_3	L_2 x T_1
		L_2 x T_2	L_6 x T_4	S x S	L_2 x T_2	L_2 x T_2

❖ Significant at 1 % level
❖ Significant at 5 % level

modified pedigree selection may not be possible. The improvement can be expected by delaying the selection to later segregating generations, when the dominance and epistatic gene actions disappear and resorting to intermating of segregants followed by recurrent selection. The diallel selective mating system can also be adopted.

REFFERENCES

Anonymous. 2009. Agricultural statistics at a glance. Department of Agriculture and Co-operation, Ministry of Agriculture, Government of India. (www.dacnet.nic.in)

Joshi, A.B. and M.W. Hardas. 1956. Alloploid nature of okra (*Abelmoschus esculentus* (L) Moench). *Nature,* 178:1198.

Kempthorne.U.1957. An introduction to genetic studies. John wiley and sons, Newyork.

Liou MinLi, GuoJiewei and Wu Shutu. 2002. Combining ability analysis of yield components in okra. *J. Agric. Forestry,* 51(2): 1-9.

Manivannan, M.I., J. Rajangam and P. Aruna. 2007. Heterosis for yield and yield governing traits in okra. *Asian J. Hort.,* 2(2): 96-103.

Martin, F.W. 1982. Okra potential multiple purpose crop for the temperate zone and tropic. *Econ. Bot*. 36(3): 340-345.

Martin, F.W. and R. Ruberte. 1978. Vegetables for the hot humid tropic Pt. two okra (*Abelmoschus esculentus* (L) Moench). USDA-ARS- S.R. New Orleans, Louisiana, pp. 1-2.

Mather, k. and J.L. Jinks 1971. Biomaterial genetics 2nd edition, Chapman and Mile Ltd., New Fetus lane, London.

Senthilkumar. N 2010. Heterosis for fruit yield and its component traits in okra (*Abelmoschus esculentus* (L.) Moench). *Adv. Plant. Sci.,* 23(1): 223-225.

Singh, D.R., P.K. Singh, M.M. Syamal and S.S. Gautam. 2009b. Studies on combining ability in okra. *India J. Hort.,* 66(2): 277-280.

Suresh Babu. K.V. 1987. Cytogenetical studies in okra (Abelmoschus esculentus (L) Moench). Ph.D. Thesis, *Univ. Agrl. Sci*., Bangalore.

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