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## COMBINING ABILITY ANALYSIS FOR YIELD AND YIELD CONTRIBUTING TRAITS IN BHENDI [*ABELMOSCHUS ESCULENTUS* (L.) MOENCH]

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### ABSTRACT

The study was carried out using six genotypes in bhendi to estimate general and specific combining ability effects for ten traits *viz.*, days to first flower, plant height, number of branches per plant, number of nodes per plant, internodal length, number of fruits per plant, fruit length, fruit girth, single fruit weight and fruit yield per plant. A total of 30  $F_1$ 's produced through diallel technique along with six parents were investigated in randomized block design with three replications during 2018-19. The *gca* and *sca* mean squares were significant for all the traits investigated and the magnitude of *gca* variance was more than the estimates of *sca* for all traits. Among the parents, Dharmapuri Local 1 was found to be excellent general combiner for fruit yield per plant and most of the yield contributing traits. The estimates of *sca* effects revealed that the cross combinations Krishnagiri Local 1  $\times$  Dharmapuri Local 1, Chidambaram Local 1  $\times$  Dharmapuri Local 1 and Chidambaram Local 1  $\times$  Dharmapuri Local 1 were most promising for marketable fruit yield per plant and most of its related traits.

**Key words :** Bhendi, Combining ability, *gca* and *sca*.

### Introduction

Bhendi [*Abelmoschus esculentus* (L.) Moench] is a commercially cultivated and potential export earner vegetable crop in India. Bhendi is native to tropical Africa and it is a self-pollinated crop (Joshi and Hardas, 1956). It is a tropical crop and is mainly grown as a summer and rainy season (*kharif*) crop in India (Baloch, 1994). Among the vegetables grown in India, Bhendi occupies an area of 5.28 lakh ha with annual production of 6.15 million tonnes and productivity of 11.9 t/ha (NHB, 2017).

As the yield potential of bhendi is low it is important to increase its productivity by improving the genetic architecture through hybridization. Combining ability helps in identifying the best parents for hybridization and identification of superior cross combinations. GCA reveals the preponderance of additive gene effects while SCA reveals the dominance and epistasis. The current study was undertaken to evaluate the common varieties and genotypes with broad character variation for combining

ability for their effective use in the bhendi improvement program in India.

### Materials and Methods

Six genetically divergent genotypes of bhendi namely, MDU 1, Dharmapuri Local 1, Arka Abhay, Chidambaram Local 1, Chidambaram Local 2 and Krishnagiri Local 1 were evaluated for general and specific combining ability. These genotypes were crossed in full diallel fashion during the *kharif* season of 2018 to develop 30  $F_1$ 's. The resultant 30  $F_1$ 's were evaluated in a Randomized Block Design (RBD) with three replications at Plant Breeding Farm, Faculty of Agriculture, Annamalai University located at east coastal region of Tamil Nadu during *rabi* season of 2018 along with six parents at a spacing of 60 and 40 cm. All the recommended package of practices was adopted to raise a healthy crop. For this study, the observations recorded on randomly selected five plants for ten quantitative traits *viz.*, days to first flower, plant height, number of branches per plant, number of nodes

per plant, internodal length, number of fruits per plant, fruit length, fruit girth, single fruit weight and fruit yield per plant in each replication. The procedure outlined by Griffing (1956b) for Model I (fixed), Method 1 was considered appropriate for this study since it involved the parents and  $F_1$ 's of both direct and reciprocal crosses.

## Results and Discussion

The analysis of variance for ten traits were studied and presented in Table 1. The variance due to general and specific combining ability effects was highly significant for all the characters. This indicated that the parents and hybrids differed highly for general combining ability (GCA) and specific combining ability (SCA). The magnitude of general combining ability variance was more than the estimates of specific combining ability for all traits in  $F_1$  generation.

The estimates of general combining ability effects (Table 2) revealed that the parent Dharmapuri Local 1 was found good general combiner for all the characters studied except days to first flower. Among the six parents, two parents *viz.*, Dharmapuri Local 1 and Krishnagiri Local 1 were good general combiner for fruit yield per plant. These parents could be useful in future breeding programme to generate more number of desirable segregates fruit yield per plant and its contributing traits. The similar results were observed by Pal and Sabesan (2009), Amaranath Reddy *et al.* (2013), Arti Verma and Sonia Sood (2015), Sugani Devi *et al.* (2017) and Pachiyappan and Saravanan (2018).

The estimates of specific combining ability effects (Table 3) revealed that the crosses ArkaAbhay  $\times$  Dharmapuri Local 1 and Krishnagiri Local 1  $\times$  Dharmapuri local 1 were significant for all the characters studied except days to first flower. The ten crosses namely MDU 1  $\times$  Arka Abhay, Dharmapuri Local 1  $\times$  Chidambaram Local 1, Dharmapuri Local 1  $\times$  Chidambaram Local 2, Dharmapuri Local 1  $\times$  Krishnagiri Local 1, Arka Abhay  $\times$  Dharmapuri Local 1, Arka Abhay  $\times$  Chidambaram Local 2, Chidambaram Local 1  $\times$  Dharmapuri Local 1, Chidambaram Local 2  $\times$  Dharmapuri Local 1, Chidambaram Local 2  $\times$  Krishnagiri Local 1, Krishnagiri Local 1  $\times$  Dharmapuri Local 1 were significant for fruit yield per plant. All the best performer crosses for fruit yield per plant involve atleast one good general combiner. The earlier workers also reported the similar results, Akotkar *et al.* (2014), Wakode *et al.* (2016) and Lyngdoh *et al.* (2017).

The crosses showing high SCA effects did not always involve parents with high GCA effects. For such crosses, it was suggesting that the inter-allelic interactions are

**Table 1 :** Estimates of variances for combining ability for yield and its contributing characters in bhendi.

Source	df	Days to first flower	Plant height	Number of branches per plant	Number of nodes per plant	Internodal length	Number of fruits per plant	Fruit length	Fruit girth	Single fruit weight	Fruit yield per plant
<b>GCA</b>	5	66.06**	752.33**	3.11**	4.27**	3.12**	3.48**	2.71**	0.09**	41.89**	8934.70**
<b>SCA</b>	5	0.47**	8.20**	0.08**	0.39**	0.14*	0.30**	1.49**	0.06**	2.75**	846.10**
<b>RCA</b>	5	25.62**	90.45**	0.72**	0.43**	0.87**	0.94**	0.63**	0.02**	12.26**	2511.91**
<b>Error</b>	70	0.05	2.07	0.01	0.06	0.05	0.09	0.07	0.01	0.21	64.58

\* Significant at 5 per cent level; \*\* Significant at 1 per cent level.

**Table 2 :** General Combining Ability (GCA) effect for various yield and its contributing characters in bhendi.

Parents	Days to first flower	Plant height	Number of branches per plant	Number of nodes per plant	Internodal length	Number of fruits per plant	Fruit length	Fruit girth	Single fruit weight	Fruit yield per plant
<b>MDU1</b>	-0.95**	1.14**	-0.11**	0.46**	-0.27**	-0.05	-0.39**	-0.02	-0.72**	-4.17
<b>DL1</b>	4.78**	15.51**	1.03**	0.99**	1.03**	1.05**	0.93**	0.17**	3.71**	49.83**
<b>AABY</b>	-0.98**	-3.54**	-0.22**	-0.31**	-0.18**	-0.40**	-0.24**	-0.02	-1.29**	-29.40**
<b>CL1</b>	-1.00**	-4.03**	-0.19**	-0.34**	-0.16**	-0.24**	-0.08	-0.03	-1.03**	-17.92**
<b>CL2</b>	-0.96**	-3.71**	-0.26**	-0.23**	-0.24**	-0.03	-0.20**	-0.06**	-0.57**	-3.35
<b>KL1</b>	-0.88**	-5.35**	-0.23**	-0.55**	-0.16**	-0.32**	0.00	-0.02	-0.08	5.02*
<b>SE</b>	0.06	0.37	0.02	0.06	0.05	0.07	0.07	0.01	0.12	2.11

MDU1 – MDU 1; DL1 – Dharmapuri Local 1; AABY – ArkaAbhay; CL1 – Chidambaram Local 1; CL2 – Chidambaram Local 2; KL1 – Krishnagiri Local 1  
 \* Significant at 5 per cent level; \*\* Significant at 1 per cent level.

**Table 3 :** Specific Combining ability (SCA) effects for various yield and its contributing characters in bhendi.

Genotypes	Days to first flower		Plant height		Number of branches per plant		Number of nodes per plant		Internodal length		Number of fruits per plant		Fruit length		Fruit girth		Single fruit weight		Fruit yield per plant	
	D	R	D	R	D	R	D	R	D	R	D	R	D	R	D	R	D	R	D	R
	MDU1/DL1	-0.21	-5.69**	0.19	-6.60**	-0.23**	-0.95**	-0.12	-0.60**	-0.18	-1.51**	-0.45*	-1.31**	-0.00	-1.33**	0.07	-0.18**	-0.13	-4.96**	5.67
MDU1/AABY	0.03	-0.03	1.76*	1.30	0.11	0.03	0.41**	-0.10	0.19	-0.82**	0.45*	-1.10**	0.21	-0.41*	0.11*	0.06	1.08**	0.57	9.89**	10.43
MDU1/CL1	-0.08	0.03	-0.88	-0.17	-0.06	0.03	0.14	0.53**	-0.31*	-0.15	0.09	0.03	0.13	-0.48*	0.00	-0.10*	0.55*	0.18	0.73	3.66
MDU1/CL2	0.02	-0.18	0.45	2.64*	0.11	0.13	0.26	0.70**	-0.08	-0.16	0.03	-0.18	0.48**	-0.45*	0.01	-0.05	0.01	-0.08	-8.40	4.61
MDU1/KL1	-0.25	0.22	-0.42	1.37	-0.01	0.03	-0.02	0.77**	-0.01	0.17	0.06	-0.18	0.12	-0.59**	-0.01	-0.08	-0.25	-0.29	-7.60	3.88
DL1/AABY	-0.51**	5.50**	-0.98	16.60**	0.09	1.23**	-0.31*	0.77**	-0.10	0.64**	-0.16	0.99**	0.02	0.54**	-0.05	0.13*	-1.25**	2.73**	-35.01**	31.21**
DL1/CL1	0.36**	6.70**	4.53**	12.17**	0.17**	1.20**	0.37*	0.03	0.32*	1.15**	0.79**	0.64**	0.38*	0.99**	0.07	0.18**	0.12	4.15**	4.74	63.01**
DL1/CL2	0.31	6.22**	-0.06	7.45**	-0.27**	0.90**	0.46**	0.38	-0.26*	1.20**	0.43*	0.64**	0.09	0.66**	-0.04	0.03	0.55*	5.02**	12.17*	74.79**
DL1/KL1	0.36**	6.75**	-1.34	11.83**	-0.09	0.83**	0.08	0.63**	0.07	0.31*	0.11	0.89**	0.31	0.41*	0.05	0.12*	2.45**	4.07**	31.29**	61.35**
AABY/CL1	-0.16	0.27	-0.01	1.12	0.02	0.07	-0.07	0.33	-0.22	0.12	-0.12	0.60**	0.60**	-0.10	0.06	0.02	0.78**	-0.09	6.80	-8.47
AABY/CL2	-0.28*	0.35*	2.51**	-1.27	0.16**	0.00	0.41**	0.06	0.18	-0.24	0.33	-0.13	0.57**	-0.12	0.17**	0.04	0.55*	-0.14	15.06**	-0.21
AABY/KL1	-0.29*	0.02	0.63	0.52	0.10	-0.03	0.39*	0.33	-0.19	-0.09	-0.06	0.69**	0.48**	-0.04	0.08*	-0.03	-0.18	-0.24	8.41	-4.02
CL1/CL2	-0.54**	0.08	-1.39	-0.33	0.13	0.07	-0.41**	0.26	-0.08	0.16	-0.12	0.03	0.61**	-0.01	0.10*	-0.00	0.21	0.01	-5.44	0.26
CL1/KL1	-0.29*	0.10	0.64	1.00	0.07	0.03	0.47**	0.15	-0.38**	-0.06	-0.35*	0.76	0.44**	0.06	0.12**	-0.04	-0.25	-0.00	0.15	-1.75
CL2/KL1	-0.44**	-0.23	1.79*	-1.00	0.13*	0.03	-0.05	0.03	0.14	-0.25	0.09	0.03	0.38*	0.04	0.12**	-0.02	0.80**	-0.47	25.81**	-29.95**
SE (sca)(i)	0.19		1.20		0.08		0.21		0.18		0.25		0.23		0.06		0.38		6.70	
SE (sca)(j)	0.14		0.86		0.06		0.15		0.13		0.18		0.16		0.04		0.28		4.83	
SE (rca)	0.16		1.02		0.07		0.18		0.15		0.21		0.19		0.05		0.33		5.68	

\* Significant at 5 per cent level; \*\* Significant at 1 per cent level; D – Direct cross; R – Reciprocal cross; sca – Specific Combining Ability; gca – General Combining Ability; MDU1 – MDU 1; DL1 – Dharmapuri Local 1; AABY – ArkaAbhay; CL1 – Chidambaram Local 1; CL2 – Chidambaram Local 2; KL1 – Krishnagiri Local 1

important for the concern traits. For fruit yield per plant, Dharmapuri Local 1 × Krishnagiri Local 1 recorded significant SCA effects and it was resulted from the parents having good x good GCA effects. Thus, it reflects additive x additive type of gene action. The similar results were observed by Weerasekara *et al.* (2008) and Nagesh *et al.* (2014).

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