COMBINING ABILITY STUDIES FOR FRUIT YIELD AND ITS COMPONENTS IN BRINJAL (*Solanum melongena* L.)

***[1]SAVALIYA, J. J.; [2]PANSURIYA, A. G.; [3]VARMODA, D. L. AND [4]TALAVIYA, B. P.**

JUNAGADH AGRICULTURAL UNIVERSITY
JUNAGADH – 362 001, GUJARAT, INDIA

EMAIL: jjsavaliya@jau.in

[1]Assistant Research Scientist, Oilseeds Research Scheme, Junagadh Agricultural University, Manavadar
[2]Associate Research Scientist, Wheat Research Station Junagadh Agricultural University, Junagadh
[3]Assistant Research Scientist, Fruit Research Station, Junagadh Agricultural University, Mangarol
[4]Assistant Professor, Office of The Director of Student Welfare, Junagadh Agricultural University, Junagadh

ABSTRACT

Combining ability effects were estimated for different traits in a diallel crossing programme in brinjal which comprising 28 crosses developed by using 8 parental lines crossed in all possible combination excluding reciprocals. Parents and crosses differed significantly for gca and sca effects. On the basis of gca and sca variances, most of the traits under study indicated the predominant of non-additive gene action except days to first flowering, days to first picking and plant height. The parents GBL 1 and JBR 02-11 wewe good general combiners for fruit yield, earliness, quality characters and fruit borer infestation. Punjab Sadabahar, K 331 and PB 69 were found best general combiners for fruit girth, single fruit weight, fruit related traits and plant height. Crosses namely GBL 1 x BB 85, JBR 02-11 x K 331 and JBR 02-11 x PB 69 have been superior on the basis of sca value and per se performance for fruit yield and its important components, which may be evaluated for further promotion.

KEY WORDS: Brinjal, Combining ability, gca, sca

INTRODUCTION

Brinjal **(***Solanum melongena* L.**)** is one of the most important and widely consumed vegetable crops of India. It can be grown through to the year. This crop exhibits rich genetic diversity for various horticultural traits and great scope for its improvement. In brinjal, yield is complex quantitative character and influenced by its contributing traits *viz.*, average fruit weight, length, breath and plant vigour. The selection of parents on the basis of *per se* performance does not necessarily lead to desirable results. A knowledge of general combining ability (gca) and specific combining ability (sca) helps in choice of parents or hybrids and the nature of gene action acts as a basis for choosing an effective breeding methodology. The present investigation, therefore, was undertaken to identify potential parental combinations in order to have superior hybrids of excellent qualities coupled with high yields.

MATERIALS AND METHODS

The present investigation was carried out to study general and specific combining ability of parents and crosses, respectively. The experimental materials for the present investigation consisted of eight diverse parental lines *viz.*, GBL 1, JBR 02-11, JBOB

03-04, Punjab Sadabahar, KS 331, PB69, DBL 02 and BB 85 crossed in adiallel fashion. The parents and F_1 crosses were grown in complete randomized block design with three replication during *rab*i 2016 at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh. The F_1 hybrids were grown in plots consisting of single row of 4.8 m length having a spacing of 75 x 60 cm. The observations were recorded on five randomly selected plants per replication per entries.

RESULTS AND DISCUSSION

In present study, the analysis of variance for combining ability (Table 1) indicated that general and specific combining ability variances were highly significant for all the characters, suggesting that both additive and non-additive gene effects were involved in the expression of these characters. The magnitude of variance due to general combining ability were observed to be higher than the specific combining variances for all the characters except single fruit weight, number of primary branches per plant, total phenol and fruit borer infestation. These results are further supported by σ^2gca /σ^2sca ratio, as its value was less than one in above said characters. These results clearly showing the predominance of non-additive gene effects in genetic control of all the characters except days to first flowering, days first to picking and plant height, for which additive genetic variance played important role. Similar results were also reported by Bisht *et al*. (2006), Kamalakkannan *et al*. (2007) and Bhakta *et a*l. (2009).

Estimates of general combining ability effects are given Table 2. Among eight parental lines, the parent GBL 1 had highly significant gca estimates for days to first flowering, days to first picking, fruit length, plant height, total phenol, total sugar and fruit yield per plant. The parent JBR 02-11 showed higher gca effects and was a good general combiner for traits like number of fruits per plant, number of primary branches per plant, total phenol, total sugar and fruit yield per plant. Thus, the parents GBL 1 and JBR 02-11 were identified as good general combiners for fruit yield, earliness, quality characters and fruit borer infestation. Punjab Sadbahar and K 331 were good general combiners for fruit girth. Parent PB 69 was found good general combiner for single fruit weight. BB 85 was proved good general combiner for total phenol and total sugar along with plant height. The present results, thus, suggested that these parents possessed high concentration of favourable genes for respective traits and may be utilized in crossing programme in order to generate wide genetic variability for effective selection to develop high yielding along with early, quality rich and fruit borer resistant varieties of brinjal. Similar results were also reported by Suneetha *et a*l. (2005), Bisht *et al*. (2006), Vaddoria (2006) and Kamalakkannan *et al*. (2007).

The estimates of sca effects are given Table 3. The number of crosses having desirable significant estimates were 8 for fruit yield, 2 for days first flowering, 3 for days to first picking, 7 for fruit length, 8 for fruit girth, 13 for single fruit weight, 4 each for number of fruits per plant and plant height, 7 each for number of primary branches per plant and fruit borer infestation, 11 for total phenol and 12 for total sugar. The best performing crosses showing highest sca effects in order to merit were GBL 1 x BB 85, JBR 02-11 x K 331 and JBR 02-11 x PB 69 for fruit yield, DBL 02 x BB 85 and GBL 1 x JBOB 03-04 for days to first flowering, DBL 02 x BB 85 and GBL 1 x JBOB 03-04 and GBL 1 x BB 85 for days to first picking, GBL 1 x Punjab Sadabahar, Punjab Sadabahar x DBL 02 and Punjab Sadabahar x PB 69 for fruit length,

K 331 x PB 69, Punjab Sadabahar x DBL 02 and JBOB 03-04 x BB 85 for fruit girth, K 331 x BB 85, JBOB 03-04 x BB 85 and DBL 02 x BB 85 for single fruit weight, JBR 02-11 x K 331, GBL 1 x JBR 02-11 and JBR 02-11 x DBL 02 for number of fruits per plant, JBR 02-11 x DBL 02, GBL 1 x BB 85 and JBOB 03-04 x DBL 02 for number of primary branches per plant, JBR 02-11 x BB 85, PB 69 x DBL 02 and GBL 1 x JBOB 03-04 for plant height, JBOB 03-04 x Punjab Sadabahar, DBL 02 x BB 85 and JBR 02-11 x Punjab Sadabahar for total phenol, GBL 1 x BB 85, Punjab Sadabahar x DBL 02 and JBR 02-11 x PB 69 for total sugar and PB 69 x DBL 02, JBOB 03-04 x K331 and GBL 1 x DBL 02 for fruit borer infestation. It is clear from the result obtained that majority of the crosses which showed the best sca effects, having at least one of 3 most outstanding parental lines *namely*, GBL1, JBR 02-11 and Punjab Sadabahar which have high gca effects for one of more for yield contributing characters. Such observation has also been made by Kamalakkannan *et al*. (2007), Bhakta *et al*. (2009) and Rai and Asati (2011). For assessing the superiority of a hybrid generally its sca effects and per se performance should be taken into account. In the present study, it was clear that it was a close correspondence for most of the characters. It was also evident that best cross combination for most of the characters generally involved one good and one poor general combiner with high sca effects may be due to a complementary type of gene action which can be fixed to great extent in the segregating generation, whereas crosses with high sca effects which involved poor xpoor combiners, may be utilized for exploitation of hybrids as the non-additive, non-fixable genes seems to play greater role.

CONCLUSION

Parents like GBL1, JBR 02-11 and Punjab Sadabahar in general were proved to be good general combiners for most of the yield contributing characters. Among combinations based on the sca values and F_1 *per se* performance, GBL 1 x BB 85, JBR 02-11 x K 331 and JBR 02-11 x PB 69 has been found superior and can be tested for promotion of F_1 hybrids in brinjal.

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Table 1: Analysis of variance (mean square) for combining ability in brinjal

Source	d.f.	Mean squares											
		Days to First Flowering	Days to First Picking	Fruit Length (cm)	Fruit Girth (cm)	Single Fruit Weight (g)	Number of Fruits / Plant	Plant Height (cm)	Number of Primary Branches / Plant	Total Phenol (mg / 100 mg)	Total Sugar (mg /100 mg)	Fruit Borer Infestation (%)	Fruit Yield / Plant (kg)
gca	7	150.16**	150.16**	4.61**	4.13**	123.78**	37.90**	540.91**	1.23**	0.08**	2.66**	3.75**	0.34**
sca	27	15.35**	15.35**	1.83**	12.13**	89.56**	15.91**	20.00**	0.43**	0.09**	7.67**	9.41**	0.32**
Error	70	8.67	9.62	0.56	0.57	6.23	2.70	9.23	0.11	0.01	0.07	0.85	0.12
σ^2gca		14.15	14.06	0.41	0.36	11.76	3.52	53.17	0.11	0.01	0.26	0.29	0.02
σ^2sca		6.68	5.73	1.28	11.55	83.33	13.21	10.78	0.32	0.09	7.61	8.56	0.20
σ^2gca /σ^2sca		2.12	2.45	0.32	0.03	0.14	0.27	4.93	0.35	0.09	0.03	0.03	0.11

***,** Significant at 5 per cent and 1 per cent probability levels, respectively*

Table 2: Estimates of general combining ability effects for different traits in brinjal

Traits / Parents	Days to First Flowering	Days to First Picking	Fruit Length (cm)	Fruit Girth (cm)	Single Fruit Weight (g)	Number of Fruits / Plant	Plant Height (cm)	Number of Primary Branches / Plant	Total Phenol (mg / 100 mg)	Total Sugar (mg /100 mg)	Fruit Borer Infestation (%)	Fruit Yield / Plant (kg)
GBL 1	-3.11**	-3.11**	0.67**	-1.10**	-0.08	1.29	9.95**	-0.09	-0.09**	0.39**	0.45*	0.23**
JBR 02-11	-3.31**	-3.31**	-0.43	0.09	1.96**	4.09**	1.78*	0.68**	-0.06**	0.77**	0.30	0.17**
JBOB 03-04	5.39**	5.39**	-0.27	-0.08	1.72*	-1.18	-5.93**	0.17	-0.04**	0.46**	0.60*	-0.11
Punjab Sadabahar	-5.98**	-5.98**	0.97**	0.17	-4.27**	0.46	-10.59**	0.57**	0.15**	-0.63**	-0.65*	0.13
K 331	2.86**	2.89**	0.50*	-0.20	0.41	-0.91	-3.61**	0.05	0.04**	0.02	-0.57*	-0.20**
PB 69	2.52**	2.59**	-0.02	1.26**	5.21**	-2.01*	-4.95**	-0.08	0.04**	-0.58**	0.16	-0.22**
DBL 02	2.13*	2.13*	-1.11**	0.01	5.80**	-0.61	5.61**	0.19	0.10**	0.07	0.90**	-0.16**
BB 85	-0.56	-0.58	-0.32	-0.14	0.84	-1.14	7.75**	0.01	-0.07**	0.43**	0.61*	0.15
S.E . ±	0.87	0.91	0.23	0.22	0.74	0.90	0.89	0.10	0.01	0.070	0.27	0.06

***,** Significant at 5 per cent and 1 per cent probability levels, respectively*

Table 3: Estimates of specific combining ability effects for different traits in brinjal

Traits / Parents	Days to First Flowe-ring	Days to First Picking	Fruit Length (cm)	Fruit Girth (cm)	Single Fruit Weight (g)	Number of Fruits / Plant	Plant Height (cm)	No. of Primary Branches / Plant	Total Phenol (mg / 100mg)	Total Sugar(g m /100mg)	Fruit Borer Infesta-tion(%)	Fruit Yield / Plant (kg)
GBL 1 x JBR 02-011	-2.48	-2.48	1.34*	0.38	-11.49**	6.90**	-9.34**	0.39	-0.13**	-4.36**	1.02	-0.11
GBL 1 x JBOB 03-04	-6.18**	-6.18**	-0.58	1.12	-0.63	-5.50**	6.29**	-0.54	0.41**	0.36	4.73**	0.17
GBL 1 x Punjab Sadabahar	-0.15	-0.15	2.65**	1.59*	10.05**	-0.13	-1.77	0.08	-0.08**	-1.38**	0.01	-0.13
GBL 1 x K 331	-4.32	-4.32	-0.38	-4.17**	-4.93	1.24	-1.48	-0.43	-0.01	-0.37	-0.31	-0.27
GBL 1 PB 69	4.29	4.29	-0.27	-1.32	1.61	1.00	3.21	0.59*	0.10**	2.05**	-0.33	-0.10
GBL 1 x DBL 02	2.42	2.42	-0.63	-0.69	8.97**	4.27**	-4.50	-0.12	0.21**	-2.22**	-2.71*	0.52**
GBL 1 x BB 85	5.55**	-5.55**	-1.03	1.71*	10.83**	0.80	4.30	1.07**	0.20**	5.67**	-2.15*	1.33**
JBR 02-11 x JBOB 03-04	-3.32	-3.32	-0.38	1.25	5.77*	-1.96	-2.63	-0.20	-0.11**	3.08**	1.11	0.15
JBR 02-11 x Punjab Sadabahar	0.72	0.72	0.28	0.170	2.46	1.74	3.06	0.87**	-0.26**	-2.47**	0.50	0.22
JBR 02-11 x K 331	-3.45	-3.45	1.35*	-0.50	0.69	7.44**	1.61	0.91**	0.21**	4.35**	-1.26	0.94**
JBR 02-11 x PB 69	-3.52	-3.52	0.36	1.54*	7.00**	-1.80	2.37	0.04	0.31**	-0.25	-2.23*	0.77**
JBR 02-11 x DBL 02	3.28	3.29	-0.17	-1.48*	4.23	6.14**	1.80	1.11**	-0.02	-0.88**	-0.64	-0.41
JBR 02-11 x BB 85	-0.02	-0.02	-0.07	1.87**	1.37	2.67	7.14**	0.30	-0.21**	-5.29**	3.81**	-0.16
JBOB 03-04 x Punjab Sadabahar	-1.65	-1.65	-1.04	-1.50	-6.96**	2.34	-2.84	0.04	-0.59**	0.62**	6.07**	-0.42
JBOB 03-04 x K 331	3.52	3.52	1.26	-0.37	-3.98	4.37	2.54	0.75**	0.46**	-0.22	-3.46**	-0.02
JBOB 03-04 x PB 69	6.12**	6.12**	1.01	-0.48	1.88	-0.53	-3.37	-0.11	0.02	-1.48**	0.29	0.24
JBOB 03-04 x DBL 02	0.59	0.59	-1.09	1.64*	5.18*	0.07	-2.16	0.96**	-0.08**	-2.31**	-2.01*	0.47**
JBOB 03-04 x BB 85	2.95	2.95	1.44**	1.99**	17.25**	-1.40	5.37	-0.86**	0.23**	2.73**	-1.84	0.59**
Punjab Sadabahar x K 331	-0.12	-0.12	0.76	-1.44**	11.85**	-1.93	0.25	-0.29	-0.07**	-0.86**	0.25	0.58**
Punjab Sadabahar x PB 69	-2.18	-2.18	1.71*	-3.04**	4.80*	0.50	-0.99	-0.27	-0.20**	1.79**	-0.50	0.05
Punjab Sadabahar x DBL 02	-2.05	-2.05	1.77**	10.12**	-4.19	0.44	3.59	-0.65*	0.14**	4.70**	-1.88*	0.59**
Punjab Sadabahar x BB 85	1.99	1.99	0.41	-1.72*	-6.40**	1.64	3.24	-0.01	0.11**	3.07**	-0.68	-0.12
K 331 x PB 69	-3.02	3.02	0.88	11.43**	9.01**	1.20	2.26	0.00	-0.06**	-2.45**	-0.88	0.28
K 331 x DBL 02	4.79	4.79	1.39*	-2.38	1.23	-4.20**	5.58*	-0.04	0.05**	0.60	-0.32	-0.51*
K 331 x BB 85	4.49	4.49	1.21	1.39	19.86**	-1.66	-7.86**	0.03	0.06**	0.56	-0.80	-0.14
PB 69 x DBL 02	-2.62	-2.62	-0.05	-1.10	-0.24	-3.76*	6.46**	0.09	0.58**	2.24**	-4.92**	-0.78**
PB 69 x BB 85	-2.25	-2.25	-1.45	0.04	2.09	1.44	-2.85	0.05	0.03	0.19	-0.24	-0.75**
DBL 02 x BB 85	-7.45**	-7.45**	0.25	-2.21**	14.10**	-3.96*	-1.44	0.12	-0.58**	2.39**	7.91**	0.23
SE(Sij)	2.66	2.81	0.68	0.69	2.26	1.49.	2.75	0.29	0.02	0.24	0.84	0.22

***,** Significant at 5 per cent and 1 per cent probability levels, respectively*

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