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COMBINING ABILITY STUDIES ON YIELD POTENTIAL OF ROUND FRUITED BRINJAL (*SOLANUM MELONGENA* L.)

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ABSTRACT

An eight-parent diallel cross without reciprocals of round fruited brinjal and their 28 F_1 hybrids were subjected to combining ability analysis for yield and fruit characters. Both additive and nonadditive gene actions were observed for all the characters, except for yield were nonadditive gene action alone was exhibited. Among the parents, Cluster White was found to be a good general combiner for early flowering, dwarf plant type and fruits/plant and variety Hyderabad Local for early flowering and number of secondary branches. The crosses Manjarigota x Mettavanga, Black Beauty x Srikakulam and Cluster White x Mettavanga were superior in yield per plant.

Key words: Brinjal, combining ability, yield, yield components.

The information available on genetic make up of round types brinjal is limited. Hence, an attempt has been made to estimate the combining ability for yield and its components in a diallel set of eight round fruited genotypes of diverse origin in brinjal.

MATERIALS AND METHODS

Eight diverse cultivars with varying morphological and fruit characters of round fruited brinjal, namely Black Beauty, Nellore, Cluster White, Hyderabad Local, Rayadurg, Srikakulam, Manjarigota and Mettavanga were crossed in diallel fashion without reciprocals to obtain F_1 seed. The eight parents and their 28 F_1 were raised in randomized block design replicated thrice. The combining ability variances and effects were estimated following Method II and Model I of Griffing [1] for nine quantitative characters (Table 1).

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RESULTS AND DISCUSSION

The analysis of variance revealed that both gca and sca variances were significant for days to flower, plant height, primary and secondary branches, fruits/plant, fruit weight, fruit volume and percentage of seed (Table 1). Variance due to sca alone was significant for fruit yield. This indicates the importance ~~of~~ both additive and nonadditive gene effects for

Table 1. ANOVA (MS) for combining ability in 28 F_1 hybrids of 8 x 8 nonreciprocal diallel crosses in brinjal

Source	d.f.	Days to flower	Plant height	Primary branches	Secondary branches	Fruits per plant	Mean fruit weight	Fruit volume	Percentage seed in fruit	Fruit yield per plant
Gca	7	289.2**	157.5**	0.490**	4.86**	76.5**	4147.5**	6299.1**	4.26**	34541.9
Sca	28	19.0**	57.1**	0.167**	2.57**	24.9**	873.1**	1486.9**	0.87**	116511.7**
Error	60	3.8	17.1	0.082	0.80	6.2	26.5	86.5	0.02	21068.5
σ^2gca		27.0	10.0	0.030	0.2	5.1	327.4	481.2	0.34	8197.0
σ^2sca		15.2	39.7	0.090	1.77	18.6	846.6	1400.4	0.85	95443.2
$\frac{2\sigma^2 gca}{\sigma^2 sca}$		3.6	0.5	0.660	0.26	0.5	0.8	0.7	0.80	0.2
h^2 (n)		0.6	0.1	0.148	0.08	0.2	0.3	0.5	0.28	0.1

*Gca significant at 5% = 2.14, and **at 1% = 2.91.

*Sca significant at 5% = 1.645, and **at 1% = 2.025.

most of the characters. Peter and Singh [2] reported that both gca and sca variances were significant for plant height and fruit yield/plant. Both gca and sca effects were significant for fruit yield per plant and plant height [3] while both gca and sca variances were reported to be significant for days to flowering, fruit weight and yield/plant [4, 5]. The present study also indicates that gca and sca variances were significant which is in agreement to the above reports, except for yield/plant where only sca variances were highly significant. The relative proportion σ_g^2 / σ_s^2 reveals that days to flower was predominantly governed by additive gene action ($2\sigma_g^2 / \sigma_s^2 = 3.6$). All other characters are predominantly governed by nonadditive gene action. Although gca and sca variances were significant, the nonadditive gene action is more predominant.

Except for variety Srikakulam, no other parent exhibited significant gca effects for fruit yield. Even the variety Srikakulam had negative significant gca effects (Table 2). Although the parents Nellore, Cluster White and Hyderabad Local exhibited significant negative gca effects for days to flower, indicating earliness, only Nellore and Cluster White exhibited significant gca effects for fruits/plant, indicating that the early parents may not necessarily

Table 2. General combining ability effects of eight parents in 8 x 8 diallel cross in brinjal

Parent	Days to flower	Plant height	Primary branches	Secondary branches	Fruits per plant	Mean fruit weight	Fruit volume	Percentage seed in fruit	Fruit yield per plant
Black Beauty	3.4**	2.3*	0.3**	0.3	-3.0**	3.8*	1.9	-0.5**	-73.6
Nellore	-8.2**	-7.1**	-0.3**	-0.5**	3.6**	-19.9**	-20.0**	0.8**	2.4
Cluster White	-2.8**	-4.6**	-0.2**	0.3**	2.3**	-7.5**	-10.7**	-0.1*	63.3
Hyderabad Local	-7.6**	-1.3	-0.1	1.1**	0.4	-14.7**	-21.1**	0.2**	40.5
Rayadurg	4.1**	2.7*	-0.0	-0.6	0.8	-1.9	3.8	-0.4**	69.3
Srikakulam	3.3**	1.1	-0.1	-1.1**	-4.9**	-46.8**	57.9**	-0.9**	-86.4*
Manjarigota	3.8**	3.9**	0.2	-0.1	0.3	-3.8*	-7.3*	-0.1**	11.2
Mettavanga	4.0**	3.0*	0.2**	0.5	0.6	-2.7	-4.5	0.9**	-26.8
SE_{gi}	0.6	1.2	0.1	0.3	0.7	1.5	2.8	0.0	42.9
$t_{0.05}$	1.1	2.4	0.2	0.5	0.5	3.0	5.5	0.1	83.8
$t_{0.01}$	1.5	3.2	0.2	0.7	2.0	4.0	7.3	0.1	113.4

*,** Significant at 5% and 1% levels, respectively.

be good general combiners for fruiting intensity. The parents Black Beauty and Srikakulam were good general combiners for lower seed content, indicating better fruit quality. Parents Nellore, Cluster White, Hyderabad Local and Manjarigota possess significant negative gca effects for fruit volume while Srikakulam displayed significant positive gca effects for this character. Incidentally, this parent Srikakulam had negative gca effects for fruits/plant, fruit/yield and secondary branches/plant. Thus, mean fruit weight, fruits/plant and total yield/plant are biologically associated. No parent had desirable gca effects for all the characters. The earlier reports were mostly based on crosses involving both round and long fruited varieties. This may be the reason for identification of parents having desirable gca effects for most of the characters in the earlier studies [2, 6].

A perusal of sca effects for yield/plant revealed (Table 3) that the crosses showing highly significant sca effects are Manjarigota x Mettavanga, Black Beauty x Srikakulam and Cluster White x Manjarigota which were also the top performers for this character. Similarly, the poorest per se performers for yield also exhibited lowest sca. The per se yield was generally reflected in sca effects. The gca effects of parents did not always reflect the performance of their hybrids, e.g. Srikakulam with significant negative gca effect produced hybrids with both positive and negative sca effects for yield/plant. These results are in agreement with

Table 3. Specific combining ability effects for nine characters in 28 F_1 hybrids in 8 x 8 diallel set of brinjal

Hybrid	Days to flower	Plant height at 150th day	Primary branches	Secondary branches	Fruits per plant	Mean fruit weight	Fruit volume	Percentage seed in fruit	Fruit yield per plant
Black Beauty x Nellore	-2.9	-10.8**	0.1	-2.1**	-4.8*	-21.8**	-49.2**	0.6**	-264.2
Black Beauty x Cluster White	-3.6*	-7.4*	0.1	-2.3**	-8.1**	-32.5**	-47.5**	1.2**	-692.1**
Black Beauty x Hyderabad Local	-5.1	7.1	-0.1	1.7	3.8	8.0	-14.9	-0.1	250.0
Black Beauty x Rayadurg	1.1	-1.8	-0.7**	-0.7	-2.1	-12.5**	-5.6	0.5**	289.7
Black Beauty x Srikakulam	7.1**	3.8*	0.2	1.0	6.1**	-42.6**	-42.7**	0.0	320.9**
Black Beauty x Manjarigota	1.0	3.5	0.1	0.1	5.8**	-12.0**	12.2	-0.4**	166.6
Black Beauty x Mettavanga	5.1**	-20.0**	-0.8**	-0.5	-7.6*	-49.7**	-57.3**	-0.8**	-514.5**
Nellore x Cluster White	-0.7	9.1**	0.2	0.2	-1.0	0.2	24.9**	0.1	252.5
Nellore x Hyderabad Local	2.5	4.7	0.2	-0.1	-0.1	8.7	19.6	-0.2	218.5
Nellore x Rayadurg	-1.1	-1.6	-0.3	-0.9	-1.6	2.6	14.4	-0.2**	169.1
Nellore x Srikalulam	-4.0**	4.0	0.7**	-1.6*	-7.1**	41.5**	50.0**	-1.3**	-583.5**
Nellore x Manjarigota	-5.1**	3.6	0.4	-0.5	0.6	10.8**	24.3**	-1.2**	173.9
Nellore x Mettavanga	1.6	-0.9	-0.4	0.2	5.9**	-3.9	7.4	2.4**	102.9
Nellore x Hyderabad Local	0.0	5.7	0.2	0.7	-4.6*	39.6**	57.6**	0.4	-14.4
Cluster White x Rayadurg	-0.1	-3.6	-0.2	-0.2	-3.8	7.5	5.3	0.2	-10.8
Cluster White x Srikakulam	-1.8	-8.6**	0.2	0.1	2.0	-12.2**	-19.8**	0.3	208.7

(Contd.)

Table 3 (contd.)

Hybrid	Days to flower	Plan. height at 150th day	Pri-mary branches	Secon-dary branches	Fruits per plant	Mean fruit weight	Fruit volume	Per-centage seed in fruit	Fruit yield per plant
Cluster White x Manjarigota	1.5	2.1	-0.3	-0.2	1.9	21.4**	31.1**	-0.5	312.0**
Cluster White x Mettavanga	-4.0**	0.5	0.3	-0.8	0.2	23.9**	29.4**	-0.4	175.4
Hyderabad Local x Rayadurg	-6.2**	2.1	0.4	-0.4	-1.5	5.3	-0.9	0.1	52.3
Hyderabad Local x Srikakulam	-0.7	2.4	0.0	-0.0	6.8**	-36.7**	-46.0**	-0.7**	230.4
Hyderabad Local x Manjarigota	1.9	0.6	0.5*	1.0	0.8	18.2**	17.9*	1.3**	38.9
Hyderabad Local x Mettavanga	-0.1	-3.9	-0.2	-5.4**	-9.9**	-22.8**	-27.6**	0.7**	-728.0**
Rayadurg x Srikakulam	6.3**	4.3	-0.1	0.8	-1.0	-8.2	-2.6	2.0**	81.2
Rayadurg x Manjarigota	-6.4**	-13.3**	-0.2	1.1	-3.5	6.1	2.0	-0.8**	189.3
Raydurg x Mettavanga	4.4**	14.3**	0.4	0.0	6.0**	-0.6	16.9*	0.1	153.5
Srikakulam x Manjarigota	-6.0	-2.0	0.4	-2.0**	-4.1	-9.7	-7.5	-0.1	-457.3**
Srikakulam x Mettavanga	-3.1	-0.3	0.3	1.3	-3.1	45.6**	49.8**	-0.1	179.6
Manjarigota x Mettavanga	6.5**	43.7**	0.2	1.8*	2.9	20.6**	20.3**	-0.7**	434.3**
SE_{sij}	1.5	3.3	0.2	0.8	2.0	4.1	7.3	0.1	111.5
$t(cal)_{0.05}$	3.0	6.5	0.5	1.4	3.9	7.9	14.6	0.2	287.6
$t(cal)_{0.01}$	4.0	8.7	0.6	1.8	5.2	10.7	19.4	0.3	302.3

that of Mital et al. [4] who could not identify a single parent with desirable gca effects for all the characters. However, Vijay et al. [5] reported that good general combiners were also better specific combiners.

For identification of the best cross combination, both sca effects and per se performance of the parents are to be considered. The two best crosses Manjarigota x Mettavanga and Black Beauty x Srikakulam for yield based on the sca effects, having small fruits with more number and larger fruits with smaller number of fruits, respectively, could be profitably exploited for production of small or bigger fruits depending on the consumer preference. For improvement of round fruited brinjal, a breeding programme considering the significance of both additive and nonadditive types of gene action would be useful.

REFERENCES

1. J. B. Griffing. 1956. Concepts of general and specific combining ability in relation to diallel crossing system. Aust. J. Biol. Sci., **9**: 463–493.

2. K. V. Peter and R. D. Singh. 1974. Combining ability, heterosis and analysis of phenotypic variation in brinjal. Indian J. agric. Sci., **44**(6): 393–399.

3. U. N. Singh, S. N. Singh, H. P. S. Verma, R. K. Mital and R. R. Singh. 1974. Combining ability in brinjal (*Solanum melongena* L.). Indian J. agric. Sci., **44**(3): 151–155.

4. R. K. Mital, S. N. Singh and H. N. Singh. 1976. Genetics of some characters in brinjal (*Solanum melongena* L.). Veg. Sci., **3**(2): 79–86.

5. O. P. Vijay, Premnath and S. H. Jalikop. 1978. Combining ability in a diallel cross of brinjal. Indian J. Hort., **35**(1): 36–38.

6. O. P. Srivastava and P. N. Bajpai. 1977. Combining ability in egg plant. Indian J. agric. Sci., **47**(4): 181–184.