

HETEROSIS AND COMBINING ABILITY STUDIES IN CHILLIES

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ABSTRACT

To estimate heterosis and combining ability, six chilli varieties (LCA 206, LCA 1079, LCA 960, LIC 13, X-235 and G 4) were crossed in a half diallel. Involvement of both additive and nonadditive gene actions was detected for days to 50% flowering, days from fruit set to fruit maturity, fruit length, fruit girth, fruits/plant, fresh fruit weight, 100-dry fruit weight, and 100-seed weight with greater predominance of nonadditive gene action. Taking into consideration the per se performance, sca effects and heterosis, LCA 206 x LCA 960 was the best hybrid, yielding 638.3 g/plant, followed by LCA 206 x LA 1079 (535.2 g/plant). The varieties LCA 960, LCA 206 and G 4 were the best general combiners for majority of the characters, which gave high gca effects for yield/plant with positive and significant gca effects for many of the yield characters. Out of the 13 characters studied, the manifestation of heterosis over midparent was maximum (upto 160.3%) for number of branches/plant.

Key words: Chilli, heterosis, combining ability.

In recent years, chilli (*Capsicum annum* L.) has assumed a greater importance as a commercial crop on account of its export value. Information on gene action and combining ability facilitates the selection of suitable parents for hybridization programme to develop promising F₁ hybrids for further exploitation. In the present study, an attempt has been made to generate information on combining ability and heterosis by crossing six diverse parents in half diallel.

MATERIALS AND METHODS

Six diverse varieties of chilli (*Capsicum annum* L.), viz., LCA 206, LCA 1079, LCA 960, LIC 13, X-235 and G 4, were crossed in all possible combinations (excluding reciprocals) to generate a half diallel. These six parents and 15 F₁ were grown in randomized block design replicated twice during 1988-89 following the usual agronomic practices.

Combining ability effects and variances were worked out by following Method 2, Model

1 of [1]. Heterosis was worked out over mid-, better and standard parental values (MP, BP, SH) as suggested by [2].

RESULTS AND DISCUSSION

Combining ability analysis indicated that variance due to gca was significant for most of the characters studied except plant height, branches/plant, yield/plant and ascorbic acid content in green chilli, indicating the importance of additive gene action (Table 1).

Table 1. Analysis of variance for combining ability of different quantitative characters in chilli

Source d.f.		Mean sum of squares for different characters												
		plant height	branches /plant	days to flowering	time for fruit maturity	fruit length	fruit girth	fruits per plant	yield per plant	fresh fruit wt.	100- dry fruit wt.	seeds per fruit	100- seed wt.	ascorbic acid content
Gca	5	81.3 ^{NS}	20.1 ^{NS}	8.1*	60.1**	5.64**	0.203**	1508.1**	2301 ^{NS}	0.50**	313.4**	39.4'	0.002'	47.5 ^{NS}
Sca	15	77.2*	102.1**	34.4**	29.1**	0.92**	0.010'	2251.3**	11721**	0.1**	76.2**	85.6**	0.003**	169.4**
Error	20	30174.0	25.4	2.6	10.4	0.20	0.003	115.4	1974	0.04	6.8	14.0	0.001	18.7

NS—Not significant.

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

The specific combining ability (sca) effects were significant for all the characters studied, indicating the importance of both additive and nonadditive gene actions in the inheritance of these characters. These results are in agreement with those of [3].

The estimates of general (gca) and specific (sca) effects for six parents and hybrids are presented in Tables 2 and 3. Among six parents, LCA 960, LCA 206 and G 4 were the best general combiners for majority of the characters studied, which gave high gca effects for yield/plant and also positive and significant gca effects for many of the yield attributes. Similar results were reported by [4].

Out of the 13 characters studied, very high manifestation of MP heterosis was recorded for fruits/plant (160.3%), yield/plant (110.5%), and branches/plant (93.0%). Out of the 15 F₁ hybrids studied, 14 hybrids recorded negative heterosis over MP for days to flowering, and 13 hybrids for duration from fruit set to fruit maturity. This indicates earliness of hybrids over the parents. Similar results were reported by [5].

The crosses LCA 206 x LCA 960, LCA 206 x LCA 1079, LCA 960 x X-235, and X-235 x G 4 exhibited greater MP, BP and SH heterosis for yield with high per se performance and significant sca effects. Higher per se performance of the above crosses was mainly due to at

least one of the good general combiners, i.e., LCA 960, LCA 206 and G 4. Such positive relationship between per se performance and sca effects would be more useful in breeding programme. Similar results were also reported by [3].

Table 2. Estimates of gca of parents for different growth and fruit characters in chilli

Parent	Gca effects for different characters								
	days to flower -ing	time for fruit maturity	fruit length	fruit girth	fruits per plant	100-dry fruit weight	seeds per fruit weight	seeds per fruit	100- seed weight
LCA 206	1.04*	0.67	0.36*	-0.11**	11.61**	-0.16*	-3.21**	-1.48	-0.03*
LCA 1079	-1.43**	0.23	0.85**	-0.89**	-1.52	0.10	-0.52	-0.50	-0.02
LCA 960	-0.37	-0.24	0.80**	0.08**	-10.97**	0.36**	9.60**	0.83	0.22*
LIC 13	0.58	4.84**	-1.33**	0.28**	-20.83**	0.16*	5.42**	4.06**	0.01
X-235	0.94	-2.71	-0.21	-0.14**	8.08*	-0.31**	-5.67**	0.81	0.01
G 4	-0.76	-2.39	-0.47**	-0.03	13.72**	-0.15*	-5.62**	-2.09	0.00
SE(gi)	0.52	1.04	0.14	0.02	3.47	0.06	0.84	1.21	0.01
SE(gi-gj)	0.80	1.61	0.22	0.03	5.37	0.10	1.30	1.87	0.01

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

High MP and BP heterosis was recorded in the cross LCA 206 x LCA 960 for ascorbic acid content in green chilli, branches/plant, fruit length, and fruits/plant; in LCA 206 x LCA 1079 for fruits/plant and 100-dry fruit weight; in LCA 960 x X-235 for plant height, branches/plant, fruit girth, fresh fruit weight, and 100-dry fruit weight. These crosses also recorded significant sca effects with high per se performance.

Table 3. Estimates of sca effects of hybrids for different growth and fruit characters in chilli

Hybrid	Plant height	Bran- ches per plant	Days to flower- ing	Time for fruit maturity	Fruit length	Fruit girth	Fruits per plant	Yield per plant	Fresh fruit weight	100- dry fruit weight	Seeds per fruit	100- seed weight	Ascorbic acid content
LCA 206 x LCA 1079	-5.03	4.7*	-8.92**	-2.99	-0.64	0.07	31.87**	136.21**	-0.15	-7.70**	-1.97	0.021	7.86**
LCA 206 x LCA 960	-8.11	20.7**	-9.98**	-13.12**	1.23**	-0.84	130.27**	213.8**	-0.11	-3.42	4.60	0.008	27.35**
LCA 1079 x G 4	10.53*	16.7**	-3.12*	-7.93**	1.20**	-0.14**	30.65**	75.4	0.26	1.64	-6.55*	0.087	-1.62
LCA 960 x X-235	18.48**	11.3**	2.68	-0.74	0.27	0.12	-21.84*	95.8	1.00**	2.02**	-3.46	0.097	-6.40**
X-235 x G 4	3.70	1.3	-8.00**	-0.99	-0.95	0.08	52.84**	114.0**	0.37*	-2.73	1.86	0.034	8.61**

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

The crosses LCA 206 x LCA 1079, LCA 206 x LCA 960, and X-235 x G 4 recorded significant negative MP and BP heterosis for days to flowering, and LCA 206 x LCA 960 and LCA 1079 x G 4 for duration of fruit maturity along with significant negative sca effects.

All the characters manifested MP heterosis. Maximum heterosis was observed for fruits/plant, yield/plant, and branches/plant. The parents LCA 960, LCA 206 and G 4 were found to be good general combiners with high per se performance.

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