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Short communication

Line × Tester analysis to study combining ability effects in chilli

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ABSTRACT

Combining ability analysis in chilli was carried out using line x tester design at the Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore. Variances due to *gca* and *sca* were highly significant for all the characters but variances due to *sca* being greater than gca indicated preponderance of non-additive gene actions for all the characters studied. Parental lines CA 192, CA 172, CA 97 and Kashi Anmol were good general combiners, whereas crosses, CA 192 x CA 97 and CA 172 x Kashi Anmol were observed to be most promising hybrid combinations for fruit yield.

Key words: Chilli, combining ability, fruit yield, gene action.

India is the largest producer, consumer and exporter of chillies in the world. The total production in the country is around 8.46 lakh tonnes from 8.31 lakh ha (Rajur *et al.*, 2). The productivity is rather low at 1.11 tonnes per ha compared to the world average of two tonnes per ha. In India, chillies are grown in almost all the states and the important ones in terms of production are Andhra Pradesh (49%), Karnataka (15%), Odisha (8%), Maharashtra (6%), West Bengal (5%), Rajasthan (4%) and Tamil Nadu (3%). The production and productivity of the crop in Tamil Nadu is 0.34 lakh tonnes and 506 kg/ha, respectively. It is cultivated in an area of 0.67 lakh ha (www.FAO.org). The major reasons for the low productivity of chilli are the paucity of varieties adapted to different agro-climatic situations and growing conditions and the high incidence of pests and diseases. Among the pests, chilli thrips (*Scirtothrips dorsalis* Hood) is important and it is not only a damaging pest but also act as a vector for viral diseases. Use of tolerant varieties is the simplest and more convenient method of pest control. Hence, development of high yielding varieties tolerant to major pests is of paramount importance.

A total of 30 hybrids were produced in line x tester design, involving 15 lines, *viz.*, CA 112, CA 24, CA 192, CA 117, Selection 1, CA 197, CA 207, 09CHIVAR03, CA 158, CA 172, CA 106, CA 72, CA 27, CA 71 and CA 173 and 2 testers, *viz.*, CA 97 and Kashi Anmol. The experiment was laid out in Randomized Block Design with three replications. The materials were transplanted during (winter) *rabi* season. The line x tester analysis was carried out as per the method given by Kempthorne (1).

The mean sum of squares due to general and specific combining ability was significant for all characters. The ratio of *gca:sca* being greater than one revealed preponderance of non-additive gene effects for all the characters. The lines CA 197, CA 192 are the good general combiners for number of fruits per plant and dry fruit yield. For capsaicin content, lines CA 197 and CA 71 showed good general combining ability. Tester CA 97 was good general combiner for plant height, 50% flowering and capsaicin content. Tester Kashi Anmol revealed good general combining ability for fruit number, fruit length, fruit girth fresh fruit weight, dry fruit yield per plant, ascorbic acid content and oleoresin content.

The main yield components in chilli are the number of fruits/plant, fruit length and weight. The present investigation also revealed that the parents having significant positive *gca* effect for the dry yield per plant also showed positive *gca* effect for one or more of the yield components studied. Several crosses showed significant *sca* for various characters under study. It was also noted that the best F_1s were not the cross combinations which showed maximum *sca* effects. Though the parents CA 192 and CA 97 were the best general combining tester and line, respectively for total dry fruit yield/plant their F_1s exhibited negative *sca* effects. Hence, it is not necessary that the parents having higher estimates of *gca* effects would also give higher estimates of *sca* effects when crossed with each other.

Perusual of specific combining ability revealed that cross combination CA 172 x Kashi Anmol was found to possess the maximum *sca* effect for dry yield per plant and specific combiners for most of the quantitative characters indicating heterosis breeding for the improvement of this crop (Table 1). Regarding the quality characters, cross combination CA 172 x Kashi Anmol showed high specific combining ability for ascorbic acid, whereas for capsaicin content and

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Table 1. Estimation of specific combining ability of hybrids for different horticultural traits in chilli.

Hybrid	Plant height	Days to 50% flowering	No. of fruits per plant	Fruit length	Fruit girth	Fresh fruit weight/per plant	Dry fruit yield per plant	Ascorbic acid content	Capsaicin content	Oleoresin content
CA 112 × CA 97	-1.52**	5.69**	-10.25**	0.93**	-0.31**	0.62**	2.52**	8.92**	-0.09**	-0.21**
CA 112 × Kashi Anmol	1.52**	-.5.69**	10.25**	-0.93**	0.31**	-0.62**	-2.52**	-8.92**	0.09**	0.21**
CA 24 × CA 97	-7.93**	3.95**	8.85**	0.32**	-0.18**	-0.34**	13.54**	-6.86**	-0.06**	-0.28**
CA 24 × Kashi Anmol	7.93**	-3.95**	-8.85**	-0.32**	0.18**	0.34**	-13.54**	6.86**	0.06**	0.28**
CA 192 × CA 97	-0.55*	-1.75**	21.70**	0.21**	0.10**	0.33**	13.46**	19.78**	0.21**	1.39**
CA 192 × Kashi Anmol	0.55	1.75**	-21.70**	-0.21**	-0.10**	-0.33**	13.46**	-19.78**	-0.21**	-1.39**
CA 117 × CA 97	8.11**	-6.10**	46.44**	0.79**	-0.74**	1.11**	36.13**	3.32**	0.06**	-1.22**
CA 117 × Kashi Anmol	-8.11**	6.10**	-46.44**	-0.79**	0.74**	-1.11**	-36.13**	-3.32**	-0.06**	1.22**
Sel. 1 × CA 97	-1.75**	1.87**	14.5**	-2.34**	0.67**	-0.36**	-4.03**	9.49**	0.07**	0.25**
Sel. 1 × Kashi Anmol	1.75**	-1.87**	-14.50**	2.34**	-0.67**	0.36**	4.03**	-9.49**	-0.07**	-0.25**
CA 197 × CA 97	2.82**	6.54**	-36.95**	0.83**	0.65**	0.07**	-31.40**	15.42**	-0.10**	0.43**
CA 197 × Kashi Anmol	-2.82**	-6.54**	36.95**	-0.83**	-0.65**	-0.07**	31.40**	-15.42**	0.10**	-0.43**
CA 207 × CA 97	10.94**	3.88**	-23.67**	-1.30**	-0.73**	0.18**	-23.02**	-18.65**	0.13**	-1.01**
CA 207 × Kashi Anmol	-10.94**	-3.88**	23.67**	1.30**	0.73**	-0.18**	23.02**	18.65**	-0.13**	1.01**
09CHIVAR03 × CA 97	3.56**	0.49**	-13.30**	1.42**	0.83**	-0.02	13.35**	5.88**	-0.02**	1.00**
09CHIVAR03 × Kashi Anmol	-3.56**	-0.49**	13.30**	-1.42**	-0.83**	0.02	-13.35**	-5.88**	0.02**	-1.00**
CA 158 × CA 97	-2.74**	2.82**	-21.40**	0.35**	-0.01**	-0.50**	-9.88**	11.01**	-0.03**	0.64**
CA 158 × Kashi Anmol	2.74**	-2.82**	21.40**	-0.35**	0.01**	0.50**	9.88**	-111.01**	0.03**	-0.64**
CA 172 × CA 97	2.08**	4.28**	-41.94**	-0.20**	0.09**	-1.08**	-41.42**	-27.57**	-0.03**	-0.31**
CA 172 × Kashi Anmol	-2.08**	-4.28	41.94**	0.20**	-0.09**	1.08**	41.42**	27.57**	0.03**	0.31**
CA 106 × CA 97	4.59**	1.99	21.77**	-0.21**	-0.40**	0.13**	16.23**	0.30	0.08**	-0.49**
CA 106 × Kashi Anmol	-4.59**	-1.99**	-21.77**	0.21**	0.40**	-0.13**	-16.23**	-0.30	-0.08**	0.49**
CA 72 × CA 97	1.54**	-9.68**	24.69**	-1.11**	-0.19**	0.16**	17.25**	-3.68**	-0.05**	1.04**
CA 72 × Kashi Anmol	-1.54**	9.68**	-24.69**	1.11**	0.19**	-0.16**	-17.25**	3.68**	0.05**	-1.04**
CA 27 × CA 97	-19.96**	-8.37**	22.45**	-1.31**	0.24**	0.35**	16.08**	6.55**	0.04**	-0.57**
CA 27 × Kashi Anmol	19.96**	8.37**	-22.45**	1.31**	-0.24**	-0.35**	-16.08**	-6.55**	-0.04**	0.57**
CA 71 × CA 97	2.18**	0.63**	-17.65**	0.72**	-0.61**	-0.91**	-16.62**	-27.07**	-0.16**	-0.41**
CA 71 × Kashi Anmol	-2.18**	-0.63**	17.65**	-0.72	0.61**	0.91**	16.62**	27.07**	0.16**	0.41**

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Hybrid	Plant height	Days to 50% flowering	No. of fruits per plant	Fruit length	Fruit girth	Fresh fruit weight/per plant	Dry fruit yield per plant	Ascorbic acid content	Capsaicin content	Oleoresin content
CA 173 × CA 97	-1.40**	-6.20**	4.71**	0.87**	0.59**	0.28**	-2.22**	3.18**	-0.05**	-0.25**
CA 173 × Kashi Anmol	1.40**	6.20	-4.71**	-0.87**	-0.59**	-0.28**	2.22**	-3.18**	0.05**	0.25**
SE (gi)	0.242	1.148	0.924	0.029	0.014	0.022	0.723	0.376	0.002	0.023
SE (gj)	0.088	0.054	0.337	0.010	0.005	0.008	0.264	0.137	0.001	0.008
SE (Sij)	0.343	0.209	1.307	0.041	0.020	0.324	1.023	0.532	0.004	0.032

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

oleoresin content CA 192 x CA 97 cross was highest specific combiner. Majority of the cross combinations exhibiting desirable sca effects had at least one of the parents as high x high, medium x high and low x high combiners. Similar reports have been expressed by (Singh and Pan, 5). The results suggests that utilizing best performing parental materials for one or more characters associated with yield in order to achieve higher gain in the F_1 hybrid through exploitation of heterosis. While selecting parental lines for obtaining F_1 hybrids, it would be useful to select those parents which have high *gca* in respect of yield and its contributing characters. Gene action on number of fruits per plant, fruit length and dry fruit yield per plant was found to be in accordance with that of earlier studies (Singh and Chaudary, 4). Likewise, the present findings on capsaicin content and ascorbic acid conformed to those of Saritha *et al*. (3).

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