



Combining ability studies in tomato (*Lycopersicon esculentum* Mill.) under mid hill conditions of Central Himalaya

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Fourteen varieties of tomato viz., Pusa Early Dwarf, Punjab Chhuhara, Punjab Kesari, Marglobe, EL-13, Sweet-72, Azad T-2, T- 1, Co-3, Pant Bahar, Arka saurabh, Shakit, NDT-5, and Azad Kranti were crossed in a half diallel fashion. The parents along with 91 F_1 's were evaluated in a randomised block design comprising 2.5×1.0 m plot size with three replications during 1996-97 at DARL, Pithoragarh. Observation were recorded on days to first harvest, number of primary and secondary branches, plant height (cm), number of flowers and fruits per truss, fruits per plant and yield per plant (kg). Data were analysed for combining ability following the method 2, model 1 of Griffing [1].

All the eight traits studied were found significant (Table 1) in respect of their gca and sca variances. The predictivity ratio ($2\sigma^2_{gca}/2\sigma^2_{gca} + \sigma^2_{sca}$) was computed to asses the relative magnitude of two variances. Predominance of non additive gene action for these traits found was similar to the earlier reports [2-4].

The parent Punjab Chhuhara showed significant high desirable gca effect for number of flower/truss, fruit/truss, fruit/plant and yield/plant (Table 2). parent Sweet-72 exhibited high significant negative gca for early maturity. None of the parent evinced good g.c.a for all the traits. However the parent Punjab Chhuhara can be considered good combiner for most of the traits. The *per se* performance of this variety was also highest

for yield, the earliness, flower/truss, fruit/truss as well as for number of fruits/plant and yield/plant which can be improved by using these parents in hybrid breeding programme for the accumulation of favourable genes.

Highest significant sca effect for yield/plant was observed in cross Punjab Chhuhara \times Azad Kranti while Arka Saurabh \times NDT 5 showed highest negative sca for earliness. The five top ranking cross combination selected on the basis of *per se* performance for yield (Table 3) had involved parents with good \times good and good \times poor general combiners. The five cross combinations with high *per se* performance performance in general exhibited significant sca effect for yield. It appears that non genetic components are of great importance, similar to the findings of Williams and Gilbert [5] and Younus *et al.*, [6]. The prepondance of non additive gene action for yield and yield contributing traits in most crosses also suggested heterosis breeding as a profitable proposition. The desirable traits can be improved by developing F_1 hybrids from the parents of good general combiners. The present investigation indicated that parents Punjab Chhuhara was found most suitable for crossing with other parents under Pithoragarh conditions. For improvement of yield and other desirable traits, a breeding programme which can exploit both the significance of additive and non additive type of gene action would be useful.

Table 1. Analysis of variance for combining ability in tomato

Source of variation	DF	Days to first harvest	No. of primary branches	No. of secondary branches	Plant height	No. of flower/truss	No. of fruit/truss	No. of fruit/plant	Total yield/plant
Gca	13	17.04**	2.78**	11.11**	1318.39**	1.46**	2.98**	509.46**	22.67**
Sca	91	15.43**	1.20**	3.74**	264.17**	0.77**	0.49**	176.66**	3.99**
Error	208	0.35	0.17	0.16	4.59	0.18	0.20	4.22	0.56
Predictivity ratio		.007	0.09	0.13	0.25	.02	0.55	0.12	0.35

Table 2. Estimation of genrenal combining ability effects in tomato

Parents	Days to first harvest	No. of primary branches	No. of secondary branches	Plant height	No. of flower/truss	No. of fruit/truss	Fruit/plant	Total yield/plant
Pusa Early Dwarf	-.07	-.18	-.96**	-2.20**	.24	1.02**	4.23**	-1.99
Punjab Chhuhara	-.05	-.11	-.51**	1.61**	.59**	.61	9.41**	3.44**
Punjab Kesari	0.09	-.08	-.45**	0.47	-.37**	-.61	5.46**	0.23**
Marglove	2.72	.46**	-1.30**	23.16**	.04	-.15	-10.13	-.08
EL-13	-.15	.34**	1.19**	6.37**	-.31**	.21	4.01	0.92**
Sweet-72	-1.76	.21**	0.94**	8.52**	.32**	-.03	4.65	-.42
Azad T-2	-.53**	-.11	-.37**	2.23**	.05	.23	8.77	-.04
Pant T-1	0.30	.18	.75**	-2.92**	.01	-.17	1.46	2.80**
Co 3	0.76	-.18	.35**	-7.80**	.10	-.48	-1.24	-.33
Pant Bahar	-.88**	0.43**	-.44**	5.92**	-.17	-.35	-5.15	-.05
Arka Saurabh	-.69**	-.17	-.30**	-6.52**	.01	-.10	-1.79	.002
Shakti	.69	.65**	1.32**	-4.09**	.09	.22	-2.14	-.64
NDT-5	-.32	-.90	-.77	-13.26**	.008	-.27	-3.68	-.77
Azad Kranti	.92	-.56	0.54**	-8.31**	.62**	-.59	-2.96	-.55
SE (gi)	.14	.10	0.09	0.52	.10	.11	0.49	0.06
SE (gi-gj)	.21	.15	0.14	0.76	.15	.16	0.73	0.08

*, ** Significant at P = 0.05 and 0.01

Table 3. Five top ranking cross combinations selected on the basis of *per se* performance along with respective sca effect and gca status

Cross combination	<i>Per se</i> performance	sca effect	gca effect	
Punjab Chhuhara × Punjab Kesari	3.193	4.50**	3.44**	× 0.23** (good × good)
Punjab Chhuhara × Azad kranti Punjab	3.103	4.73**	3.44**	× -0.55 (good × poor)
Punjab Chhuhara × Azad T-2 Punjab	2.863	2.13**	3.44**	× -0.06 (good × poor)
Punjab Chhuhara × EL 13 Punjab	2.843	2.07**	3.44**	× 0.92** (good × good)
Punjab Chhuhara × CO ₃	2.660	2.40**	3.44**	× -0.33 (good × poor)

*, **Significant at P = 0.05 and 0.01

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