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Combing ability for yield and yield contributing characters in tomato (*Solanum lycoperiscum* L.)

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Abstract
Combining analysis of a 10x10 diallel, excluding reciprocals was undertaken for yield and yield contributing characters. Non additive gene action was noticed to be predominant for all the traits studied. A perusal of the GCA effects revealed parents P5, P3 and P7 were beat general combiners for the fruit yield. Hence, these parents may be used in breeding programme for development of high yielding hybrids. The hybrid 3x5 involving both good combiners for fruit yield per plant had recorded maximum fruit yield, in addition to desirable sca effects for fruit yield. In case of specific combining ability of hybrids the best crosses were 3x5, 7x8, 6x7, 3x6, 3x4, 3x7 and 6x8 which were also found promising for yield and yield traits studied.

Keywords: Combining ability, general combing ability, specific combining ability, tomato

Introduction
The investigation on "Combining ability studies in tomato (*Solanum lycopersicum* L.)" was carried out at Tomato Improvement Scheme, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, during rabi season 2016-17. A set of 10x10 half diallel was attempted and the resulting 45 hybrids and 10 parents along with one standard check (commercial hybrid) were evaluated in RBD with two replications during rabi season 2016-17 to study the combining ability among the economic characters such as growth, yield and quality of F1 and their parents.
Breeding of high yielding varieties of any crop mainly depends on the choice of parents. The breeding methods for the improvement of self pollinated crops should be based on nature and magnitude of genetic variance governing the inheritance of quantitative characters. Diallel analysis is one of the precise techniques to identify parents as well as the best cross combination in the immediate generation after making the crosses. In the present investigation attempts have been made to identify best parent to be involved in producing best cross combination and nature of gene action for various characters in tomato.

Materials and Methods
The investigation on "Combining ability studies in tomato (*Solanum lycopersicum* L.)" was carried out at Tomato Improvement Scheme, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, during rabi season 2016-17. The ten diverse parents were selected and crossed in diallel mating excluding reciprocals as suggested by Griffing (1956)[7] to produce 45 hybrids. The experimental material consists of 45 F1 ^{s} and their ten parents and commercial hybrid such as Abhinav. A complete set of 56 genotyes were evaluated in randomized block design with two replication in rabi 2016-17. The plot size was 3.60 x 3.00 m and plants spaced at 90 x 30 cm apart. The recommended cultural practices and plant protection were followed to grow healthy crop.
The data was recorded for each entry in each replication and average values were computed. The estimates of combining ability variances and effects were obtained using method 2 of Model I (Griffing, 1956) [7].

Results and Discussion
Combining ability variances
The analysis of variances for combining ability showed significant differences for various characters in respect of general and specific combining ability indicating variation of the parents in their ability to combine with each other (Table. 1). The magnitude of sca variances were higher than the GCA variances for all the characters under. This indicate the predominance of non additive gene action for all the characters which is always favourable for heterosis breeding for improvement of this traits.

Similar finding were also reported by Dharmathi (1999), Dod *et al*. (1995) [6], Dharwal *et al*. (2000), Thakur and Joshi (2000) [12], Bhatt *et al*. (2001) [1] and Bhlekar (2003).

General combining ability (GCA)

A perusal of the general combining ability (GCA) effects for parents (Table-1) revealed that, none of the parents was good general combiner for all the characters. The parent P5, P3 and P7 were beat general combiners for the fruit yield. Hence, these parents may be used extensively in breeding programae aimed at the development of high yielding tomato hybrids. Similar findings were also reported by Srivastava *et al*. (1998) [11], Chaudhary and Malhotra (2001) [3], Sekar (2001) [10], Bhatt *et al*. (2001) [1], Premalakshmi *et al*. (2002) [9], Joshi and Thakur (2003), Makesh *et al*. (2003 a) [8] and Bhalekar (2003).

Specific combining ability (SCA)

The study of specific combining ability effects (Table 2) reveled significant effects for several hybrids with regards to fruit yield and yield components.

The higher sca effects were observed in the crosses for various characters. In the cross 2x8, higher sca effects were observed for plant height and equatorial diameter of the fruit. In the cross 6x8, high sca effects for average weight of fruit and no. of locules per fruit. In the cross 3x5,7x8, 6x7, 3x6, 3x4, 3x7, 6x8 high sca effects were observed for the characters like total number of fruits per plant, average no. of branches per plant, yield per plant, yield per plot, yield per hectare. The other crosses for higher sca effects were 2x5 for polar diameter, 3x10 for pericarp thickness, 4x10 for fruit Fimness, 3x8 for TSS, and 9x10 for days to 50% flowering.

Considering overall mean performance and combining ability effects the cross combinations *viz*., 3x5, 7x8, 6x7, 3x6, 3x4, 3x7 and 6x8 were found most promising combinations.

Table 1: Analysis of variance for combining ability.

Sr. No.	Character	MSS		
		GCA (9)	SCA (45)	Error (54)
1.	Plant height (cm)	186.69	77.10	1.07
2.	Average number of branches	0.26	0.14	0.02
3.	Days to 50% flowering	2.30	3.40	0.64
4.	Number of fruits per plant	86.53	34.99	0.50
5.	Average fruit weight(g)	265.20	163.67	0.47
6.	Equatorial diameter of fruit (cm)	0.15	0.15	0.019
7.	Polar diameter of fruit (cm)	0.48	0.23	0.019
8.	Number of locules	0.20	0.14	0.03
9.	Pericarp thickness(cm)	0.0033	0.0038	0.00075
10.	Yield /plant (kg)	0.11	0.01	0.0015
11.	Yield/plot (kg)	148.15	23.47	2.30
12.	Yield/ha (t)	106.37	16.24	1.42
13.	Fruit firmness(kg/cm2)	1.43	0.56	0.02
14.	TSS (0B)	0.68	0.18	0.02

Table 2: Estimates of general combining ability effects of various characters in 10 x 10 half diallel of tomato

Parents	Plant height (cm)	Average No. of branches	Days to 50% flowering	Number of fruits per plant	Average fruit weight (g)	Equatorial diameter of fruit (cm)	Polar diameter of fruit
P1	-6.258 **	-0.182**	-0.017	-0.928**	-1.122**	-0.124 **	0.128 **
P2	2.433 **	-0.007	-0.433	-1.688**	4.734**	0.075	0.237 **
P3	0.421	0.002	-0.142	0.308	1.395**	0.042	0.172 **
P4	-.3112 **	0.202 **	0.317	-0.071	0.844**	-0.216 **	-0.041
P5	-0.221	-0.198 **	-0.850 **	4.384**	-5.689**	0.014	-0.046
P6	7.858 **	0.160 **	0.108	0.551**	-1.687**	0.074	-0.401 **
P7	3.392 **	0.185 **	0.692 **	-0.284	4.245**	0.207 **	0.214 **
P8	-0.292	0.035	-0.225	3.603**	-7.201**	-0.021	-0.183 **
P9	-0.933 **	-0.148 **	0.233	-5.308**	7.60**	-0.037	0.037
P10	-3.288 **	-0.048	0.317	-0.568**	-3.119**	-0.015	-0.115 **
S.E. +	0.284	0.0448	0.220	0.195	0.188	0.038	0.038
C.D.at 5%	0.642	0.101	0.497	0.391	0.378	0.086	0.086
C.D.at 1%	0.922	0.145	0.715	0.457	0.498	0.123	0.124

* and ** significant at 5% and 1%

Table 2: (Contd…)

Parents	Number of locules	Pericarp thickness (cm)	Yield/plant (kg)	Yield/plot (kg)	Yield/ha (t)	Fruit firmness (kg/cm2)	TSS (0B)
P1	-0.135 *	-0.032 **	-0.105**	-3.714**	-3.161**	-0.007	0.104 *
P2	0.140 *	0.007	0.032**	1.193**	0.966**	-0.595 **	-0.502 **
P3	0.032	-0.014	0.095**	3.476**	2.885**	-0.563 **	-0.184 **
P4	-0.210 **	-0.009	0.044**	1.617**	1.322**	0.313 **	0.193 **
P5	0.107	-0.014	0.114**	3.936**	3.461**	0.190 **	0.107 **
P6	0.215 **	0.022 **	0.024*	0.912*	0.730*	0.243 **	0.198 **
P7	0.015	0.008	0.087**	3.161**	2.620**	-0.241 **	-0.243 **
P8	-0.068	0.018 *	-0.006	-0.370	-0.160	0.176 **	0.197 **
P9	-0.085	0.007	-0.175**	-6.249**	-5.293**	0.182 **	0.168 **
P10	-0.010	0.007	-0.111**	-3.962**	-3.371**	0.302 **	-0.038
S.E +	0.054	0.0075	0.010	0.415	0.326	0.0416	0.039
C.D.at 5%	0.123	0.0169	0.065	2.51	1.976	0.094	0.088
C.D.at 1%	0.176	0.024	0.098	4.27	2.598	0.135	0.127

* And ** significant at 5% and 1% level

References

1. Bhalekar MN. Genetical studies of pigmented anther cone as a new Phenotypical marker in tomato. Ph.D., Thesis. Mahatma Phule Krishi Vidyapeeth, Rahuri, 2003.
2. Bhatt RP, Biswas VR, Kumar N, France J, Crompton LA. Heterosis, combining ability and genetics for vitamin C, total soluble solids and yield in tomato (*Lycopersicon esculentum* Mill.) at 1700m altitude, 2001.
3. Meeting of the agricultural Research Modellers Group N33, London, Royaume Uni., 137(1):113-122.
4. Chaudhary DR, Malhotra SK. Studies on hybrid vigour in tomato (*Lycopersicon esculentum* Mill.) Ind. J Agril. Res. 2001; 35(3):176-180.
5. Dharmatti PR, Madalgeri BB, Mannikeri IM, Patil RV. Combining ability for tomato leaf curl virus resistance in summer tomatoes (*Lycopersicon esculentum* Mill.). Adv. In Agrl. Res. In India. 1999; 11:67-72.
6. Dod VN, Kale PB, Wankhade RV. Heterosis and combining ability in tomato (*Lycopersicon esculentum* Mill.). PKV Res. J. 1995; 19(2):125-129.
7. Dhaliwal MS, Singh S, Cheema DS. Estimating combining ability effects of the genetic male sterile lines of tomato for their use in hybrid breeding. J Gen. and Breed. 2000; 54(3):199-205.
8. Griffing B. Concept of general and specific combining ability in relation to diallel crossing system, Aust. J Biol. Sci. 1956; 9:463-493.
9. Joshi, A. and Thakur, M. C. 2003. Exploitation of heterosis for yield and yield contributing traits in tomato (Lycopersicon esculentum Mill.). Prog. Hort., 35(1): 64-68.
10. Makesh S, Puddan M, Banu MR, Ramaswamy N. Heterosis for some important quantitative traits in tomato (*Lycopersicon esculentum* Mill.). Research on crops. 2003; 4(2):235-239.
11. Premalakshmi V, Thangaraj T, Veeraragathatham D, Arumugam T. Hybrid vigour for yield and shelf life in tomato (*Lycopersicon esculentum* Mill.). South Indian Hort. 2002; 50(4-6):360-369.
12. Sekar K. Heterosis for yield and yield components in tomato (*Lycopersicon esculentum* Mill.). Adv. In Hort. and Forest. 2001; 8:95-102.
13. Srivastava JP, Singh H, Srivastava BP, Verma HPS, Singh H. Heterosis in relation to combining ability in tomato. Veg. Sci. 1998; 25(1):43-47.
14. Thakur MC, Joshi A. Combining ability analysis of yield and other horticultural traits in tomato. Haryana J Hort. Sci. 2000; 29(3-4):214-216.