

Original Research Article

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Heterosis for Quality Traits in Tomato (*Solanum lycopersicum* L.)

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ABSTRACT

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A set of 18 F₁ hybrids developed as a result of line x tester mating design involving six lines and three testers were evaluated in randomized block design in three replications for heterosis in four quality traits. Heterosis to the extent of 24.68, 65.19, 25.90 and 76.21 over mid parent and 9.09, 38.70, 17.07 and 68.57 over better parent was recorded for number of locules per fruit, pericarp thickness, total soluble solids and ascorbic acid content, respectively. Standard heterosis over Lakshmi to the extent of -7.46, 24.56, 35.21 and 89.39 was recorded for number of locules per fruit, pericarp thickness, total soluble solids and ascorbic acid content respectively and over US-618 to the extent of 5.53, 51.33, 28.86 and 68.92 was recorded for number of locules per fruit, pericarp thickness, total soluble solids and ascorbic acid content respectively. The crosses LE-67 × Pusa Gaurav, LE-65 × Pant T-3, LE-62 × Pant T-3 and LE-64 × Pant T-3 for number of locules per fruit, pericarp thickness, total soluble solids and ascorbic acid content were identified as a best heterotic combination, respectively.

Introduction

Tomato is the most important vegetable crop of the world, which is consumed as fresh as well as processed vegetable. In India, it has ample scope in the processing industry. The fruit quality and suitability for long distance transport, which has direct bearing on its effective utilization as processed vegetable, are determined by number of locules per fruit, pericarp thickness, total soluble solids and ascorbic acid content. Keeping in view the present experiment was formulated to estimate

the heterotic potential for those quality traits in tomato.

Materials and Methods

The experimental material for the present study comprised six lines viz., EC-165749, LE-56, LE-62, LE-64, LE-65, LE-67, three testers viz., Punjab Chuhara, Pant T-3 and Pusa Gaurav and three standard checks viz; Lakshmi, US-618 and Arka vikas. These lines were crossed in line x tester fashion to develop 18 F₁ hybrids, which were evaluated along

with their parents in randomized block design in three replications at the experimental farm of Vegetable Research Station, Dr. Y.S. R. Horticultural University, Rajendranagar, Hyderabad. Observations were recorded for number of locules per fruit, pericarp thickness (mm), total soluble solids ($^{\circ}$ Brix) and ascorbic acid (mg/100 g). Pericarp thickness was measured with the help of a vernier caliper, total soluble solids with the help of hand refractometer and ascorbic acid was estimated by titration method as described by Ranganna (1986).

Results and Discussion

Heterosis was estimated for quality characters studied in 18 hybrids and was expressed as increase or decrease over mid parental value (relative heterosis), over better parent (heterobeltiosis) and over commercial checks (standard heterosis). The results are presented in the table 1 and 2.

Number of locules per fruit

Heterosis in negative direction is considered desirable for number of locules per fruit. Significant desirable relative heterosis was recorded in 9 out of 18 hybrids and range was from -27.60 (LE-67 \times Pant T-3) to 24.68 per cent (LE-56 \times Punjab chhuhara). Heterobeltiosis was found to be negative and significant in 13 hybrids. It ranged from -37.04 (LE-67 \times Pusa Gaurav) to 9.09 per cent (LE-56 \times Punjab chhuhara).

Standard heterosis ranged from -47.01 (LE-64 \times Punjab chhuhara and LE-65 \times Punjab chhuhara) and -39.57 (LE-64 \times Punjab chhuhara and LE-65 \times Punjab chhuhara) to -7.46 (EC-165749 \times Pant T-3) and 5.53 (EC-165749 \times Pant T-3) over Lakshmi and US-618 respectively. Among 18 hybrids studied, 16 hybrids over Lakshmi and 13 hybrids over US - 618 exhibited significant desirable standard heterosis (Table 1).

Pericarp thickness (mm)

Relative heterosis ranged from -19.18 (LE-67 \times Pant T-3) to 65.19 per cent (LE-67 \times Punjab chhuhara) with 10 hybrids registered positively significant relative heterosis.

Heterobeltiosis ranged from -35.05 (LE-67 \times Pant T-3) to 38.70 per cent (LE-65 \times Pant T-3) and 9 hybrids exhibited significantly positive heterobeltiosis for pericarp thickness.

The range of standard heterosis was from -43.25 (LE-67 \times Pant T-3) to 24.56 per cent (LE-65 \times Punjab chhuhara) over Lakshmi and -31.06 (LE-67 \times Pant T-3) to 51.33 per cent (LE-65 \times Punjab chhuhara) over US-618. Significant positive standard heterosis was recorded by 3 hybrids over Lakshmi and 8 hybrids over US-618 (Table 1).

TSS ($^{\circ}$ Brix)

The relative heterosis ranged from -24.00 (EC-165749 \times Punjab chhuhara) to 25.90 per cent (LE-62 \times Pant T-3).

Out of 18 hybrids, 6 exhibited positive significant relative heterosis for

TSS. The range of heterobeltiosis was from -26.11 (EC-165749 \times Punjab chhuhara) to 17.07 per cent (LE-62 \times Pant T-3) with 3 hybrids showing significant positive heterobeltiosis (Table 2).

The range of standard heterosis was from -6.4 (EC-165749 \times Punjab chhuhara) to 35.21 per cent (LE-62 \times Pant T-3) over Lakshmi and -10.74 (EC-165749 \times Punjab chhuhara and LE-67 \times Punjab chhuhara) to 28.86 per cent (LE-62 \times Pant T-3) over US-618. Significant positive standard heterosis was recorded by 11 hybrids over Lakshmi and 8 hybrids over US-618.

Ascorbic acid content (mg 100 g⁻¹)

Relative heterosis ranged from -38.73 (LE-65 × Punjab chhuhara) to 76.21 per cent (LE-64 × Pant T-3). Significant positive relative heterosis was recorded in 7 hybrids for ascorbic acid content. Heterobeltiosis ranged from -44.98 (EC-165749 × Pant T-3) to 68.57 per cent (LE-64 × Pant T-3) and 7 hybrids exhibited significant positive heterobeltiosis (Table 2).

Standard heterosis over Lakshmi ranged from -22.47 (EC-165749 × Pant T-3) to 89.39 per cent (LE-56 × Pusa Gaurav) and over US-618 ranged from -30.85 (EC-165749 × Pant T-3) to 68.92 per cent (LE-56 × Pusa Gaurav). Significant positive standard heterosis expressed by 8 and 7 hybrids over Lakshmi and US-618 respectively.

The less number of locules per fruit indicates the fruit firmness in Tomato (Dundi and Madalageri, 1991). Hence, negative heterosis is considered as desirable. Fruits with high pericarp thickness stored for more days. Hence, positive heterosis was desirable.

The cross LE-67 × Pusa Gaurav for number of locules per fruit and LE-65 × Pant T-3 for pericarp thickness registered high significant heterosis over better parent. The results are in confirmation with the earlier findings of Sidhu *et al.*, (1981) for the character pericarp thickness. Tendulkar (1994) reported significant desirable standard heterosis for number of locules per fruit and pericarp thickness.

Table.1 Estimates of heterosis over mid parent (MP), better parent (BP) and standard checks for number of locules per fruit and pericarp thickness in tomato

S. No	Cross	Number of locules per fruit				Pericarp thickness			
		MP	BP	Lakshmi	US-618	MP	BP	Lakshmi	US-618
1	EC -165749 × Punjab Chhuhara	5.26	-14.29**	-10.45	2.13	32.42**	22.68**	11.56	35.54**
2	EC -165749 × Pant T-3	-12.68**	-13.89**	-7.46	5.53	27.17**	20.03**	4.88	27.41**
3	EC -165749 × Pusa Gaurav	-3.39	-18.57**	-14.93**	-2.98	11.12	9.55	-12.56*	6.23
4	LE-56 × Punjab Chhuhara	24.68**	9.09	-28.36**	-18.30**	46.25**	17.80*	7.13	30.14**
5	LE-56 × Pant T-3	-2.86	-29.17**	-23.88**	-13.19*	4.07	-14.88*	-25.63**	-9.64
6	LE-56 × Pusa Gaurav	11.11	-6.25	-32.84**	-23.40**	49.49**	26.78**	1.19	22.93
7	LE-62 × Punjab Chhuhara	-10.40	-10.90	-40.82**	-32.51**	-13.19*	-21.51**	-28.63**	-13.29
8	LE-62 × Pant T-3	-11.33*	-28.26**	-22.91**	-12.09	12.74	3.79	-9.31	10.17
9	LE-62 × Pusa Gaurav	-14.59*	-17.71*	-41.04**	-32.77**	2.24	-1.80	-21.63**	-4.78
10	LE-64 × Punjab Chhuhara	-15.48*	-19.32*	-47.01**	-39.57**	39.88**	15.46*	5.00	27.56**
11	LE-64 × Pant T-3	-16.07**	-34.72**	-29.85**	-20.00**	36.12**	14.16*	-0.25	21.18**
12	LE-64 × Pusa Gaurav	-4.55	-12.50	-37.31**	-28.51**	-6.74	-18.79*	-35.19**	-21.26**
13	LE-65 × Punjab Chhuhara	-22.40**	-25.26**	-47.01**	-39.57**	61.25**	36.98**	24.56**	51.33**
14	LE-65 × Pant T-3	-9.62	-25.00**	-19.40**	-8.09	60.58**	38.70**	21.19**	47.23**
15	LE-65 × Pusa Gaurav	0.52	0.00	-28.36**	-18.30**	-16.04*	-24.59**	-39.81**	-26.88**
16	LE-67 × Punjab Chhuhara	-18.83**	-32.96**	-32.46**	-22.98**	65.19**	30.79**	18.94**	44.50**
17	LE-67 × Pant T-3	-27.60**	-29.86**	-24.63**	-14.04*	-19.18*	-35.05**	-43.25**	-31.06**
18	LE-67 × Pusa Gaurav	-26.41**	-37.04**	-36.57**	-27.66**	37.72**	14.64	-8.50	11.16
	S.Ed	0.21	0.24	0.24	0.24	0.28	0.32	0.32	0.32

* Significant at 5% level

** Significant at 1 % level

MP - Mid Parent, BP-Better Parent

Table.2 Estimates of heterosis over mid parent (MP), better parent (BP) and standard checks for TSS and ascorbic acid content in tomato

S. No	Cross	TSS				Ascorbic acid content			
		MP	BP	Lakshmi	US-618	MP	BP	Lakshmi	US-618
1	EC -165749 × Punjab Chhuhara	-24.00**	-26.11**	-6.4	-10.74*	-11.86	-16.13*	18.18	5.41
2	EC -165749 × Pant T-3	-21.51**	-25.00**	-4.93	-9.40*	-37.21**	-44.98**	-22.47*	-30.85**
3	EC -165749 × Pusa Gaurav	16.13**	0.00	26.76**	20.81**	-36.09**	-41.94**	-18.18	-27.03**
4	LE-56 × Punjab Chhuhara	3.14	-3.53	15.49**	10.07*	33.33**	28.89**	75.76**	56.76**
5	LE-56 × Pant T-3	5.77	0.61	16.20**	10.74*	52.50**	35.56**	84.85**	64.86**
6	LE-56 × Pusa Gaurav	19.42**	12.16*	16.90**	11.41*	50.60**	38.89**	89.39**	68.92**
7	LE-62 × Punjab Chhuhara	17.68**	7.65	28.87**	22.82**	2.13	-14.29	9.09	-2.70
8	LE-62 × Pant T-3	25.90**	17.07**	35.21**	28.86**	-18.11	-25.71*	-21.21*	-29.73**
9	LE-62 × Pusa Gaurav	18.08**	13.48**	12.68*	7.38	54.89**	35.53**	56.06**	39.19**
10	LE-64 × Punjab Chhuhara	-12.43**	-15.76**	9.15	4.03	66.29**	46.43**	86.36**	66.22**
11	LE-64 × Pant T-3	-13.79**	-18.48**	5.63	0.67	76.21**	68.57**	78.79**	59.46**
12	LE-64 × Pusa Gaurav	1.91	-13.04**	12.68*	7.38	-2.81	-10.53	3.03	-8.11
13	LE-65 × Punjab Chhuhara	-7.08	-11.18**	6.34	1.34	-38.73**	-44.93**	-12.12	-21.62*
14	LE-65 × Pant T-3	2.19	-0.61	14.79**	9.40*	-11.02	-25.95**	18.18	5.41
15	LE-65 × Pusa Gaurav	14.39**	5.16	14.79**	9.40*	-30.51**	-40.19**	-4.55	-14.86
16	LE-67 × Punjab Chhuhara	-20.83**	-21.76**	-6.34	-10.74*	-15.66*	-16.67*	6.06	-5.41
17	LE-67 × Pant T-3	-1.82	-2.41	14.08**	8.72	7.89	0.00	24.24*	10.81
18	LE-67 × Pusa Gaurav	0.68	-10.24*	4.93	0.00	41.77**	36.59**	69.70**	51.35**
	S.Ed	0.19	0.22	0.22	0.22	1.93	2.23	2.23	2.23

* Significant at 5% level

** Significant at 1 % level

MP - Mid Parent, BP-Better Parent

Total soluble solids is one of the important quality parameter governing the processing quality in tomato. The cross LE-62 × Pant T-3 for total soluble solids and LE-64 × Pant T-3 for ascorbic acid content exhibited high significant heterosis over better parent. These results are in accordance with the findings of Kurian and Peter (2001), Kaur *et al.*, (2002) and Makesh *et al.*, (2002) for TSS. Bhatt *et al.*, (2004), Kumar *et al.*, (2006) and Sharma *et al.*, (2006) also reported the similar projections for ascorbic acid in tomato.

Considering the magnitude of heterosis for these traits the superior crosses, namely, LE-67 × Pusa Gaurav for number of locules per fruit and LE-65 × Pant T-3 for pericarp thickness, LE-62 × Pant T-3 for total soluble solids and LE-64 × Pant T-3 for ascorbic acid content were identified as a best heterotic combination.

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