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Evaluation of parents and hybrids of tomato (*Solanum lycopersicum* L.) for their suitability to prepare puree and paste

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Abstract

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 completely randomized block design in three replications for their suitability to prepare tomato puree and paste. Acidity of the puree and paste was highest in the parent LE-65 (1.04% & 3.08%) followed by parent EC-165749 (0.86% and 3.40%) and the hybrids LE-65 x Punjab chhuhara (1.03% and 3.36%), EC -165749 x Pant T-3 (0.95% and 3.14%), LE-65 x Pant T-3 (0.93% and 2.82%), EC-165749 x Pusa Gaurav (0.93% and 3.06%), and LE-65 x Pusa Gaurav (0.90% and 2.97%). The highest reducing sugars of puree and paste was recorded by the parent Punjab Chhuhara (9.78% and 10.48%) recorded the significantly highest in puree which was on par with the parent EC-165749 (9.65% and 10.12%) and LE-64 (9.56% and 9.93%). The hybrid LE-62 x Punjab Chhuhara (11.09% and 11.80%) recorded significantly highest reducing sugars which was on par with EC-165749 x Pusa Gaurav (10.45% and 10.74%), LE-62 x Pant T-3 (10.40% and 10.85%) and these are followed by LE-56 x Punjab Chhuhara (10.26% and 10.60%) and LE-64 x Punjab Chhuhara (10.10% and 10.40%). The significantly highest total sugar content of puree and paste was recorded by the parent Punjab Chhuhara (11.84% and 11.94%) which was on par with LE-64 (11.50% and 11.78%) and LE-67 (11.32% and 11.70%). The hybrids EC-165749 x Pusa Gaurav (12.82% and 12.85%), LE-62 x Punjab Chhuhara (12.25% and 13.68%), LE-56 x Punjab Chhuhara (12.19% and 11.95%), LE-62 x Pant T-3 (11.93% and 12.56%) and LE-64 x Punjab Chhuhara (11.66% and 12.35%) recorded highest total sugars. The hybrids LE-62 x Punjab Chhuhara and EC-165749 x Pusa Gaurav are best suited for processing having moderate acidity, high reducing and total sugars.

Keywords: Tomato, parents, hybrids, puree, paste

Introduction

Tomato (*Solanum lycopersicum* L.) is one of the most important and widely cultivated vegetable crops across the world, owing to its broad adaptability and high yield potential. The fruits are consumed both fresh and cooked, and they are available year-round. Tomatoes are valued as a rich source of essential vitamins, minerals, and other bioactive compounds that contribute to human health. In India, tomato breeding programs have traditionally emphasized yield improvement, with comparatively less focus on fruit quality attributes. However, increasing consumer demand and the expansion of the processing industry have intensified interest in enhancing fruit quality traits. Although a general negative association exists between yield and fruit quality, continued research and breeding efforts can help optimize both parameters simultaneously. The future of tomato processing in India appears promising, given the rapidly increasing domestic consumption and growing export potential for processed products such as ketchup, paste, and puree. In this context, the present investigation was undertaken to identify tomato genotypes suitable for processing, particularly for the preparation of ketchup, puree and paste.

Materials and Methods

The study was conducted at the Experimental Farm of the Vegetable Research Station, Agricultural Research Institute, Rajendranagar, Dr. Y.S.R. Horticultural University, Hyderabad, India. The experimental material consisted of nine parental genotypes: six lines, EC-165749 (L₁), LE-56 (L₂), LE-62 (L₃), LE-64 (L₄), LE-65 (L₅), and LE-67 (L₆) and three testers, Punjab Chhuhara (T₁), Pant T-3 (T₂), and Pusa Gaurav (T₃).

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The crosses were made following the Line $\times$ Tester mating design proposed by Kempthorne (1957) [1]. The experimental treatments included 18 F_1 hybrids derived from these crosses, along with the 9 parental lines (6 lines and 3 testers) and 2 commercial hybrids plus one standard variety as checks. Tomato puree and paste were prepared from all treatments for subsequent evaluation. The experiment was laid out in a Complete Randomized Block Design (CRBD). Observations were recorded from the freshly prepared tomato puree and paste for titratable acidity (%), reducing sugars (%), and total sugars (%). These parameters were estimated following the standard procedures described by Ranganna (1986) [2]. The resulting data were statistically analyzed as per the methods outlined by Panse and Sukhatme (1967) [3].

Results and Discussion

The data regarding the chemical composition of tomato ketchup are presented in Table 1 and Table 2.

Titration Acidity of the puree was recorded significantly highest in the parent LE-65 (1.04%) followed by parent EC-165749 (0.86%), LE-64 (0.85%) and LE-62 (0.83%). Among the hybrids LE-65 $\times$ Punjab Chhuhara (1.03%) recorded significantly highest titration acidity followed by EC-165749 $\times$ Pant T - 3 (0.95%), LE-65 $\times$ Pant T-3 (0.93%), EC-165749 $\times$ Pusa Gaurav (0.93%), LE-65 $\times$ Pusa Gaurav (0.90%) and EC-165749 $\times$ Punjab Chhuhara (0.90%), while the lowest titration acidity was recorded with LE-56 $\times$ Pusa Gaurav (0.61%). The checks Lakshmi, US - 618 and Arka Vikas recorded 0.60, 0.70 and 0.83% titration acidity, respectively. It might be due to one of them as their parent recorded the highest acidity and also be due to its higher acidity content in the juice. Similar results were reported by Gowda *et al.* (1993) [4] and Jawaharlal *et al.* (1999) [5].

Considering the reducing sugars, the parent Punjab Chhuhara (9.78%) recorded the significantly highest in puree which was on par with the parent EC-165749 (9.65%), LE-64 (9.56%) and LE-67 (9.40%). The hybrid LE-62 $\times$ Punjab Chhuhara (11.09%) recorded significantly highest reducing sugars which was on par with EC-165749 $\times$ Pusa Gaurav (10.45%), LE-62 $\times$ Pant T-3 (10.40%) and these are followed by LE-56 $\times$ Punjab Chhuhara (10.26%) and LE-64 $\times$ Punjab Chhuhara (10.10%), while the lowest reducing sugars was recorded with EC-165749 $\times$ Punjab Chhuhara (6.87%). The checks Lakshmi, US -618 and Arka Vikas recorded 8.76, 8.70 and 8.30% reducing sugars, respectively. The significantly highest total sugar content of puree was recorded by the parent Punjab Chhuhara (11.84%) which was on par with LE-64 (11.50%), LE-67

(11.32%) and EC-165749 (11.31%). The hybrid EC-165749 $\times$ Pusa Gaurav (12.82%) recorded significantly highest total sugars which was on par with LE-62 $\times$ Punjab Chhuhara (12.25%) LE-56 $\times$ Punjab Chhuhara (12.19%) and these are followed by LE-62 $\times$ Pant T-3 (11.93%) and LE-64 $\times$ Punjab Chhuhara (11.66%), while the lowest total sugars were recorded with EC-165749 $\times$ Punjab Chhuhara (8.83%). The checks Lakshmi, US -618 and Arka Vikas recorded 10.85, 10.22 and 10.02% total sugars, respectively. It might be due to one of them as their parent recorded the highest sugar content and also be due to its higher sugar content and TSS in the juice.

Titration Acidity of the paste was recorded significantly highest in the parent EC-165749 (3.40%) followed by parent LE-65 (3.08%), LE-64 (2.96%) and LE-67 (2.73%). Among the hybrids LE-65 $\times$ Punjab Chhuhara (3.36%) recorded significantly highest titration acidity which was on par with EC-165749 $\times$ Pant T - 3 (3.14%) and these are followed by EC-165749 $\times$ Pusa Gaurav (3.06%), LE-65 $\times$ Pusa Gaurav (2.97%) and LE-65 $\times$ Pant T-3 (2.82%), while the lowest titration acidity was recorded with LE-62 $\times$ Pant T-3 (1.98%). The checks Lakshmi, US -618 and Arka Vikas recorded 2.00, 2.38 and 2.61% titration acidity, respectively. It might be due to one of them as their parent recorded the highest acidity and also be due to its higher acidity content in the juice. Similar results were reported by Gowda *et al.* (1993) [4] and Jawaharlal *et al.* (1999) [5].

Considering the reducing sugars, the parent Punjab Chhuhara (10.48%) recorded the highest in paste which was on par with the parent EC-165749 (10.12%), LE-64 (9.93%) and Pant T-3 (9.90%). The hybrid LE-62 $\times$ Punjab Chhuhara (11.80%) recorded significantly highest reducing sugars followed by LE-62 $\times$ Pant T-3 (10.85%), EC-165749 $\times$ Pusa Gaurav (10.74%), LE-56 $\times$ Punjab Chhuhara (10.60%) and LE-64 $\times$ Punjab Chhuhara (10.40%), while the lowest reducing sugars was recorded with EC-165749 $\times$ Punjab Chhuhara (7.04%). The checks Lakshmi, US -618 and Arka Vikas recorded 9.14, 9.06 and 8.60% reducing sugars, respectively. The significantly highest total sugar content of paste was recorded by the parent Punjab Chhuhara (11.94%) which was on par with LE-64 (11.78%), LE-67 (11.70%) and Pant T-3 (11.44%). The hybrids LE-62 $\times$ Punjab Chhuhara (13.68%) recorded the significantly highest total sugars in the paste followed by EC-165749 $\times$ Pusa Gaurav (12.85%), LE-62 $\times$ Pant T-3 (12.56%), LE-64 $\times$ Punjab Chhuhara (12.35%) and LE-56 $\times$ Punjab Chhuhara (11.95%), while the lowest total sugars was recorded with LE-56 $\times$ Punjab Chhuhara (9.67%) in hybrids. The checks Lakshmi, US -618 and Arka Vikas recorded 11.43, 11.14 and 10.76% total sugars, respectively.

Table 1: Chemical constituents of freshly prepared puree

S. No	Characters	Titration Acidity (%)	Reducing sugars (%)	Total sugars (%)
1	EC -165749 x Punjab Chhuhara	0.90	6.87	8.83
2	EC -165749 x Pant T-3	0.95	7.52	9.41
3	EC -165749 x Pusa Gaurav	0.93	10.45	12.82
4	LE-56 x Punjab Chhuhara	0.68	10.26	12.19
5	LE-56 x Pant T-3	0.63	9.85	11.26
6	LE-56 x Pusa Gaurav	0.61	9.48	11.07
7	LE-62 x Punjab Chhuhara	0.72	11.09	12.25
8	LE-62 x Pant T-3	0.67	10.40	11.93
9	LE-62 x Pusa Gaurav	0.72	8.86	10.81
10	LE-64 x Punjab Chhuhara	0.70	10.10	11.66
11	LE-64 x Pant T-3	0.75	8.05	10.74

12	LE-64 x Pusa Gaurav	0.74	9.13	10.89
13	LE-65 x Punjab Chhuhara	1.03	7.96	9.69
14	LE-65 x Pant T-3	0.93	8.98	10.78
15	LE-65 x Pusa Gaurav	0.90	9.20	11.08
16	LE-67 x Punjab Chhuhara	0.74	7.89	9.63
17	LE-67 x Pant T-3	0.73	8.18	9.94
18	LE-67 x Pusa Gaurav	0.66	7.82	9.78
19	EC -165749	0.86	9.65	11.31
20	LE-56	0.70	8.12	9.74
21	LE-62	0.83	7.68	9.60
22	LE-64	0.85	9.56	11.50
23	LE-65	1.04	8.55	10.80
24	LE-67	0.78	9.40	11.32
25	Punjab Chhuhara	0.70	9.78	11.84
26	Pant T-3	0.80	8.84	10.93
27	Pusa Gaurav	0.79	7.08	9.47
28	Lakshmi	0.60	8.76	10.85
29	US-618	0.70	8.70	10.22
30	Arka Vikas	0.83	8.30	10.02
	CD @ 5%	0.06	0.69	0.76
	SE(m) $\pm$	0.02	0.24	0.27

Table 2: Chemical constituents of freshly prepared paste

S. No	Characters	Titration Acidity (%)	Reducing sugars (%)	Total sugars (%)
1	EC -165749 x Punjab Chhuhara	2.81	7.04	9.74
2	EC -165749 x Pant T-3	3.14	7.72	9.69
3	EC -165749 x Pusa Gaurav	3.06	10.74	12.85
4	LE-56 x Punjab Chhuhara	2.25	10.60	11.14
5	LE-56 x Pant T-3	2.08	10.12	11.64
6	LE-56 x Pusa Gaurav	2.19	9.74	11.30
7	LE-62 x Punjab Chhuhara	2.31	11.80	13.68
8	LE-62 x Pant T-3	1.98	10.85	12.56
9	LE-62 x Pusa Gaurav	2.42	8.98	11.15
10	LE-64 x Punjab Chhuhara	2.31	10.40	11.95
11	LE-64 x Pant T-3	2.48	8.38	10.03
12	LE-64 x Pusa Gaurav	2.38	9.87	11.46
13	LE-65 x Punjab Chhuhara	3.36	8.48	12.35
14	LE-65 x Pant T-3	2.82	9.45	11.20
15	LE-65 x Pusa Gaurav	2.97	9.36	11.27
16	LE-67 x Punjab Chhuhara	2.60	8.30	9.67
17	LE-67 x Pant T-3	2.38	8.55	11.43
18	LE-67 x Pusa Gaurav	2.15	8.05	10.08
19	EC -165749	3.40	10.12	12.26
20	LE-56	2.31	8.20	10.25
21	LE-62	2.52	8.12	9.92
22	LE-64	2.96	9.93	11.78
23	LE-65	3.08	8.68	10.84
24	LE-67	2.73	9.52	11.70
25	Punjab Chhuhara	2.31	10.48	11.94
26	Pant T-3	2.42	9.90	11.44
27	Pusa Gaurav	2.56	7.74	9.60
28	Lakshmi	2.00	9.14	11.43
29	US-618	2.42	9.06	11.14
30	Arka Vikas	2.61	8.60	10.76
	CD @ 5%	0.22	0.82	0.82
	SE(m) $\pm$	0.08	0.29	0.29

Conclusion

In an evaluation of nine parents, eighteen hybrids and three checks of tomato for quality of ketchup, the parent LE-64 was found to be the best for making ketchup followed by LE-56 and Punjab Chhuhara. The hybrids involving EC-165749, LE-64 and Punjab Chhuhara were found to be better for their qualities such as titrable acidity, reducing sugars and total sugars. The hybrids LE-62 $\times$ Punjab Chhuhara and EC-165749 $\times$ Pusa Gaurav are best suited for

processing having moderate acidity, high reducing and total sugars.

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