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RESEARCH NOTE

Genetic diversity studies on neutraceuticals, industrial quality traits and yield components of tomato (*Solanum lycopersicum* L.)

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The present investigation was carried out to estimate the genetic diversity for neutraceuticals, industrial quality traits and yield components among 28 genotypes of tomato. The experiment was carried out during summer 2015 at botanical garden of the Department of Genetics and Plant Breeding, UAS, Dharwad. The 28 genotypes were grouped into 12 clusters and of them, cluster I was largest and comprised of 14 genotypes followed by cluster II with four genotypes and remaining were solitary. The inter cluster D^2 values were maximum between cluster VIII and IX. Maximum contribution to the total divergence was made by â-carotene followed by total soluble solids. Hence, these genotypes could be further utilized for creation of variability for neutraceutical and industrial quality traits

Key words: Genetic diversity, Neutraceuticals, Tomato

Tomato *(Solanum lycopersicum* L.) (2n = 2x = 24) is a self-pollinated vegetable crop grown widely all over the world and it belongs to solanaceae family. It is used directly as raw vegetable in the sandwiches, juice, soup, salad *etc.* (Joshi and Kohli, 2006). Tomato is an important source of vitamin A and C. In India, the fruits are mainly consumed either as raw or in the preparation of sambar, chatni, pickles *etc*.

Lycopene is the most abundant carotenoid in tomatoes with concentrations ranging from 0.9-4.2 mg/100 g depending upon the variety. Tomato sauce and ketchup are concentrated sources of lycopene compared to unprocessed tomatoes. Carotenoids like lycopene are unstable and highly reactive towards oxygen and free radicals. This reactivity of lycopene is the basis for its anti-oxidant activity in biological systems (Paola *et al.,* 2011).

Lycopene consumption reduces the risk of prostate cancer (Jiregna, 2013). The â-carotene reduces risk of night blindness. The total soluble solids (TSS), acidity and pH play important role in deciding the flavour and quality of tomato. Tomatoes with high TSS, high acidity and low pH are preferred in processing industry thus favouring higher price to the farmers. In order to exploit the potential health benefits of tomato it is very important to change the genetic architecture to suit to these needs.

The present study comprised of 13 commercial hybrids (Mahyco anagha, Mahyco 303, S-85, Soubhagya, Laxmi, NS 962, Arka rakshak, Arka samrat, Sagar, Shivum, Abhilash, Abhishek and Holi), eight varieties (Arka abha, Arka alok, Arka vikas, DMT-1, DMT-4, DMT-5, PKM-1 and S-21) and seven germplasms (Line-1, Line-2, Line-3, Line-4, Line-6, Line-9 and Line-10). A total of 28 genotypes were evaluated during 2015 in a randomized block design replicated twice at botanical garden of the Department of Genetics and Plant Breeding, UAS, Dharwad. Standard package of practices was followed to raise a good crop. Observations were recorded on plant height (cm), number of primary branches, number of clusters per plant, number of fruits per plant, average fruit weight per plant (g), polar length of fruit (cm), equatorial length of the fruit (cm), fruit yield per plant (kg), number of locules per fruit, total soluble solids (%), lycopene (mg/100 g of fresh weight), ascorbic acid (mg/100 g of fresh weight), β-carotene (mg/100 g of fresh weight) and pH values. The data was analyzed for genetic diversity using Tocher's method as described by Rao (1952).

The 28 genotypes were grouped into 12 clusters and cluster I was the biggest of all comprising of 14 genotypes (Table 1). The cluster II had four genotypes and remaining were solitary with single distinct genotype in each. The genotypes in solitary cluster are popular hybrids or varieties with distinctly different genetic background. The intra cluster distance was highest in cluster II (626.72) followed by cluster I (475.31) (Table 2). The inter cluster D^2 values were maximum between VIII and IX (3890.41) indicating that the genotypes of these two clusters could be used for heterosis breeding or to develop heterotic gene pools.

The cluster means for 14 characters (Table 3) indicated, considerable difference among clusters for all the characters. The maximum plant height (75.5 cm), maximum number of primary branches (7.5) and highest fruit diameter (4.35 cm) was observed in cluster IX. The cluster XI recorded maximum (24.67) number of fruits, maximum fruit yield per plant, highest

Table 1. Clustering pattern of twenty eight genotypes based on D^2 analysis

Clusters	No. of genotypes	Genotypes
I	14	Holi, Line-9, Line-10, Arka abha, Arka vikas, Line-6, Line-3, S-21, DMT-4, Mahyco 303, Shivum, Line-1, DMT-5, Arka alok
II	4	Arka rakshak, Abhilash, Line-2, DMT-1
III	1	Line-4
IV	1	Mahyco anagha
V	1	NS 962
VI	1	S-85
VII	1	Sagar
VIII	1	Soubhagya
IX	1	Laxmi
X	1	Abhishek
XI	1	Arka samrat
XII	1	PKM-1

Table 2. Average intra-cluster and inter-cluster D^2 values of twenty eight genotypes observed in tomato

	Cluster I	Cluster II	Cluster III	Cluster IV	Cluster V	Cluster VI	Cluster VII	Cluster VIII	Cluster IX	Cluster X	Cluster XI	Cluster XII
Cluster I	475.31	1048.53	712.86	952.63	758.82	714.86	768	1331.46	1995.73	1591.98	1611.19	1371.63
Cluster II		626.72	1831.94	2417.94	1871.28	1075.58	1355.92	1093.61	3418.52	3579.36	2067.85	2875.93
Cluster III			0	864.97	817.05	1167.64	456.83	2292.88	1996.47	709.8	1930.09	2036.75
Cluster IV				0	571.75	850.11	1075.5	2513.7	1525.81	560.51	1482.63	1577.67
Cluster V					0	412.22	527	1937.85	463.02	993.82	610.33	1071.08
Cluster VI						0	655.02	940.46	1428.94	1737.32	691.9	1879.97
Cluster VII							0	1843.29	1456.77	1406.71	1050.78	2183.9
Cluster VIII								0	3890.41	3561.07	2241.15	2751.42
Cluster IX									0	1815.39	880.54	1520.92
Cluster X										0	2303.83	2434.91
Cluster XI											0	2107.05
Cluster XII												0

Table 3. Cluster means for fourteen characters in twenty eight genotypes of tomato

Characters	Cluster I	Cluster II	Cluster III	Cluster IV	Cluster V	Cluster VI	Cluster VII	Cluster VIII	Cluster IX	Cluster X	Cluster XI	Cluster XII
Plant height (cm)	43.27	55.35	28.00	72.84	65.84	59.50	61.00	41.00	75.50	37.84	65.84	45.00
Primary branches	3.94	4.52	3.00	3.47	5.54	5.52	4.37	5.74	7.50	5.27	5.95	4.74
Number of clusters	4.16	6.16	3.05	6.72	7.54	9.37	5.74	3.59	9.95	3.10	11.37	3.15
Number of fruits	6.04	10.23	8.90	9.15	11.67	13.54	14.25	10.50	18.00	5.74	24.67	10.37
Number of locules	3.29	4.42	3.55	2.60	3.00	3.54	3.32	3.37	3.05	2.74	4.05	2.47
Yield (kg)	0.19	0.19	0.20	0.35	0.43	0.38	0.38	0.15	0.62	0.20	0.65	0.18
Polar length (cm)	3.43	3.54	3.43	3.18	3.84	3.58	4.77	4.27	3.63	3.27	4.22	3.34
Equatorial length (cm)	3.81	3.67	3.70	4.07	4.25	4.25	3.99	3.69	4.35	3.70	3.84	3.85
Average fruit weight (g)	23.97	18.36	22.84	42.00	31.50	37.06	25.30	16.77	32.50	36.50	27.22	18.00
Lycopene (mg/100 g of fruit)	2.17	1.83	2.23	2.27	2.23	1.57	1.80	1.80	1.99	2.77	2.87	2.36
Ascorbic acid (mg/100 g of fruit)	25.79	18.50	16.00	32.50	35.50	28.50	20.50	31.50	40.5	21.50	44.50	56.00
â-carotene (mg/100 g of fruit)	1.74	1.33	1.35	1.75	1.35	3.30	1.20	3.20	0.70	1.05	1.45	2.40
pH	5.05	4.49	6.40	5.05	6.10	5.45	6.10	5.40	6.05	6.15	4.55	4.70
Total soluble solids (%)	5.33	5.06	4.35	7.53	5.75	7.20	4.60	8.65	3.80	6.50	6.75	4.35

lycopene content (2.87 mg) and lowest pH (4.55). Cluster XII had highest ascorbic acid content (56 mg). The maximum â-carotene content (3.3 mg) was observed in cluster VI and highest TSS was registered in cluster VIII (8.65%). The genotypes from the four cluster *viz.,* cluster IX (Laxmi), XI (Arka samrat), VI (S-85) and VIII (Soubaghya) can be used for future crossing programme to derive the recombinants bearing high yield coupled with neutraceutical and industrial quality traits. These hybrids can also be used to develop heterotic pool for genetic enhancement of these traits.

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