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Analysis of Genetic Divergence in Tomato (*Lycopersicon esculentum* Mill.)

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ABSTRACT

Non-hierarchical analysis conducted on 60 genotypes of tomato (*Lycopersicon esculentum* Mill.) grouped the genotypes into 10 clusters. Maximum divergence within a cluster was exhibited by the cluster VIII (1.531), closely followed by cluster III (1.528) and cluster V (1.460), whereas, cluster VIII and cluster II were the most divergent from each other followed by cluster VII and cluster VIII. Promising genotypes selected were FT-5, LBR-10-2, THS-1-1, THS-2-2, T-99-1-2 and T-99-2-3 for yield per plant, fruit size index, pericarp thickness and plant height, whereas, W 55, Campbell and EC-123018 were found to be the best for average fruit weight. However, genotypes EC-170785 and Red cherry may be used to improve the number of fruits per plant and earliness.

Key words: Cluster analysis, tomato, genetic divergence, *Lycopersicon esculentum*

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is an important vegetable crop grown worldwide. The crop has been studied extensively and a marked improvement has been achieved with respect to yield and other useful traits. Since, the success of crop improvement programme is based solely on diversity available in the breeding material. In the present studies, Non-Hierarchical Euclidean clustering approach was used to assess diversity and to select elite and divergent parents for use in further crop improvement programmes.

MATERIAL AND METHODS

The experimental material comprised of 60 genotypes of tomato collected from various sources in India. The experiment was laid out during Kharif 2005 at Dr. Y.S. Parmar University of Horticulture and Forestry, Horticultural Research Station, Kandaghat, Solan, Himachal Pradesh, situated at an altitude of 1270m above mean sea level, lying between latitude 30^0 52' North and longitude 77^0 11' East. The climate here ranges from sub-tropical to sub-temperate. Sixteen plants of each genotype were transplanted at the recommended spacing of 60cm x 45cm. Standard cultural practices were followed as to raise the tomato crop as per recommendations of the package of practices developed by the University (Anon. 2005).

Observations on plant height, days to first harvest, fruit size index, average fruit weight, number of fruits per plant and yield per plant were recorded on 10 randomly selected competitive plants from each plot. Mean values of all the traits were subjected to statistical analysis. Genetic divergence analysis was performed by using non-hierarchical Euclidean cluster analysis (Spark, 1973).

RESULTS AND DISCUSSION

Cluster analysis of data on yield and traits grouped the 60 genotypes into ten clusters. Composition of the clusters is given in Table 1. Maximum number of genotypes figured in cluster IX followed by cluster III, cluster V and cluster VII (8 genotypes in each), cluster X (7 genotypes), cluster I and cluster VI (6 genotypes), cluster II (3 genotypes) and cluster IV and cluster VIII (2 genotypes each).

Maximum intra-cluster distance (Table 2) was exhibited by cluster VIII (1.531) closely followed by cluster III (1.528) and cluster V (1.460). Higher values of intra-cluster distance indicate greater diversity among members of the cluster. The least intra-cluster distance observed in cluster X (0.983) indicated limited genetic divergence. The inter - cluster distance among different clusters shows that cluster VIII and cluster II are most divergent having maximum (7.384) inter cluster distance followed by cluster VII and cluster VIII (6.361). Similar findings have also been reported earlier by Rai *et al* (1998), Dharmatti *et al* (2001), Mohanty and Prusti (2001), Sharma and Verma (2001) and Parthasarathy and Aswath (2002). The genotypes selected

from divergent clusters may, thus, provide genetically divergent parents for hybridization programmes and may produce heterotic F_1s or transgressive segregants in later generations.

Cluster means for yield and horticultural traits in tomato (Table 3) revealed that maximum number of fruits per plant (75.28) were obtained in cluster VIII, whereas genotypes of cluster VI gave the highest yield per plant (2.38 Kg), fruit size index (34.58 cm^2), pericarp thickness (8.03 mm) and plant height (200.44 cm). Cluster VII showed the minimum number of days (46 days) to achieve marketable maturity. The genotypes may, thus, be selected from these clusters to improve a particular trait.

Genotypes FT-5, LBR-10-2, THS-1-1, THS-2-2, T-99-1-2 and T-99-2-3 were found to be promising with respect to yield per plant; fruit size index, pericarp thickness and

Table 1. Composition of clusters in tomato

Cluster	Number of genotypes	Genotype
I	6	EC 122911, EC 177862, LE 580, LE 590, LE 598, DVRT-2
II	3	W 55, Compbell, EC 123018
III	8	Rutger, IIHR-1278, EC 122171, EC 368860, EC 126255, EC 353830, EC 143540, Ageta
IV	2	IIHR-1200, IIHR-1260
V	8	Solan Gola, Lalmani, Sioux, Sel 147, Pusa Ruby, EC 130031, EC 126762, HS 88
VI	6	FT-5, LBR-10-2, THS-1-1, THS-2-2, T 99-1-2, T 99-2-3
VII	8	Roma, Russel, Chiku, LE 581, LE 258, LE 259, LE 260, LE 600
VIII	2	EC 170785, Red Cherry
IX	10	Beefsteak, Marglobe, Solan Surkha, Sel 231, A 2, AI-11, LBR-12-1, LBR_14-1, LBR-8-2, UC 82 B
X	7	Marathan, IIHR-I246, EC 546280, EC 141830, EC 143590, JTL, Hawaii 7998

Table 2. Intra - and inter - cluster distance in tomato

Cluster	I	II	III	IV	V	VI	VII	VIII	IX	X
I	**1.305**									
II	3.171	**0.994**								
III	2.460	3.825	**1.528**							
IV	3.006	2.893	3.870	**1.031**						
V	2.681	3.522	2.064	4.583	**1.460**					
VI	3.071	4.174	4.679	4.588	3.506	**1.212**				
VII	2.902	4.528	3.421	5.337	3.490	4.631	**0.902**			
VIII	4.804	7.384	4.452	6.196	5.249	6.260	6.361	**1.531**		
IX	1.878	2.984	2.500	4.006	1.494	2.655	2.665	5.715	**1.124**	
X	2.650	3.805	2.536	3.330	2.412	3.225	4.831	4.450	2.619	**0.983**

Table 3. Cluster means for various characters in tomato

Cluster	Number of fruits per plant	Yield per plant (Kg)	Average fruit weight (g)	Fruit size index (cm^2)	Pericarp thickness (mm)	Plant height (cm)	Days taken to first harvest
I	34.09	2.11	62.98	23.20	4.84	152.04	58.17
II	16.02	1.76	110.86	29.59	3.08	167.67	66.67
III	26.09	1.16	48.42	20.32	2.96	144.82	60.38
IV	24.28	2.31	95.12	12.87	2.00	170.67	75.50
V	26.11	1.22	49.63	33.25	4.23	165.34	67.75
VI	36.63	2.38	64.65	34.58	8.03	200.44	81.67
VII	26.77	1.59	59.79	27.99	7.97	66.91	46.00
VIII	75.28	1.28	17.98	13.46	1.91	163.50	69.00
IX	25.62	1.60	63.35	30.92	6.36	154.33	66.00
X	31.84	1.62	51.48	22.32	3.54	204.17	83.71

Table 4. Promising genotypes for various traits

Character	Promising genotypes identified
Number of fruits per plant	EC 170785, Red Cherry
Yield per plant (Kg)	FT-5, LBR-10-2, THS-1-1, THS-2-2, T 99-1-2, T 99-2-3
Average fruit weight (g)	W 55, Compbell, EC 123018
Fruit size index (cm^2)	FT-5, LBR-10-2, THS-1-1, THS-2-2, T 99-1-2, T 99-2-3
Pericarp thickness (mm)	FT-5, LBR-10-2, THS-1-1, THS-2-2, T 99-1-2, T 99-2-3
Plant height (cm)	FT-5, LBR-10-2, THS-1-1, THS-2-2, T 99-1-2, T 99-2-3
Days taken to first harvest	Roma, Russel, Chiku, LE 581, LE 258, LE 259, LE 260, LE 600

plant height, whereas W 55, Campbell and EC-123018 were found to be the best for average fruit weight. However, genotypes EC-170785 and Red cherry may be used to improve the number of fruits per plant and earliness (Table 4).

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