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ASSESSMENT OF GENETIC VARIABILITY IN ELITE GERMPLASM OF TOMATO

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Abstract

Fifteen genotypes of tomato were evaluated in randomized complete block design for fruit yield and yield contributing Observations were recorded for important fruit and agronomic traits *viz.,* Number of clusters/plants, Number of flower/ cluster, Number of fruits per plant, fruit yield per plant (g), fruit length (cm), fruit width (cm), average fruit weight (kg), plant height, number of primary branches in a plant, days to 50% flowering, days taken to first harvest and days taken to last harvest. Relatively high magnitude of significant variation was observed for all characters. Phenotypic coefficient of variance were higher than genotypic coefficient of variance except days to last harvest. Most of the characters shown high percentage of PCV and GCV. Genetic advance as expressed as percentage of mean was observed high for all the characters except days to 50% flowering, days to last harvest. Fruit yield/plant exhibited significant positive correlation with fruit length, fruit diameter, fruits/plant, days to last harvesting, days to last harvesting at genotypic and phenotypic levels. Path coefficient analysis also indicates that fruits/plant had a higher positive direct effect on fruit yield/plant followed by days to first harvesting, average fruit weight, number of flowers/plant, days to 50% flowering, days to last harvest, fruit diameter, number of primary branches and number of clusters/plant. Traits like fruit length, plant height, showed a negative direct effect on a yield/plant.

Key words: Tomato, Path analysis, Variability, Heritability, GCV, PCV.

Introduction

Tomato (*Solanum lycopersicum* L.) is second largest vegetable crop after potato and tops in canned vegetables. It fits well in different cropping systems of cereals, pulses and oilseeds. Tomato crop is grown in different months in different regions of the country which helps in constant availability in the market. It eaten directly as raw vegetable or consumed in a variety of processed products like ketchup, sauce, chutney, juice, diced, soup, paste, puree etc. It is a rich source of vitamin A and C, minerals (iron, phosphorus). Furthermore, tomato is also a good source of antioxidants like lycopene and beta-carotene. The shape, size and colour of tomato decide their market value. The lycopene content in tomato fruit is mainly correlated with the colour of tomato fruit. Production of hybrid cultivars are now playing a very vital role in a crop improvement and helps farmers to improve profits. The successful development is of good hybrids is possible by selection of superior lines for breeding programme. Therefore, assessment of germplasm and correlation between different traits is foremost for the direct and indirect effect of them in addition, Path analysis measures direct/indirect effects, thus providing an understanding of the direct/indirect contribution of each character towards fruit yield.

Materials and Methods

The present study is conducting at the Research Farm, Department of Genetics and Plant breeding, School of Agriculture, Lovely Professional University, Punjab 2017-18. Fifteen diverse Genotypes were used for this investigation by planting them in a RCBD. The data was recorded in for important fruit, and agronomic traits *viz.,* Yield/Plant, Fruit Length, Fruit Diameter, Average Fruit Weight, Fruits/Plant, Number of Clusters/Plant, Primary Branches, Plant Height (cm), Number of Flowers/plant, Days to 50% flowering, Days to First Harvesting and Days to Last Harvesting. Statistical analysis done for all the traits by using Analysis of Variance, Estimates of variability components (Range, GCV, PCV, H2b, and GA), Correlation coefficients, and Path coefficients done by using OPSTAT software (Sheoran *et al.*, 1998).

Table 1: Analysis of Variance (ANOVA).

Source d.f	Replication 2	Treatments 14	Error 28
Mean Sum of Squares			
Yield/plant	2708.26	1285156.0**	1997.76
Fruit length	0.37	3.25**	0.46
Fruit diameter	0.53	2.44**	0.15
Average fruit weight	0.14	0.35**	0.99
Fruits/plant	0.35	353.80**	1.93
Number of clusters/plant	0.67	2.48**	0.74
Primary branches	0.58	17.82**	0.27
Plant height	27.74	773.15**	6..83
Number of flowers/plant	1.09	19.70**	0.33
Days to 50% flowering	60.95	31.69**	1.43
Days to first harvesting	3.87	360.83**	1.93
Days to last harvesting	2.87	151.34**	0.86

present experiments data analysis are agreement with the findings of Dar and Sharma (2011), Jilani *et al.* (2013); Monamodi *et al.* (2013), Sunilkumar *et al.* (2016) Mitul *et al.* (2016), Kumar *et al.* (2017). The mean performance of the genotypes revealed a wider variability range for most of observed traits (Table 2) except average fruit weight (0.04681-0.07873). The variation was highest for fruit yield/plant (1845.43-3532.75) followed by plant height (47.58-93.6), fruits/plant (25.33-60), days to last harvesting (125.33-146.67), days to first harvest (94.33-126.33), days to 50% harvesting (26.67-37.67), number of flowers/plant (12.27-20.93), number of primary branches (7.47-14.67), TSS Brix% (2.08-5.30), fruit length (4.09-7.24), fruit diameter (3.94-6.61). Bhandari *et al.* (2017) also reported similar results in his paper. PCV was similar to GCV for all the characters except days to last harvest (Table 2). Thereby narrow

Table 2: Genetic parameters.

Sr. no	Characters	Range	Mean	Components of variance			GCV%	PCV%	Heritability (Broad sense %)	Genetic Advance % of mean
				σ 2 g	σ 2 p	σ 2 e				
1	Fruit yield/Plant (g)	1952.88 - 3532.75	2447.14	427719.41	1287153.76	1997.76	26.72	26.78	99.53	54.92
2	Fruit Length	4.09 - 7 .24	5.82	0.93	3.71	0.46	17.73	18.11	95.89	35.76
3	Fruit Diameter	3.94 - 6.61	5.51	0.76	2.59	0.15	16.33	16.42	98.08	33.32
4	Average Fruit Weight (kg)	0.04681 -0.07873	0.064	-0.21	1.34	0.99	16.70	16.77	99.15	34.26
5	Fruits/Plant	25.33 - 60	38.61	117.87	353.98	0.18	28.11	28.13	99.84	57.87
6	Number of Clusters /Plant	2.33 - 5.67	3.92	0.58	3.22	0.74	22.83	23.86	91.55	45.00
7	Primary Branches	7.47 - 14.67	11.43	5.85	18.09	0.27	21.15	21.65	95.46	42.58
8	Plant Height (cm)	47.58 - 93.6	69.57	255.44	779.98	6.83	22.97	23.27	97.39	46.69
9	Number of Flowers /plant	12.27 - 20.93	15.79	6.46	20.03	0.33	16.08	16.5	95.06	32.31
10	Days to 50% flowering	26.67 - 37.67	30.77	10.09	33.12	1.43	10.32	11.02	87.57	19.89
11	Days to First Harvesting	94.33 - 126.33	110.91	119.63	362.76	1.93	9.86	9.94	98.40	20.15
12	Days to Last Harvesting	125.33 -146.67	136.93	50.16	152.20	0.86	5.17	5.12	98.30	10.56

Results and Discussion

Significant mean sum of squares due to genotypes were reported for all characters (Table 1) which in turns confirms existence of sufficient genetic variability in the germplasm under study. The significantly differences among genotypes indicating diverse genetic make-up of these cultivars, thereby can be useful in identification of better gene combinations (for important traits) as well as their utilization in development of future cultivars, The differences between GCV and PCV confirmed the small effect of environment as the data generated in three replications. It further confirmed the predominant influence of genetic components over phenotypic expression of the characters studied. Thereby effective selection is possible on the basis of their phenotypic expressions. The findings are in agreement with Ramzan *et al.* (2014). High genetic advance coupled with high heritability indicates additive gene action would be more

Table 3a: Genotypic and phenotypic correlation coefficient for fruit and agronomic traits.

Traits		yield/plant	Fruit length	Fruit diameter	Average fruit weight	Fruits/plant
Fruit length	rg	0.367*				
	rp	0.360*				
Fruit diameter	rg	0.365*	0.992**			
	rp	0.359*	0.963**			
Average fruit weight	rg	0.146NS	-0.176NS	-0.171NS		
	rp	0.150NS	-0.174NS	-0.172NS		
Fruits/plant	rg	0.821**	0.473**	0.461**	-0.435**	
	rp	0.820**	0.465**	0.458**	-0.433**	
Number of clusters/plant	rg	-0.116NS	-0.606NS	-0.017NS	-0.294NS	0.043NS
	rp	-0.110NS	-0.028NS	-0.013NS	-0.282NS	0.042NS

Table 3b: Genotypic and phenotypic correlation coefficient for fruit and agronomic traits

Traits		Yield/plant	Primary branches	Plant height	No. of flowers/ plant	Days to 50% flowering	Days to first harvesting
Primary branches	rg	0.261NS					
	rp	0.255NS					
Plant height	rg	0.044NS	0.004NS				
	rp	0.041NS	0.00NS				
Number of flowers/plant	rg	0.201NS	-0.303*	0.455**			
	rp	0.193NS	-0.283NS	0.436**			
Days to 50% flowering	rg	0.188NS	0.071NS	0.160NS	0.343*		
	rp	0.179NS	0.075NS	0.135NS	0.308*		
Days to first harvesting	rg	0.445**	-0.098NS	0.289NS	0.033NS	-0.320*	
	rp	0.441**	-0.090NS	0.290NS	0.037NS	-0.295*	
Days to last harvesting	rg	0.398**	0.181NS	0.208NS	-0.048NS	0.384**	0.387**
	rp	0.392**	-0.176NS	0.196NS	-0.059NS	0.350*	0.379*

Table 4a: Path matrix for yield/plant (fruit and agronomic traits)

Traits	Indirect effect via					Direct effect
	Fruit length	Fruit diameter	Average fruit weight	Fruits/ plant	No. of clusters/plant	
Fruit length		0.05812	-0.10935	0.51756	-0.00052	-0.106
Fruit diameter	-0.10223		-0.10808	0.50943	-0.00025	0.06038
Average fruit weight	0.01848	-0.01038		-0.48175	-0.00517	0.62846
Fruits/plant	-0.04939	0.02764	-0.27206		0.00076	1.11287
Number of clusters/plant	0.003	-0.00081	-0.17705	0.04619		0.01834

Table 4b: Path matrix for yield/plant (fruit and agronomic traits)

Traits	Indirect effect via						Direct effects
	Primary branches	Plant height	No. of flowers/plant	Days to 50% flowering	Days to first harvesting	Days to last harvesting	
Primary branches		-0.00139	-0.11284	0.01893	-0.06188	0.01261	0.04058
Plant height	0.00156		0.16175	0.04247	0.18355	0.01451	-0.3601
Number of flowers/plant	-0.12306	-0.15652		0.09098	0.02105	-0.00335	0.37207
Days to 50% flowering	0.02896	-0.05765	0.12761		-0.20315	0.02676	0.26526
Days to first harvesting	-0.03957	-0.10415	0.01234	-0.08493		0.02697	0.63451
Days to last harvesting	0.07349	-0.07503	-0.01787	0.10194	0.24571		0.06964

important for these characters (Table 2). By this means improvement would be more effective if thorough selection done in the present material under evaluation.

Fruit yield/plant exhibited significant and positive correlation (for both genotypic and phenotypic levels) with fruit length, fruit diameter, fruits/plant, days to last harvesting, days to last harvesting at genotypic and phenotypic levels indicating that these characters are the primary yield determinants in Tomato (Table 3). Results are similar to the reports of Singh *et al.* (1990), kadam *et al.* (1992), sooriantha *et al.* (1994), mehta (2008), Islam *et al.* (2010), Kaushik *et al.* (2011). Path coefficient analysis revealed higher positive direct effects on yield/ plant for most of the characters studied in our investigation (Table 4). Asati *et al.* (2008), Mahapatra *et al.* (2013), Monamodi *et al.* (2013), and Iqbal *et al.* (2014) also reported similar path coefficients analysis in their research findings.

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