



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2019; 7(3): 261-263

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Received: 08-03-2019

Accepted: 12-04-2019

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Extent of genetic variability, heritability genetic advance for quantitative traits in tomato (*Solanum lycopersicon* [mill.]Wettd.)

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Abstract

The present investigation was carried out to evaluate 47 genotypes with 3 check varieties in respect of genetic variability, heritability and genetic advance for twelve yield contributing traits. Analysis of variance revealed, moderate to high level of genetic variability among different genotypes for all yield contributing traits. In general the value of phenotypic coefficient of variation (PCV) was higher than their respective genotypic coefficient of variation (GCV), but the extent was quite low. This indicates that there is very less environmental influence on the expression of characters. High value of GCV was recorded for the characters such as number of fruit per plant (53.15), unmarketable fruit yield per plant (46.93), average fruit weight (38.67), marketable fruit yield per plant (35.73), total fruit yield per plant (35.33). While low magnitude of coefficient of variability was exhibited by total soluble solid (6.19) and days to 50 per cent flowering (8.70).

Keywords: Genetic variability, Gcv, Pcv, heritability (h^2), genetic advance, tomato (*Solanum lycopersicon* [mill.] Wettd.)

Introduction

Tomato (*Solanum lycopersicon* [Mill.] Wettd.) belongs to Solanaceae family and the genus *Solanum*. It is a herbaceous annual to perennial in nature and sexually propagated crop plant with perfect flowers. It is a day neutral plant and mainly self-pollinated but a certain percentage of cross-pollination also occurs. It is a warm season crop reasonably resistant to heat, drought and grows under wide range of soil and climatic conditions. It is widely cultivated vegetable throughout the world and ranks second in importance after potato in many countries including India. In India, total area was 0.808 million hectares with production 19.69 million tonnes and there productivity 24.4 tonnes per hectare (Anonymous, 2016) [1].

There are four to eight flowers in each compound inflorescence. Anthesis occurs from 7:00-8:00AM and dehiscence from 9:00-11:00AM. All the species of tomato are native to western South America (Rick, 1976) [1]. Growth habit ranged from strongly determinate (bushy type) to indeterminate types.

Tomato is considered as "Poor man's Orange" and universally treated as 'Protective Food'. Tomato fruits are eaten raw or cooked. Tomato in large quantities is used for the preparation of several processed items like soup, juice, ketchup, puree, paste, powder and ripen fruits are used as raw vegetable in salad. Tomato is a good appetizer and its soup is said to be a good remedy for patients suffering from constipation.

Genetic variability and its inheritance pattern is paramount significant in challenging out strategy for effective crop improvement in terms of selection response. Keeping in view the present study was under taken to find out the presence of variability, pattern of heritability and to judge the genetic advance under selection.

Materials and Methods

The experiment was conducted with 47 genotypes including 3 checks viz. Arka vikas, NDT-7 and DBRT-2-1 in Randomized Block Design with three replications at Main Experimental Station of Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Ayodhya, Uttar Pradesh, India. The observations were recorded on yield and its attributing traits.

The recorded data was subjected for the estimation of analysis of variance for the design of experiment as suggested by (Panse and Sukhatme, 1967) [5]. Estimation of genotypic and phenotypic coefficients of variation, heritability and genetic advance given by Burton and de Vane, (1953) [5]. And expected genetic advance in per cent of mean as per method suggested by Johnson *et al.* (1955) [5].

Results and conclusion

The mean sum of squares due to genotypes were highly significant for all the characters (Table- 1), indicating that there were significant variations among the genotypes with respect to the characters under study. In other words, the performance of all the genotypes with respect to characters studied were different. The result indicating the better chance of selection in the available tomato genotype.

The result of variability, heritability and genetic advance in per cent of mean in tomato germplasm has been presented in (table 2).

The estimate of phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the characters. Highest phenotypic coefficient of variation was observed in number of fruit per plant (53.68), unmarketable fruit yield per plant (48.58), average fruit

weight (38.77), marketable fruit yield per plant (36.89) and total fruit yield per plant (36.26). Moderate variations were recorded for number of fruit per cluster (21.55), plant height (18.45), equatorial diameter of fruit (17.66), primary branches per plant (16.64) and polar diameter of fruit (15.95). While, high estimate of genotypic coefficient of variation were observed in case of number of fruit per plant (53.15), unmarketable fruit yield per plant (46.93), average fruit weight (38.67), marketable fruit yield per plant (35.73), total fruit yield per plant (35.33). Moderate variations were recorded for number of fruit per cluster (21.13) and plant height (18.32). The high estimates of PCV and GCV for these characters were also reported by Dar and Sharma (2011) [3], Rani and Anitha (2011) [3], and Rai *et al.* (2016) [3].

The high heritability (98.03) coupled with high genetic advance in per cent of mean (108.41) was observed for number of fruits per plant indicating the ample scope of improvement by selection in these traits. Similar findings have also been reported by Sahanur *et al.* (2012) [10], and Reddy *et al.* (2013) [10].

Thus, it could be concluded that there exist of ample variation among the genotypes under study which reflects the great opportunity of improvement following selection in available germplasms of tomato.

Table 1: Analysis of variance (mean squares) for twelve quantitative characters in tomato germplasm

S. No.	Characters	Source of variation		
		Replication	Treatment	Error
	Degree of freedom	2	49	98
1.	Days to 50% flowering	0.186	25.323**	1.928
2.	Plant height (cm)	6.334	427.591**	2.065
3.	Primary branches per plant	0.113	4.241**	0.070
4.	Polar diameter of fruit (cm)	0.013	2.022**	0.008
5.	Equatorial diameter of fruit (cm)	0.003	2.758**	0.016
6.	TSS (⁰ Brix)	0.072	0.578**	0.126
7.	Number of fruits per cluster	0.024	1.764**	0.023
8.	Average fruit weight (g)	3.194	2225.79**	4.004
9.	Number of fruit per plant	2.055	176.590**	1.175
10.	Marketable fruit yield per plant (g)	14657.360	255306.450**	5488.498
11.	Unmarketable fruit yield per plant (g)	68.456	4865.142**	113.412
12.	Fruit yield per plant (g)	14036.320	303548.623**	5334.598

*Significant at 5 per cent probability level, **Significant at 1 per cent probability level

Table 2: Estimates of range, mean, phenotypic (PCV), genotypic (GCV), heritability in broad sense, genetic advance (Ga) and genetic advance (in per cent of mean) for twelve characters in tomato germplasm

S. No.	Genetic parameters Characters	Range		mean	PCV (%)	GCV (%)	Heritability in broad sense (h ² bs) (%)	Genetic advance (Ga)	Genetic advance in per cent of mean (Ga)
		Lowest	Highest						
1.	Days to 50 per cent flowering	22.33	37.00	32.07	9.72	8.70	80.18	5.15	16.06
2.	Plant height (cm)	39.66	97.16	64.98	18.45	18.32	98.56	24.35	37.48
3.	Primary branches per plant	4.66	9.53	7.26	16.64	16.23	95.16	2.36	32.63
4.	Polar diameter of fruit (cm)	3.66	7.30	5.16	15.94	15.84	98.79	1.67	32.45
5.	Equatorial diameter of fruit (cm)	3.99	8.28	5.46	17.66	17.50	98.02	1.95	35.73
6.	Total soluble solids (⁰ Brix)	5.55	7.40	6.26	8.40	6.19	54.40	0.58	9.41
7.	Number of fruits per cluster	1.43	5.50	3.60	21.55	21.13	96.08	1.53	42.66
8.	Average fruit weight (g)	29.45	142.28	70.36	38.77	38.67	99.46	55.90	79.45
9.	Number of fruits per plant	4.66	40.71	14.38	53.68	53.15	98.03	15.59	108.41
10.	Marketable fruit yield per plant (g)	388.44	1531.66	807.51	36.89	35.73	93.83	575.78	71.03
11.	Unmarketable fruit yield per plant(g)	31.53	260.00	84.80	48.58	46.93	93.32	79.19	93.39
12.	Total fruit yield per plant (g)	428.88	1705.00	892.32	36.26	35.33	94.91	632.73	70.90

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