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Sunanda Khuntia
Department of Vegetable Crops, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

V Premalakshmi
Assistant Professor, Directorate of open and distance learning, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

P Irene Vethamoni
Professor, Department of Vegetable Crops, Horticulture College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Correspondence
Sunanda Khuntia
Department of Vegetable Crops, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Studies on genetic variability, heritability and genetic advance for yield and quality traits in tomato (*Solanum lycopersicum* L.) under poly house

Sunanda Khuntia, V Premalakshmi and P Irene Vethamoni

Abstract
The genetic parameters were studied to elucidate the genetic variability, heritability and genetic advance in tomato (*Solanum lycopersicum* L.). Evaluation of fifty one genotypes of tomato was done in augmented block design due to limited germplasm. The genotypes exhibited a wide range of variability for all the characters studied. Phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the characters studied. High heritability combined with high genetic advance was observed for the characters plant height, number of fruits per cluster, number of fruits per plant, fruit setting percentage, individual fruit weight, number of harvest, yield for plant, fruit firmness, flesh thickness, number of locules per fruit, shelf life, lycopene and β-carotene. High heritability combined with high genetic advance indicates that additive gene action plays a major role in governing these traits and these traits can be improved by simple selection.

Keywords: Genetic parameters, PCV, GCV, heritability and genetic advance

Introduction
In terms of human health, tomato fruit provide significant quantities of betacarotene, a provitamin-A carotenoid and ascorbic acid. Lycopene is the major carotenoid in tomato fruit, is a powerful anti-oxidant and is associated with reduced risk of certain cancers, heart diseases and age-related diseases (Heber and Lu, 2002) [2]. The magnitude of variability and its genetic components are the most important aspects of breeding material. Hence, basic understanding of the genetic variability is a pre requisite for the planning of breeding programme. So, a knowledge of the genetic variability and is components being very useful in designing selection procedure to any variable population.

Materials and Methods
The experiment has been carried out at Department of vegetable crops, Tamil Nadu Agricultural University (TNAU), Coimbatore with fifty one tomato genotypes collected from different parts of India. The experiment was laid out in randomized block design with two replication. The analysis is done using the GENERES Software.

Result and Discussion
High phenotypic and genotypic coefficients of variation were observed for plant height (36.60 and 35.98%), number of fruits per cluster (34.39 and 31.09 %), number of fruits per plant (48.97 and 44.91%), fruit setting percentage (28.70 and 24.07%), individual fruit weight (76.76 and 74.83%), number of harvest (31.08 and 26.24%), yield per plant (84.36 and 72.75%), fruit firmness (55.53 and 53.51%), fruit flesh thickness (77.80 and 77.72 %), number of locules per fruit (33.23 and 33.23 %), shape index (61.18 and 46.12 %), shelf life (30.82 and 26.76%), physiological loss in weight (23.94 and 17.67%)), ascorbic acid (31.29 and 19.75%), acidity (90.06 and 67.99%), lycopene content (74.13 and 66.76%) and beta-carotene content (75.21 and 67.28%) (Table 1). Whereas low phenotypic and genotypic coefficient of variation were observed for TSS (total soluble solids) (6.13 and 5.66%). Phenotypic coefficient of variation was highest as compared to genotypic coefficient of variation for all the characters in fifty one genotypes under study. Even though PCV was more than GCV but the differences were narrow suggesting that, there was a less influence of environment on these characters. This result were in accordance with Hosamani (2010) [3] for plant height, fruits per cluster, fruits per plant, locules per fruit, TSS, fruit length and width, Islam *et al.* (2012) [4]

for weight of fruit, number of fruits per plant, number of clusters per plant, fruit breadth and total soluble solids and Shankar *et al.* (2013) [6] for plant height, number of fruits per cluster, average fruit weight, yield per plant, titrable acidity, ascorbic acid and lycopene content.

Higher values of heritability (>60) has been observed for fruit flesh thickness (99.79%), plant height (96.66%), individual fruit weight (95.04%), number of locules per fruit (95.02%), fruit firmness (92.86%), TSS (total soluble solid 85.41%), number of fruits per plant (84.12%), number of fruits per cluster (81.72%), lycopene content (81.11%), beta-carotene content (80.02%), shelf life (75.38%),yield per plant (74.37%), number of harvest (71.27%), fruit setting percentage (70.33%) and days to first flowering (63.61%). Moderate values of heritability (30-60) has been observed for acidity (56.99%), shape index (56.82%), physiological loss in weight (54.47%), ascorbic acid (39.84%) and number of flowers per truss (36.48%) (Table 1) indicated that environmental factors constituted a major portion of total phenotypic variation and selection for these character would be less effective.

High genetic gain (>20%) was observed for fruit flesh thickness (159.95 %) followed by individual fruit weight (150.28 %), yield per plant (129.24%), β-carotene content (123.98%), lycopene content (123.86%), fruit firmness (106.23%), acidity (105.74%), number of fruits per plant (84.86%), plant height (72.00%), shape index (71.61%), number of locules per fruit (64.58%), number of fruits per cluster (57.89%), shelf life (47.86%) number of harvest (45.64%), fruit setting percentage (41.59%) physiological loss in weight (26.86%) and ascorbic acid (25.68%). Whereas, days to first flowering (16.01%), number of flowers per truss (15.39%) and TSS (total soluble solid) (10.78%) showed moderate estimate of genetic advance as per cent of mean (Table 1).

Highest estimate of heritability accompanied with high genetic advance were found in plant height, number of fruits per cluster, number of fruits per plant, fruit setting percentage, individual fruit weight, number of harvest, yield for plant, fruit firmness, flesh thickness, number of locules per fruit, shelf life, lycopene and β-carotene which suggested the suitability of the characters for phenotypic selection. High heritability along with low genetic advance was recorded in days to first flowering and TSS which might be due to low phenotypic variance for these characters. Nevertheless, they could be improved by development of hybrid varieties or utilization of transgressive segregants in heterosis breeding programme. The results are in accordance with Rahman *et al.* (2012) [5] for primary and secondary branches, plant height, fruits per plant, fruit length, fruit diameter and fruit weight, Singh (2009) [7] for plant height and Ghosh *et al.* (2010) [1] fruit yield per plant, fruit clusters per plant, number of fruits per plant, individual fruit weight and yield per plant.

Table 1: Mean, coefficient of variation (GCV and PCV), heritability and genetic advance for various characters in tomato

S. No	Characters	Grand mean	Coefficient of variation (%)		Heritability (%)	Genetic advance as % of mean
			GCV	PCV		
1	Plant height	266.00	35.99	36.61	96.66	72.89
2	Days to first flowering	33.84	9.75	12.22	63.61	16.01
3	Number of flowers per truss	5.50	12.38	20.49	36.48	15.39
4	Number of fruits cluster	3.46	31.09	34.39	81.72	57.89
5	Number of fruits per plant	19.03	44.92	48.97	84.12	84.86
6	Fruit setting percentage	62.78	24.08	28.71	70.33	41.59
7	Individual fruit weight	33.00	74.83	76.76	95.04	150.28
8	Number of harvest	2.62	26.25	31.09	71.27	45.64
9	Yield per plant	0.87	72.76	84.37	74.37	129.25
10	Fruit firmness	1.01	53.51	55.53	92.86	106.23
11	Flesh thickness	4.75	77.73	77.81	99.79	159.95
12	Number of locules per fruit	2.90	33.63	34.50	95.02	64.58
13	Shape index	1.31	46.12	61.19	56.82	71.61
14	Shelf life	9.82	26.76	30.82	75.38	47.86
15	Physiological loss in weight	9.83	17.67	23.94	54.47	26.86
16	TSS	8.63	5.67	6.13	85.41	10.79
17	Ascorbic acid	32.13	19.75	31.30	39.84	25.68
18	Acidity	0.17	67.99	90.06	56.99	105.74
19	Lycopene	2.20	66.77	74.14	81.11	123.87
20	β-carotene	1.86	67.28	75.22	80.02	123.99

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