Eco. Env. & Cons. 29 (April Suppl. Issue) : 2023; pp. (S100-S103)
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ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i02s.019

Genetic variability studies in F_2 segregating population of indeterminate tomato (*Solanum lycopersicum* L.) genotypes under protected conditions

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(Received 10 September, 2022; Accepted 4 November, 2022)

ABSTRACT

A field study under protected conditions was conducted to assess genetic variability for yield and yield attributes in an F_2 segregating population of tomato cross EC521069× EC362941. The experiment was carried out during 2021–2022 at the College of Horticulture, Mudigere, in an augmented block design. Analysis of variance showed highly significant differences among the traits. High values of PCV and GCV were registered for number of fruits per plant, fruit yield per plant, fruit volume and average fruit weight. Estimates of high heritability coupled with high genetic advance as per cent over mean recorded for plant height, number of flowers per cluster, days taken from first harvest to last harvest, fruits per cluster, fruits per plant, fruit yield per plant, fruit length, fruit diameter, fruit volume, average fruit weight and pericarp thickness which supports the notion that selection could actually improve these traits by highlighting the significance of additive gene action.

***Key words**: Tomato, Genetic variability, Heritability, Genetic advance*

Introduction

Tomato (*Solanum lycopersicum* L.) is one of the most important vegetables, belonging to the family Solanaceae. It was introduced to India in the 17th century by Europeans and native being South America where it was diversified first in Mexico-Peru-Equador region. Today it has become part and parcel of Indian food. Tomato is consumed in both fresh and processed form. Nutritionally, it is considered as 'protective food,' and it is a significant dietary source of antioxidants like lycopene, β-carotene, ascorbic acid, folic acid, phenolic acids and flavonoids. The improvement in any crop is proportional to the magnitude of its genetic variability present in the germplasm (Dhankhar and Dhankhar, 2002). Yield, is a complex trait influenced by various yield attributing plant characters, hence direct selection for yield is often misleading. Therefore, knowledge about inter-relationship between pairs of these characters and with yield is essential to bring a rational improvement in the desirable traits.

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Materials and Methods

The present research work was carried out at experimental block of Department of Vegetable Science, College of Horticulture, Mudigere, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga. The experiment was laid out in augmented block design during *Rabi* 2021 under protected conditions. The experimental material for the study comprises of 200 F_2 plants derived from the bi-parental cross EC521069× EC362941 along with their parents, F_1 hybrids and four checks *viz*., Arka Vikas, Kashi Vishesh, Pusa Ruby, Marglobe and were evaluated for different growth and yield components. Data was recorded on all the F_2 plants, ten randomly selected plants in each of the checks, parents and F_1 hybrids. Phenotypic Coefficient of variation (PCV) and genotypic coefficient of variation was calculated as per the formula suggested by Burton and Devane (1953). Heritability (broad sense) and genetic advance was estimated using the formula given by Johnson *et al*. (1955).

Results and Discussion

Genetic parameters

The genetic factors *viz*., range, mean, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability (h^2), genetic advance (GA) and genetic advance as per cent mean (GAM) were calculated and are presented in the Table 1.

Variability and genetic components of variation for growth and flowering characteristics are briefly discussed below in F_2 segregating population of tomato cross EC512069 × EC362941.

High values of PCV and GCV (>20 %) were registered for number of fruits per plant, fruit yield per plant, fruit volume and average fruit weight indicating wider variation in the population and less environmental influence on the expression of traits. These results are in agreement with the findings of Pooja *et al.* (2022).

The moderate PCV and GCV (10 were recorded for plant height, number of primary branches per plant, number of secondary

Table 1. Estimates of genetic parameters for growth, flowering and yield parameters in F_2 segregating population of tomato cross EC521069× EC362941

Sl. No.	Characters	Mean	Range		GV	PV	GCV (%)	PCV (%)	h^2(%)	GA	GAM (%)
			Min.	Max.							
1.	Plant height (cm)	192.23	122	268	620.23	669.13	12.96	13.46	92.69	49.39	25.69
2.	Number of primary branches per plant	6.63	4.0	9.0	0.78	1.34	13.29	17.42	58.21	1.39	20.89
3.	Number of secondary branches per plant	19.28	11.0	29.0	4.40	11.30	10.88	17.43	38.93	2.70	13.98
4.	Days to first flowering	32.45	26.0	40.0	10.89	12.56	10.17	10.92	86.73	6.33	19.51
5.	Number of flowers per cluster	5.06	3.0	8.0	0.77	1.09	17.29	20.64	70.20	1.51	29.85
6.	Number of fruits per cluster	3.97	2.0	8.0	0.61	0.94	19.63	24.30	65.26	1.3	32.67
7.	Number of fruit clusters per plant	20.22	12.0	33.0	7.58	15.46	13.61	19.44	49.05	3.97	19.64
8.	Days taken from first harvest to last harvest	53.45	16.0	81.0	84.42	101.46	17.19	18.85	83.20	17.26	32.30
9.	Days taken for first harvest	67.34	58	85	28.20	30.27	7.89	8.17	93.15	10.56	15.68
10.	Number of fruits per plant	27.73	8.0	62.0	98.33	100.90	35.75	36.22	97.45	20.17	72.71
11.	Fruit yield per plant (kg)	1.67	0.77	2.75	0.20	0.21	26.86	27.62	94.60	0.90	53.82
12.	Fruit length (cm)	3.76	1.49	5.22	0.46	0.48	18.11	18.47	96.08	1.38	36.57
13.	Fruit diameter (cm)	4.14	1.52	5.90	0.50	0.57	17.10	18.13	88.99	1.38	33.23
14.	Fruit volume (cc)	75.66	20.00	156.00	1062.28	1137.98	43.08	44.59	93.35	64.87	85.74
15.	Average fruit weight (g)	76.30	23.24	150.16	836.32	898.52	37.90	39.29	93.08	57.48	75.33
16	Pericarp thickness (mm)	5.27	3.02	7.93	0.80	1.04	16.97	19.35	76.94	1.62	30.66

GV: Genotypic variance GCV: Genotypic coefficient of variance h^2: Heritability (broad sense) GA: Genetic advance
PV: Phenotypic variance PCV: Phenotypic coefficient of variance GAM: Genetic advance as per cent of meanthickness, Anuradha *et al*. (2020) for plant height, fruit yield per plant and yield per hectare, Eppakayala *et al*. (2021) for number of flowers per cluster, days from first harvest to last harvest and fruit length, Pooja*et al*. (2022)for fruit diameter, fruit volume and number of locules per fruit.

branches per plant, days to first flowering, number of fruit clusters per plant, days taken from first harvest to last harvest, fruit length, fruit diameter and pericarp thickness, suggesting that there is wider scope for selection to improve upon these characters in the cross studied.

Similar results were also obtained by Prema (2010) for number of primary branches per plant, Basavaraj *et al.*(2015) for fruit clusters per plant, Kumar (2015) for plant height, Nitish (2014) fordays taken from first harvest to last harvest, Dar and Sharma (2011) for pericarp thickness, Ghosh *et al.*(2010) for fruit diameter and fruit length and Khanom *et al.* (2008) for days to first flowering.

The low PCV and GCV values were observed for days taken for first harvest representing lack of variability in the tested breeding materials. These results are in agreement with the report of Lakshmi *et al*. (2017).

Estimates of high heritability coupled with high genetic advance as per cent over mean recorded for plant height, number of flowers per cluster, days taken from first harvest to last harvest, fruits per cluster, fruits per plant, fruit yield per plant, fruit length, fruit diameter, fruit volume, average fruit weight and pericarp thickness. This supports the notion that selection could actually improve certain features by highlighting the significance of additive gene effects. These results are in agreement with Adhi *et al*. (2013) for plant height, number of fruits per cluster and fruit length, Patel *et al*. (2013) for fruit yield per plant and average fruit weight, Ullah *et al.* (2015) for fruits per plant and flowers per cluster, Arun *et al*. (2016) for pericarp.

Conclusion

In the F_2 segregating population of the tomato crosses EC521069× EC362941, high values of PCV and GCV were registered for fruit yield per plant, number of fruits per plant, fruit volume and average fruit weight. It indicated existence of broad geneticbase, which would be useful for further selection. Higher estimates of broad sense heritability coupled with high genetic advance as per cent over mean were recorded for most of the studied traits this indicates the role of additive gene action in the expression of these characters. Hence, simple selection method can be employed for the improvement of these characters.

Acknowledgement

The authors are thankful to the College of Horticulture, Mudigere-577 132, Karnataka, India., India for its facilities.

Conflict of interest

The authors have declared that no conflict of interest exists.

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