GENETIC VARIABILTY, HERITABILITY AND GENETIC ADVANCE IN TOMATO

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Abstract: 68 genotypes of tomato were assessed for genetic variability, heritability and genetic advance studies at Vegetable Research Farm, Department of Horticulture, Institute of Agricultural Sciences, B. H. U., Varanasi during rabi season 2009-10. All the characters studied for all the genotypes showed highly significant variation. General coefficient of variation at phenotypic level was higher in magnitude than corresponding genotypic level though the differences were not much in all the cases. Maximum PCV (49.55) and GCV (47.30) were registered for shelf life while days to 50% flowering had the lowest PCV (8.66) and GCV (7.40). The range of heritability was observed between 73.10 to 99.60 %. Highest value of heritability 99.60 was observed for fruit yield per plant and fruit yield per hectare, while it was lowest for days to 50% flowering (73.10). Highest genetic gain was recorded for shelf life followed by fruit yield per plant, fruit yield per hectare, whereas days to 50% flowering exhibited moderate genetic gain.

Keywords: Tomato, *Lycopersicon esculentum*, Variability heritability, Genetic advance

INTRODUCTION

Tomato is an herbaceous, annual to perennial, prostate and sexually propagated plant. Tomato is mainly grown for its fruits which are rich in vitamins and minerals; hence it is called as one of the most important protective foods. The success of any breeding programme depends on the availability of genetic variability present in the population, which is however not directly measurable by itself, but has to be inferred with phenotypic expression. It is a linear function of genotype (G) and environment (E) and genotype × environment (G × E) interaction effect. Association of genotypic and phenotypic coefficient of variation, heritability and genetic advance appears to be good criteria for selection in crop improvement programme. The knowledge of genetic variability that is heritable from generation to generation has great significance in breeding programme. Heritability estimates aid in determining the relative amount of heritable portion of variation. However, heritability values alone itself provide no indication of the amount of genetic progress that would result from selecting the best individuals. According to Ramanujan and Tirumalachar (9) heritability estimates in broad scene would be reliable if high genetic advance will be accompanied. Hence the present investigation was initiated to assess the high yielding genotypes, extent of genetic variability, heritability and genetic advance in diverse lines of tomato.

MATERIAL AND METHOD

The present investigation was carried out at Vegetable Research Farm, Department of Horticulture, Institute of Agricultural Sciences, B.H.U, Varanasi during 2009-10 in rabi season using Randomized Block Design with three replications in each genotype. Each genotype was sown in two rows of 3 m length at 60 × 45 cm spacing accommodating 12 plants in each replication. The experimental material consisting of 68 genotypes of tomato. All the recommended package of practices was followed for raising a healthy crop. The observations were recorded on five randomly selected plants in each genotype per replication for various characters using standard procedures. Genotypic and phenotypic coefficients of variances were calculated as per the formula given by Burton (3). Heritability in broad sense was calculated by the formula given by Burton and Devene (2) and Allard (1) Genetic advance was calculated as per Johnson *et al.* (5)

RESULT AND DISCUSSION

ANOVA revealed that all the characters studied showed highly significant differences for all the genotypes, indicating sufficient amount of variability. General coefficient of variation at phenotypic level was higher in magnitude than corresponding genotypic level though the differences were not much in all the cases. Maximum Phenotypic coefficient of variation (PCV) (49.55) and Genotypic coefficient of variation (GCV) (47.30) (Table 1) were registered for shelf life while days to 50% flowering had the lowest PCV (8.66) and GCV (7.40). High PCV and GCV were also exhibited number of locules per fruit, number of seeds per fruit and fruit yield per hectare, indicating selection for these traits will be effective. Moderate PCV and GCV were recorded for plant height, number of primary branches per plant, number of flower clusters per plant, number of fruits per plant, fruit length, fruit width and pericarp thickness. Similar reports were given by Pujari *et al.* (8) and Mittal *et al.* (7). The difference between PCV and GCV values were low, indicating that the traits under study were

less influenced by environment and these characters could be improved by following phenotypic selection.

Genotypic coefficient of variation represents the total genetic variation whereas heritability measures the proportion to which the variability of a character is transferred to offspring. The heritability estimates were high for all the characters studied. The range of heritability was observed between 73.10 to 99.60 %. Highest value of heritability 99.60 (Table 2) was observed for fruit yield per plant and fruit yield per hectare, while it was lowest for days to 50% flowering (73.10). High estimates of heritability for these traits were also reported by Singh and Singh (12), Sharma *et al.* (10) and Singh (11).

Highest genetic gain (Table 3) was recorded for shelf life followed by fruit yield per plant, fruit yield per hectare, number of locules per fruit, number of seeds per fruit, average fruit weight, plant height, number of flower clusters per plant, number of fruits per plant, pericarp thickness, fruit width, number of primary branches per plant and fruit length, whereas days to 50% flowering exhibited moderate genetic gain. Similar kind of results was observed by Mehta and Asati (6) and Singh *et al.* (13).

Heritability being a single numerical expression on the ratio of two variances, it may not lead to success if selection is based on heritability estimates alone. Therefore, high heritability coupled with high GCV and genetic gain was more valuable in predicting the selection. High heritability coupled with high GCV and genetic gain were observed for shelf life, plant height, number of branches per plant, number of flower clusters per plant, number of fruits per plant, pericarp thickness, number of locules per fruit, average fruit weight, number of seeds per fruit, fruit yield per plant and fruit yield per hectare which might be assigned to additive gene action conditioning their expression and phenotypic selection for their amelioration could be brought about by simple methods.

Table 1. Range, mean, genotypic and phenotypic coefficient of variation (GCV and PCV), heritability (HA) and genetic advance (GA) for 14 characters in 68 genotypes of tomato

S. No.	Character	Mean Sum of Squares	Range	Grand mean	GCV	PCV	HA (%)	GA	Genetic Gain (%)
1	**Days to 50% Flowering**	18.00**	23.00-38.00	31.24	7.40	8.66	73.10	4.07	13.02
2	**Plant Height (cm)**	1493.16**	51.23-129.40	83.06	26.91	27.04	99.00	45.66	54.97
3	**No. of primary Branches per plant**	11.14**	4.60-15.03	8.64	21.14	24.45	74.70	3.25	37.61
4	**No. of flower Clusters per plant**	18.07**	5.40-17.73	8.86	26.68	29.60	81.30	4.39	49.54
5	**No. of fruits Per plant**	131.44**	11.57-47.11	27.59	23.74	24.50	93.90	13.07	47.37
6	**Fruit length (cm)**	1.38**	2.70-5.77	4.01	16.71	17.19	94.50	1.34	33.41
7	**Fruit width (cm)**	1.77**	2.35-6.08	4.05	18.83	19.27	95.50	1.54	38.02
8	**Pericarp Thickness (mm)**	0.03**	0.31-0.86	0.50	22.60	22.75	98.70	0.23	46.00
9	**No. of locules Per fruit**	4.77**	2.09-7.61	3.78	32.95	34.00	93.90	2.49	65.87
10	**Avg. fruit Weight (g)**	465.76**	21.00-78.00	41.68	29.74	30.19	97.00	25.15	60.34
11	**No. of seeds Per fruit**	5957.12**	54.77-234.29	148.93	31.37	31.45	99.50	91.47	61.41
12	**Fruit yield Per plant (kg)**	0.61**	0.35-2.67	1.14	39.54	39.62	99.60	0.93	81.57
13	**Fruit yield Per hectare (q/ha)**	84528.84**	187.98-987.49	424.22	39.54	39.63	99.60	344.78	81.27
14	**Shelf Life(days)**	56.37**	4.00-12.85	7.68	47.30	49.55	91.10	6.39	83.20

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