Plant Archives Vol. 15 No. 1, 2015 pp. 519-522 *ISSN 0972-5210*

GENETIC VARIABILITY, CHARACTER ASSOCIATION AND PATH COEFFICIENT ANALYSIS IN TOMATO (*LYCOPERSICON ESCULENTUM* MILL.) GENOTYPES

Manjai Phom, H. P. Chaturvedi[1]* and S. P. Kanaujia

Department of Horticulture, Nagaland University, SASRD, Medziphema - 797 106 (Nagaland), India.
[1]Department of Genetics and Plant Breeding, Nagaland University, SASRD, Medziphema - 797 106 (Nagaland), India.

Abstract

Genetic variability, correlation and path coefficient analysis was studied in thirteen tomato (*Lycopersicon esculentum* Mill.) genotypes for yield and its attributing characters. The analysis of variance revealed significant differences among the genotypes for all the characters studied indicating a high degree of variability in the material. The highest PCV and GCV were recorded for number of fruits, yield/plant, fresh weight, vitamin C and number of branches indicating presence of ample variation for these traits in the present material. In the present study, high estimates of heritability and genetic advance as per cent of mean were obtained for fresh weight and fruit diameter. Thus, selection of these traits is likely to accumulate more additive genes leading to further improvement of their performance and these traits may be used as selection criteria in tomato breeding program. The yield/ha exhibited significant positive correlation with plant height, number of branches, number of leaves, crop duration, fruit diameter, fresh weight and yield/ plant indicating relative utility of these traits for selection. The present study suggested that while selection, emphasis should be given on yield/ plant, number of branches, fruit diameter and crop duration for improvement of yield.

Key words : Genetic variability, correlation coefficient, path coefficient, tomato.

Introduction

Tomato (*Lycopersicon esculentum* Mill.) is one of the most important edible and nutritious vegetable crops grown in the world. It is universally treated as 'Protective Food' and provides almost all types of vitamins and minerals in fair amount. It is eaten directly as raw vegetable in sandwiches, salad etc and used in a number of ways for culinary purposes. Its ripe fruits are used in preparation of variety of processed products such as sauce, powder, ketchup, syrup, juice, drinks, puree, canned peeled tomatoes etc. Tomato consumption is believed to benefit the heart among other things etc. They contain Lycopene, one of the most powerful natural antioxidant. Lycopene has also been shown to improve the skin's ability to protect against harmful UV rays. Natural genetic variation in tomatoes and their wild relatives has given a genetic treasure trove of genes that produce lycopene, carotene, anthocyanin and other antioxidants. Red tomatoes contain energy 75 kJ, carbohydrates 4g, sugars 2.6g, dietary fiber 1g, fat 0.2g, protein 1g, water 95g, vitamin C 13mg (22%). Tomato fruits are abundantly rich in vitamins (vitamin A & C), organic acids (citric acid & maleic acid), minerals etc. It is a very good appetizer and has many medicinal values. There is emerging epidemiology data supporting the connection between increased tomato consumption and reduced risk for both cardio-vascular disease and prostate cancer. Nagaland is bestowed with the Agro-Climatic condition, which is suitable for all type of vegetable crop grown in the region. But due to lack of proper knowledge about the cultivars best suited in the area, the potential of tomato is not exploited and is still insufficient even to meet the demands of the people. Since tomato is a potential crop both for domestic and export purpose, it is worth for any research pertaining to its improvements. Keeping these in view, the present study was undertaken to assess the nature and magnitude of genetic variability present in different genotypes of tomato. An attempt has also been made to study the correlation and path coefficient which are helpful in selecting the desirable traits.

***Author for correspondence:** E-mail- hpchaturvedi68@gmail.com

Table 1 : Analysis of coefficient of variation, heritability, genetic advance & genetic advance as % of mean.

Character	Coefficient of variation			Heritability (h^2) in broad sense	GA as % of mean
	GCV	PCV	ECV		
Plant height	7.3018	10.9763	8.1953	0.4425	10.0063
No of branches	15.1153	23.5282	18.0307	0.4425	20.0037
No. of leaves	12.4600	20.3779	16.1247	0.3739	15.6943
Days to fruit ripening	7.8493	9.5989	5.5253	0.6687	13.2221
Crop duration	3.3323	3.5711	1.2840	0.8707	6.4054
Fruit length	9.4065	13.1678	9.2146	0.5103	13.8425
Fruit diameter	15.6085	16.7687	6.1290	0.8664	29.9289
No. of fruits	25.6097	39.7875	30.4498	0.4143	33.9570
Fresh weight	26.4058	29.3631	12.8423	0.8087	48.9175
Yield/plant	24.9198	38.5466	29.4082	0.4179	33.1873
Vitamin C	15.6980	27.4062	22.4650	0.3281	18.5227
TSS	9.3108	16.5599	13.6945	0.3161	10.7840
Yield/ha	24.9391	38.6979	29.5900	0.4153	33.1087

Materials and Methods

The present investigation was carried out in the experimental farm of Nagaland University, School of Agricultural Sciences and Rural Development, Medziphema Campus, Nagaland during September, 2013 to February; 2014. Thirteen genotypes of tomato were grown in randomized complete block design with three replications. All the recommended agronomic practices were followed for raising a good crop. Observations were recorded on five plants sampled randomly in each replication for plant height, number of branches, number of leaves, days to fruit ripening, crop duration, fruit length, fruit diameter, number of fruits, fresh weight, yield per plant, vitamin C, TSS and yield per ha. Analysis of variance was done using standard statistical procedure. Heritability (broad sense) was estimated according to Allard (1960). Genotypic and phenotypic coefficients of variation were estimated as per Burton (1952). Genetic advance as per cent of mean was estimated according to Johnson *et al*. (1955). Genotypic and phenotypic correlation coefficients for all possible comparisons were computed as per formulae suggested by Al- Jibouri *et al.* (1958). The partitioning of genotypic correlation coefficient of traits into direct and indirect effects was carried out using the procedure suggested by Dewey and Lu (1959).

Results and Discussion

The analysis of variance revealed significant differences among the genotypes for all characters studied indicating a high degree of variability in the material. The estimates of phenotypic coefficient of variation (PCV) were higher than those of genotypic coefficient of variation (GCV) for all the traits indicating environmental factors influencing the characters (table 1). The highest PCV and GCV were recorded for number of fruits, yield/plant, fresh weight, vitamin C and number of branches indicating presence of ample variation for these traits in the present material. Burton (1952) has suggested that genotypic coefficient of variation together with heritability estimates gives best option expected for selection. A fair measure of efficiency of selection for any quantitative traits can be derived from the estimates of heritability for the characters under consideration. But reliability of selection depends not only on heritability but it should also be accompanied by high genetic advance (Johnson *et al*., 1955). High heritability coupled with high genetic advance shows that a progress can be made through selection as it suggests the presence of additive gene effects (Panse, 1957). In the present study, high estimates of heritability and genetic advance were obtained for fresh weight and fruit diameter. Thus, selection for these traits is likely to accumulate more additive genes leading to further improvement of their performance and these traits may be used as selection criteria in tomato breeding program. Similar results have also been reported by Asati *et al*. (2008), Manna and Paul (2012), Mohammed *et al*. (2012) and Narolia *et al*. (2012).

To utilize various quantitative characters in breeding program, interrelationship between the characters are of immense value. Therefore, in the present study, correlations between 13 characters were studied in all possible combinations at genotypic level (table 2). The yield/ha exhibited significant positive correlation with plant height, number of branches, number of leaves, crop

Table 2 : Estimates of genotypic correlation coefficient between different characters in tomato.

Character	Plant height	No. of branches	No. of leaves	Days to fruit ripening	Crop duration	Fruit length	Fruit diam.	No. of fruits	Fresh weight	Yield/ plant	Vitamin C	TSS	Yield/ha
Plant ht.		0.314	0.752**	-0.243	0.555*	0.079	0.805**	-0.281	0.700**	0.872**	-0.022	0.107	0.876**
No. of branches			0.88**	-0.95**	-0.032	-0.548	0.101	0.407	-0.101	0.584*	0.089	-0.275	0.584*
No. of leaves				-0.411	0.338	-0.125	0.569*	-0.023	0.451	0.947**	0.227	-0.417	0.951**
Days to fruit ripening					0.079	0.630*	0.218	-0.89**	0.411	-0.226	0.350	0.159	-0.219
Crop duration						0.479	0.543	0.163	0.639*	0.717**	-0.017	0.379	0.721**
Fruit length							0.322	-0.613*	0.655*	0.139	0.707**	0.724**	0.145
Fruit diameter								-0.173	0.96**	0.61*	0.513	0.397	0.613**
No. of fruits									-0.371	-0.156	-0.361	0.360	-0.160
Fresh weight										0.738**	0.848**	0.379	0.741**
Yield/ plant											0.460	-0.170	1.000**
Vitamin C												0.156	0.463
TSS													-0.169

*Significant at 5% level **Significant at 1% level

Table 3 : Direct and indirect effect of different characters at genotypic level in tomato.

Character	Plant height	No. of branches	No. of leaves	Days to fruit ripening	Crop duration	Fruit length	Fruit diam.	No. of fruits	Fresh wt.	Yield/ plant	Vitamin	TSS	r_{sa} for yield/ha
Plant height	**-0.01502**	0.00744	-0.00136	-0.00432	0.00266	-0.00023	0.00980	0.00454	-0.01097	0.88111	0.00022	0.00175	0.876**
No. of branches	-0.00472	**0.02367**	-0.00159	-0.01627	-0.00015	0.00158	0.00123	-0.00658	0.00158	0.59090	-0.00088	-0.00450	0.584*
No. of leaves	-0.01130	0.02083	**-0.00180**	-0.00730	0.00162	0.00036	0.00693	0.00037	-0.00707	0.95759	-0.00227	-0.00683	0.951**
Days to fruit ripening	0.00366	-0.02168	0.00074	**0.01776**	0.00038	-0.00181	0.00265	0.01443	-0.00645	-0.22803	-0.00350	0.00261	-0.219
Crop duration	-0.00834	-0.00076	-0.00061	0.00141	**0.00480**	-0.00138	0.00661	-0.00263	-0.01002	0.72514	0.00017	0.00621	0.721**
Fruit length	-0.00119	-0.01296	0.00022	0.01119	0.00230	**-0.00288**	0.00391	0.00991	-0.01027	0.14040	-0.00706	0.01186	0.145
Fruit diam.	-0.01210	0.00239	-0.00103	0.00387	0.00261	-0.00093	**0.01217**	0.00279	-0.01506	0.61664	-0.00512	0.00650	0.613*
No. of fruits	0.00422	0.00964	0.00004	-0.01586	0.00078	0.00177	-0.00210	**-0.01616**	0.00581	-0.15753	0.00360	0.00589	-0.160
Fresh wt.	-0.01051	-0.00238	-0.00081	0.00730	0.00306	-0.00188	0.01168	0.00599	**-0.01569**	0.74617	-0.00847	0.00621	0.741**
Yield/plant	-0.01309	0.01383	-0.00171	-0.00401	0.00344	-0.00040	0.00742	0.00252	-0.01158	**1.01099**	-0.00460	-0.00279	1.000**
Vitamin	0.00033	0.00210	-0.00041	0.00622	-0.00008	-0.00204	0.00624	0.00583	-0.01331	0.46550	**-0.00999**	0.00255	0.463
TSS	-0.00161	-0.00650	0.00075	0.00283	0.00182	-0.00208	0.00483	-0.00581	-0.00595	-0.17215	-0.00156	**0.01638**	-0.169

duration, fruit diameter, fresh weight and yield/plant indicating relative utility of these traits for selection. Significant positive correlations were also observed between plant height and number of leaves, crop duration, fruit diameter, fresh weight & yield/ plant; Number of branches and number of leaves, days to fruit ripening & yield/ plant; Number of leaves and fruit diameter & yield/ plant; days to fruit ripening and fruit length & number of fruits; Crop duration and fresh weight & yield/ plant; Fruit length and fresh weight, Vitamin C & TSS; Fruit diameter and fresh weight & yield/ plant; Fresh weight and yield/ plant & Vitamin C. Similar results were also reported by Dhankhar and Dhankhar (2006). The path analysis (table 3) revealed that yield/plant, number of branches, fruit diameter and crop duration exerted positive direct effect and also exhibited significant positive correlation with yield/ ha indicating a true relationship between the traits. This suggested that the direct selection for yield/ plant, number of branches, fruit diameter and crop duration would likely be effective in increasing yield. The present study suggested that while selection, emphasis should be given on yield/ plant, number of branches, fruit diameter and crop duration for improvement of yield.

References

Al-Jibouri, N. A., P.A. Miller and H.F. Robin (1958). Genotypic and environmental variances, co-variances in an upland cotton cross of inter-specific origin. *Agronomy Journal,* **50** : 633-637.

Allard, R. W. (1960). *Principles of Plant Breeding*. John Wiley and Sons Inc, New York.

Asati, B. S., N. Rai and A. K. Singh (2008). Genetic parameters study for yield and quality traits in tomato. *Asian Journal of Horticulture*, **3** : 222-225.

Burton, G. W. (1952). Quantitative inheritance in grasses. Proc. 6th Int. *Grassland Cong*., **1** : 227-83.

Dewey, D. R. and K. H. Lu (1959). Correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron. J.*, **57** : 515-18.

Dhankhar, S. K. and B. S. Dhankhar (2006). Variability, heritability, correlation and path coefficient studies in tomato. *Haryana Journal of Horticultural Sciences*, **3(1-2)** : 179-181.

Johnson, H. W., H. F. Robinson and R. E. Comstock (1955). Estimates of genetic and environmental variability in soybean. *Agron. J.*, **47** : 314-18.

Manna, M. and A. Paul (2012). Studies on genetic variability and character association of fruit quality parameters in tomato. *HortFlora Research Spectrum*, **1(2)** : 110-116.

Mohammed, S. M., E. E. Ali and T Y (2012). Study of heritability and genetic variability among different plant and fruit characters of tomato (*Solanum lycopersicon* L.). *International Journal of Science and Technology Research*, **1(2)** : 55-58.

Narolia, R. K., R. V. S. K. Reddy and M. Sujatha (2012). Genetic architecture of yield and quality in tomato (*Solanum lycopersicon* L.). *Agriculture Science Digest*, **3(4)** : 281-285.

Panse, V. G. (1957). Genetics of quantitative characters in relation to plant breeding. *Indian J. Genet*., **47** : 318- 328.