CHARACTER INTER-RELATIONSHIP AND PATH CO-EFFICIENT STUDIES IN TOMATO (*Solanum lycopersicum* L.)

J. L. joshi [1], Ajish Muraleedharan[2]*, Y. Anbuselvam[1] and K. Saravanan[1]

[1]Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalai nagar, Tamil nadu, India - 608002.
[2]Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai nagar, Tamil nadu, India - 608002.

* Author for correspondence

Abstract

Inorder to observe trait inter-relationship and direct and indirect effects of growth factors on fruit yield thirty three genotypes were sown in randomized block design during 2014. In general, phenotypic correlation coefficient was lesser in magnitude than the genotypic correlation coefficient for all the traits observed. Fruit yield per plant exhibited positive correlation with number of number of flower trusses per plant, fruit length, pericarp thickness, days to first flower, average fruit weight and number of fruits per plant. In path coefficient analysis the highest positive direct effect was noted in average fruit weight, followed by number of fruits per plant, fruit length and number of flower trusses per plant. Hence, these traits should be given more weightage in selection programme of high yielding genotypes in tomato.

Keywords: tomato, correlation coefficient, path coefficient, fruit yield traits

Introduction

Tomato (*Solanum lycopersicum* L.) is a self-pollinated diploid species with twelve pairs of chromosomes (2n = 24). It belongs to the *Solanaceae* family. Tomato is a rich source of vitamins (A and C), minerals (Ca,P and Fe) and a strong antioxidant against cancer and heart diseases (Dhaliwal *et al*., 2003).

The degree and direction of relationship between two or more variables could be find out through statistical measure of correlation coefficient. It helps to measures the mutual relationship between various plant characters and determines the component characters on which selection could be made for genetic improvement of yield and quality contributing traits. Correlation coefficient alone cannot give a complete picture of the causal basis of relationship. Under such circumstances, path coefficient analysis is an effective tool (Islam and Khan, 1991 and McGiffen *et al.*, 1994).

The prime objective in this research work has been undertaken was to determine the nature of association, direct and indirect relationship between yield and yield contributing characters and relative contribution of each character towards seed yield in tomato by means of correlation and path analysis.

Materials and methods

The study was conducted at Plant breeding farm, Department of Genetics and Plant Breeding, Annamalai University, Chidambaram during 2015.The material for the present study comprised of 33 genotypes of tomato which were sown in randomized block design with three replications with row-to-row spacing of 60cm and plant-to-plant spacing of 50cm. All recommended agronomic package ofpractices were followed to grow a healthy crop.

The observations were recorded on various growth and yield parameters such as plant height (cm), days to first flowering, number of flower trusses per plant, fruit length (cm), fruit diameter (cm), pericarp thickness (mm), number of locules per fruit, average fruit weight (g), number of fruits per plant and yield per plant (kg) from 10 randomly selected plants in each replication as per standard procedure. Recorded mean values were subjected to inter-relationship studies as per the method described by AL-Jibouri *et al*., 1958. Path coefficient analysis was done following the method outlined by Dewey and Lu (1959).

Results and discussion

Trait inter-relationship studies (Table 1) revealed that the genotypic coefficient of correlation was high in magnitude than the respective phenotypic correlation coefficient in most cases suggesting the suppressive effect of environmental factors on phenotypic factors (various growth and fruit yield characters). Similar finding were observed by Nagariya *et al.*, (2015) and Salehur Rahman *et al*., (2015).

The correlation coefficient results of the present investigation on tomato germplasm revealed that the yield per plant was positively and significantly correlated with number of flower trusses per plant, fruit length, average fruit weight and number of fruits per plant at both genotypic and phenotypic levels. These observations were in accordance with the findings of Meena and Bahadur (2014) and Singh *et al.*, (2015). This indicates that fruit yield in tomato can be improved by direct selection of fruit characters like number of flower trusses per plant, fruit length, average fruit weight and number of fruits per plant.

The genotypic as well as phenotypic association of pericarp thickness showed highly significant positive correlation fruit length and fruit diameter, which is corroboration with Nagariya *et al.*, (2015) Salehur Rahman *et al*., (2015).Similarly number of fruits per plant exhibited highly significant positive correlation with number of flower trusses per plant at genotypic and phenotypic levels whereas plant height, fruit diameter and number of locules per fruit at genotypic level only. Similar observations were obtained by Rani *et al.*, (2010).

Average fruit weight showed highly significant positive correlation with fruit length, fruit diameter, pericarp thickness at both genotypic as well as phenotypic level while it has significant negative correlation with days to first flower at genotypic level, respectively. This was also confirmed by Kumar *et al.*, (2013). Number of fruit trusses per plant had highly significant positive correlation with number of fruits per plant

and yield per plant at genotypic and phenotypic level, respectively. At both levels, fruit length showed significant positive correlation with pericarp thickness, average fruit weight and yield per plant. Fruit diameter had highly significant positive correlation with pericarp thickness, number of locules per fruit and average fruit weight at genotypic and phenotypic level, respectively. Similar results were observed by Mehta and Asati (2008) and Indu Rani *et al*., (2010).

The residual effect (0.0126) on yield per plant was negligible, which suggest that most of yield contributing component was included in the present study (Table 2). The highest positive direct effect was noted in average fruit weight, followed by number of fruits per plant, fruit length, number of flowers trusses per plant which also had significant positive correlation with yield per plant. Hence, the plant with high number of fruits per plant, average fruit weight, fruit length and number of flower trusses per plant are to be considered in selection for increasing yield per plant in tomato. Overall all the characters revealed positive effect directly or indirectly on yield per plant, which is corroboration with finding of Kumar and Dudhi (2011) and Hidaytullah *et al*. (2008).

Hence it could be concluded that in tomato yield per plant was positively and significantly correlated with number of number of flower trusses per plant, fruit length, pericarp thickness, days to first flower, average fruit weight and number of fruits per plant. In path coefficient analysis the highest positive direct effect was noted in average fruit weight, followed by number of fruits per plant, fruit length and number of flower trusses per plant. So, the traits like; average fruit weight, number of fruits per plant, fruit length and number of flower trusses per plant showed positive correlation with yield as well as they have direct effect on yield. This results showed that direct selection of average fruit weight, number of fruits per plant, fruit length and number of flower trusses per plant can be used as basis of selection for improvement in tomato in respect of yield.

References

Al-Jibouri, A., Miller, P. A. and Robison, H.F. 1958. Genotypic and environmental variation and covariation in upland cotton crops of inter-specific origin. *Agronomy Journal*. 50: 626-636.

Dewey, D. and Lu, K. H. 1959. A correlation and path coefficient analysis in crested wheat grass seedproduction. *Journal of Agronomy*. **54**: 515-518.

Dudhi, B.S. and Kalloo, G. 1982. Correlation and path analysis studies in tomato (*Lycopersicon esculentum* Mill.). *Haryana J. Hort.*, **11:**1-2, 122-126.

Harer, P. N., D. B. Lad and T. J. Bhor. 2003. Correlation and path analysis studies in tomato. *J. Maharashtra Agric. Univ*. **27**(3): 302-303.

Haydar, A., M. A. Mandal, M. B. Ahmed, M. M. Hannan, R. Karim, M. A. Razvy, U. K. Roy and M. Salahin. 2007. Studies on genetic variability and interrelationship among the different traits in tomato (*L. esculentum* Mill.). *Middle-East J. Sci. Res*. **2**(3-4): 139-142.

Hidaytullah, Shakheel Ahmad, Ghafoor and Mahmood. 2008. Path coefficient analysis of yield component in tomato (*Lycopersicon esculentum* Mill). *Pakistan J. Bot.*, **40**(2): 627-635.

Islam, M. S. and S. Khan. 1991. Variability and character association in tomato (*Lycopersicon esculentum* Mill). *Bangladesh J. Pl. Breed. Genet*. **4**(1-2): 49-53.

Khapte, P. S. and Jhansirani, P. 2014. Correlation and path analysis in tomato. *Electronic Journal of Plant Breeding*, **5**(2): 300-304.

Lakshmi Kant and Mani, V.P. 2004. Association and contribution of different characters towards fruit yield in tomato (*Lycopersicon esculentum* Mill.). *Indian J. Hort.*, **61**(4): 327-330.

McGiffen, M. E. Jr., D. J. Pantone and J. B. Masiunas. 1994. Path analysis of tomato yield components in relation to competition with black and eastern black nightshade. J. *American Soc. Hort. Sci*. **1119**(1): 6-11.

Mukherjee, S. and Umesh 2015. Correlation and path analysis in tomato (*Solanum lycopersicon* L.). *International Journal of Farm Sciences*. **5**(4): 111-117.

Rani, C. I., Muthuvel, I. and Veer, D. 2010. Correlation and path analysis of yield components and quality traits in tomato (*Lycopersicon esculentum* Mill.). *Agricultural Science Digest*. **30**(1): 11-14.

Meena, O. P. and Bahadur, V. 2014. Assessment of correlation and path coefficient analysis for yield and yield contributing traits among tomato (*Solanum lycopersicum* L.) germplasm. *Agricultural Science Digest*. **34**(4): 245-250.

Wright, S. 1921. System of mating biometric relation between parent and offspring. *Genetics*. **6**: 111-123.

Yadav, D. S. and S. P. Singh. 1998. Correlation and path analysis in tomato. J. Hill Res. 11(2): 207-21.

Table 1.Genotypic (rg) and phenotypic (rp) coefficient of correlation

Characters		DFF	NFTP	FL	FD	PT	NOL	AFW	NFP	YPP
PH	rg	0.452**	0.056	0.121	-0.413	-0.382	-0.254	-0.137	0.355**	0.124
	rp	0.106	0.072	0.085	-0.205	-0.264	-0.179	-0.098	0.317	0.120
DFF	rg			-0.213	-0.445	-0.567*	-0.107	-0.541**	0.020	-0.348*
	rp			-0.075	-0.218	-0.314	-0.080	-0.204	-0.013	-0.174
NFTP	rg			0.068	-0.296	-0.175	-0.257	-0.023	0.663**	0.480**
	rp			0.022	-0.217	0.197	0.135	-0.054	0.562**	0.378*
FL	rg				0.324	0.698**	-0.217	0.615**	0.302	0.628**
	rp				0.379*	0.656**	0.144	0.563**	0.281	0.577**
FD	rg					0.642**	0.757**	0.769**	-0.376*	0.232
	rp					0.554**	0.473**	0.678**	-0.320	0.340
PT	rg						0.123	0.732**	-0.023	0.389*
	rp						0.065	0.595**	-0.018	0.318
NOL	rg							0.357**	-0.358*	-0.073
	rp							0.203	-0.213	-0.018
AFW	rg								0.078	0.678**
	rp								0.054	0.681**
NFP	rg									0.765**
	rp									0.736**

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

PH: Plant height (cm), DFF: Days to first flowering, NFTP: Number of flower trusses per plant, FL: Fruit length (cm), FD: Fruit diameter (cm), PT: Pericarp thickness (mm), NOL: Number of locules, AFW: Average fruit weight (g), NFP: Number of fruits per plant, YPP: Yield per plant (kg)

Table 2. Path coefficient showing direct (bold) and indirect effects

Characters	PH	DFF	NFTP	FL	FD	PT	NOL	AFW	NFP	GCY
PH	**0.0453**	-0.0412	0.0012	0.0273	0.1543	0.0425	0.0093	-0.1395	0.2361	0.1321
DFF	0.0246	**-0.0765**	-0.0025	-0.0682	0.2326	0.0865	0.0028	-0.4615	0.0108	-0.3587*
NFTP	0.0012	0.0034	**0.0608**	0.0216	0.1678	0.0239	0.0102	-0.0196	0.4387	0.4924*
FL	0.0039	0.0178	0.0042	**0.2756**	-0.1792	-0.1005	0.0104	0.5084	0.2124	0.6104**
FD	-0.0122	0.0316	-0.0178	0.0963	**-0.5300**	-0.0837	-0.0312	0.6484	-0.2372	0.2194
PT	-0.0126	0.0436	-0.0084	0.1834	-0.3287	**-0.1456**	-0.0042	0.5932	-0.0180	0.3899*
NOL	-0.098	0.0080	-0.0156	-0.0775	-0.4056	-0.0189	**-0.0393**	0.2945	-0.2397	-0.0819
AFW	-0.0071	0.0408	-0.0014	0.1655	-0.4165	-0.1106	-0.0147	**0.8267**	0.0485	0.6783**
NFP	0.0147	-0.0011	0.0403	0.0879	0.1848	0.0032	0.0121	0.0653	**0.6568**	0.7682**

***Significant at 5% level and **Significant at 1% level** **[Residual effect: 0.0126]**

PH: Plant height (cm), DFF: Days to first flowering, NFTP: Number of flower trusses per plant, FL: Fruit length (cm), FD: Fruit diameter (cm), PT: Pericarp thickness (mm), NOL: Number of locules, AFW: Average fruit weight (g), NFP: Number of fruits per plant, YPP: Yield per plant (kg), GCY: Genotypic correlation with yield.