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Study of character association in the tomato genotypes

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Abstract
Tomato is a very important vegetable crop grown all over the world. Study was done on 36 genotypes of tomato for correlation and path coefficient for different characters. Study of correlation between different quantitative characters provides a thought of association that would be effectively exploited to formulate selection strategies for improving yield components. Correlation coefficient studies indicated that genotypic correlation coefficient was higher than phenotypic correlation coefficients for most of the characters. Fruit per hectare expressed highly significant and positive correlation with fruit weight, number of fruits per plant and number of primary branches and plant height and days to first fruit set showed positive correlation which implies that these characters were the prime contributing factors to fruit yield. The path coefficient technique helps in estimating direct and indirect contribution of various components in finding out the total correlation towards yield. The highest positive direct effect on weight of fruits per hectare was observed on fruit weight followed by days to first fruit maturity and number of primary branches.

Keywords: Correlation coefficient, genotypes, path coefficient, quantitative characters and tomato

Introduction
Tomato [*Lycopersicon esculentun* Mill.] is a very important vegetable crop with diploid chromosome number 2n=2x=24. The distribution of the allele studies gives the evidence that tomato originated in Peru-Ecuador region. Tomato is grown as an annual plant with a growth habit of determinate and indeterminate. Tomato is consumed when they ripen. It is a good source of ascorbic acid and amino acid. Tomato is a very good appetizer and it is believed that tomato soup helps in relieving constipation. Large number of tomato cultivars has evolved from various organization of the country. These cultivars have desirable attributes like high yielding. And as we know that yield is a complex and dependent character controlled by a large number of contributing characters and their interactions. Study of correlation between different quantitative characters provides a thought of association that would be effectively exploited to formulate selection strategies for improving yield components. The path coefficient technique helps in estimating direct and indirect contribution of various components in finding out the total correlation towards yield. On the basis of these studies the quantum importance of individual characters is marked to facilitate the future selection and hybridization programme for better gains.

Materials and Methods
The field experiment under the present investigation was conducted at Horticulture Research Centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (UP) 250110 during *rabi* season (Oct, 2018 – April, 2019). The experimental material comprised of 36 diverse genotypes of tomato (Table 1). Out of these, 35 tomato genotypes were from Indian Institute of Vegetable Research, Varanasi U.P. and 1 genotype i.e. Pusa Ruby was from Indian Agriculture Research Institute, New Delhi. The experiment was laid out in a randomized block design by using 36 tomato genotypes and replicated three times, in each replication there were 15 plants. The spacing was 90 X 60 cm to study different morphological characters. To record the data on different characters five random plants per replication in each genotype were selected. 10 quantitative traits *viz.* days to 50% flowering, days to first fruit set, days to first fruit maturity, days to first fruit harvest, number of primary branches, plant height(cm), number of fruits per plant(g), fruit yield per plant(g), fruit weight(g) and fruit yield per hectare(q) analyzed statistically for different genetic parameters.

The correlations of coefficients among yield and quality attributes were calculated as suggested by Panse and Sukhatme (1957) [11]. Path coefficient analysis was carried out according to Dewey and Lu (1959) [3].

Table 1: List of tomato genotypes

Sl. No.	Variety Name	Sl. No.	Variety Name	Sl. No.	Variety Name	Sl. No.	Variety Name
1.	VRT- 4	10.	VRT-21	19.	VRT-54	28.	VRT-66
2.	VRT-05	11.	VRT-23	20.	VRT-56	29.	VRT-67
3.	VRT-07	12.	VRT-24-1	21.	VRT-57	30.	VRT-70
4.	VRT-10	13.	VRT-26	22.	VRT-58	31.	VRT-71
5.	VRT-11	14.	VRT-27	23.	VRT-60	32.	VRT-74
6.	VRT-16	15.	VRT-29	24.	VRT-61	33.	VRT-76
7.	VRT-17	16.	VRT-50	25.	VRT-62	34.	VRT-77
8.	VRT-18	17.	VRT-52	26.	VRT-63	35.	VRT-78
9.	VRT-20	18.	VRT-53	27.	VRT-65	36.	Pusa ruby

Table 2: Estimation of correlations genotypic level.

Characters	Days to 50% flowering	Days to first fruit set	Days to first fruit maturity	Days to first fruit harvest	Number of primary branches	Plant height (cm)	Number of fruits per plant	Fruit yield per plant (g)	Fruit weight (g)	Fruit yield per hectare (q)
Days to 50% flowering	1.000	0.357**	0.146	0.150	-0.191*	-0.191*	-0.085	-0.269**	-0.031	-0.307**
Days to first fruit set		1.000	0.664**	0.653**	-0.228*	-0.203*	-0.116	-0.004	0.143	0.010
Days to first fruit maturity			1.000	1.000**	-0.194*	-0.394**	-0.344**	-0.228*	0.181	-0.186
Days to first fruit harvest				1.000	-0.171	-0.400**	-0.340**	-0.234*	0.161	-0.193*
Number of primary branches					1.000	0.038	0.418**	0.336**	-0.392**	0.360**
Plant height(cm)						1.000	0.089	0.192*	0.016	0.181
Number of fruits per plant							1.000	0.756**	-0.602**	0.626**
Fruit yield per plant(g)								1.000	-0.089	0.948**
Fruit weight(g)									1.000	-0.035
Fruit yield per hectare(q)										1.000

*, ** significant at 5% and 1% level, respectively

Table 3: Estimation of correlations at phenotypic level.

Characters	Days to 50% flowering	Days to first fruit set	Days to first fruit maturity	Days to first fruit harvest	Number of primary branches	Plant height (cm)	Number of fruits per plant	Fruit yield per plant(g)	Fruit weight (g)	Fruit yield per hectare (q)
Days to 50% flowering	1.000	0.291**	0.131	0.133	-0.109	-0.165	-0.072	-0.243*	-0.019	-0.279**
Days to first fruit set		1.000	0.605**	0.595**	-0.205*	-0.178	-0.109	0.007	0.132	0.008
Days to first fruit maturity			1.000	0.995**	-0.168	-0.386**	-0.335**	-0.221*	0.177	-0.180
Days to first fruit harvest				1.000	-0.142	-0.391**	-0.331**	-0.225*	0.160	-0.186
Number of primary branches					1.000	0.034	0.352**	0.275**	-0.325**	0.290**
Plant height (cm)						1.000	0.084	0.191*	0.009	0.174
Number of fruits per plant							1.000	0.751**	-0.593**	0.618**
Fruit yield per plant(g)								1.000	-0.083	0.932**
Fruit weight(g)									1.000	-0.030
Weight of fruit per hectare (q)										1.000

*, ** significant at 5% and 1% level, respectively

Table 4: Path coefficient analysis at genotypic level on Fruit yield per hectare.

Characters	Days to 50% flowering	Days to first fruit set	Days to first fruit maturity	Days to first fruit harvest	Number of primary branches	Plant height (cm)	Number of fruits per plant	Fruit yield per plant(g)	Fruit weight (g)	Fruit yield per hectare (q)
Days to 50% flowering	-0.0351	0.0227	-0.3020	0.2992	-0.0029	0.0054	0.0362	-0.3345	0.0041	-0.307**
Days to first fruit set	-0.0125	0.0635	-0.3751	0.3063	-0.0034	0.0058	0.0493	-0.0054	-0.0188	0.010
Days to first fruit maturity	-0.0051	0.0422	-0.0703	0.0002	-0.0029	0.0112	0.1460	-0.2835	-0.0237	-0.186
Days to first fruit harvest	-0.0053	0.0415	-0.0702	0.0002	-0.0026	0.0114	0.1445	-0.2911	-0.0211	-0.193*
Number of primary branches	0.0067	-0.0145	0.4025	-0.3417	0.0151	-0.0011	-0.1776	0.4187	0.0515	0.360**
Plant height (cm)	0.0067	-0.0129	0.8155	-0.7995	0.0006	-0.0285	-0.0376	0.2391	-0.0021	0.181
Number of fruits per plant	0.0030	-0.0074	0.7118	-0.6805	0.0063	-0.0025	-0.4246	0.9414	0.0790	0.626**
Fruit yield per plant (g)	0.0094	-0.0003	0.4714	-0.4677	0.0051	-0.0055	-0.3211	1.2448	0.0117	0.948**
Fruit weight (g)	0.0011	0.0091	-0.3740	0.3219	-0.0059	-0.0005	0.2557	-0.1114	-0.1311	-0.035

Residual effect = 0.0503

*, ** significant at 5% and 1% level, respectively

Table 5: Path coefficient analysis at phenotypic level on Weight of fruit per hactare

Characters	Days to 50% flowering	Days to first fruit set	Days to first fruit maturity	Days to first fruit harvest	Number of primary branches	Plant height (cm)	Number of fruits per plant	Fruit yield per plant (g)	Fruit weight (g)	Fruit yield per hectare(q)
Days to 50% flowering	-0.0131	-0.0017	0.0497	-0.0533	-0.0061	0.0058	0.0282	-0.2909	0.0028	-0.279**
Days to first fruit set	-0.0038	-0.0059	0.2297	-0.2390	-0.0115	0.0063	0.0425	0.0088	-0.0194	0.008
Days to first fruit maturity	-0.0017	-0.0036	0.3798	-0.3996	-0.0094	0.0137	0.1309	-0.2645	-0.0259	-0.180
Days to first fruit harvest	-0.0017	-0.0035	0.3779	-0.4017	-0.0080	0.0138	0.1293	-0.2691	-0.0234	-0.186
Number of primary branches	0.0014	0.0012	-0.0637	0.0570	0.0562	-0.0012	-0.1373	0.3292	0.0475	0.290**
Plant height (cm)	0.0022	0.0011	-0.1466	0.1571	0.0019	-0.0354	-0.0329	0.2277	-0.0013	0.174
Number of fruits per plant	0.0010	0.0006	-0.1274	0.1330	0.0198	-0.0030	-0.3904	0.8972	0.0868	0.618**
Fruit yield per plant (g)	0.0032	0.0000	-0.0841	0.0904	0.0155	-0.0067	-0.2931	1.1950	0.0122	0.932**
Fruit weight (g)	0.0003	-0.0008	0.0671	-0.0643	-0.0182	-0.0003	0.2315	-0.0995	-0.1463	-0.030

Residual effect = 0.186

*, ** significant at 5% and 1% level, respectively.

Results and Discussion

A wide range of variation in quantitative characters provides the basis for selection in plant breeding programme. The knowledge of association among the characters is useful to the breeder for improving the efficiency of selection. Correlation coefficient analysis measures the mutual relationship between plant characters and determines the component character on which selection can be made for genetic improvement of yield. Investigation regarding the presence of component and nature of association among themselves is essential and prerequisite for improvement in yield. Correlation coefficient provides a clear picture of the extent of association between a pair of traits and indicates whether simultaneous improvement of the correlated traits may be possible or not. The knowledge of genetic association between yield and its component characters helps in improving the efficiency of selection for yield by making proper choice and balancing one component with another.

In present study correlation coefficient at genotypic and phenotypic levels among the fruit yield per hectare and its component characters have been worked out in Table 2 and Table 3. In general, the genotypic correlation coefficient values were higher than phenotypic correlation coefficient values. This indicated that strong inherent associations were somewhat masked at phenotypic level due to environmental effects. In the present investigation, correlation coefficient was computed among ten characters. Weight of the fruit per hectare expressed highly significant and positive correlation with fruit yield per plant, number of fruits per plant and number of primary branches and plant height and days to first fruit set showed positive correlation. Islam *et al.* (2010) [6], Souza *et al.* (2012) [17], Saleem *et al*. (2013) [18]. Therefore, it can be inferred that selection based on any one of these characters either alone or in combination, will result in identifying high yielding strains. These results were close in conformity with findings of Manna and Paul (2012) [7] Khapte and Jansirani (2014) [5], Shrama and Jaipal (2014) [15], Ullah *et al.* (2015) [19], Bajpai *et al.* (2017) [2], Rajolli *et al.* (2017) [13] Meena *et al.* (2018) [8] and Ritonga *et al.* (2018) [14].

Path coefficient analysis

Path coefficient analysis is a powerful tool, which enable portioning of the given relationships in its further components. In other words, it takes into account not only the relationship of component characters with the dependent character, but simultaneously takes care of its relationship with another component also. Thus, it helps in understanding the causal system in a better way because it enables portioning the total correlations coefficient into direct and indirect effects of various characters.

In the present investigation path coefficient analysis was done for characters using genotypic and phenotypic correlation coefficient and fruit yield q/ha was taken as dependable variables, shown in Table 4 and Table 5. In general, the genotypic direct as well as indirect effects were slightly higher in magnitude as compared to corresponding phenotypic direct and indirect effects. Among the various traits studied fruit yield per plant had very high positive direct effect at both genotypic and phenotypic levels on fruit yield per hectare. This indicated that fruit yield per plant is most important character in influencing fruit yield per hectare.

Fruit yield per hectare could be improved by selection based on fruit yield per plant. The direct effect of remaining characters on fruit yield per hectare were of low magnitude. These results are in general agreement with the findings of Sharma and Singh (2012) [16], Nwosu *et al.*, (2014) [10], Shrama and Jaipal (2014) [15] and Meitei *et al*., (2014) [9].

At genotypic and phenotypic level No. of fruits per plant showed positive high to moderate indirect effect on fruit yield per hectare via fruit weight, days to first fruit maturity and days to first fruit harvesting. Fruit yield per plant exhibited very high to moderate indirect contribution on fruit yield per hectare via number of fruits per plant, number of primary branches and plant height. Similar studies were made by Phom *et al*., (2015) [12], Ahirwar and Prashad (2013) [1], Sharma and Singh (2012) [16] and Henareh *et al.,* (2015) [4].

In the present study path analysis identified fruit yield per plant as important direct fruit yield per hectare contributing character. Fruit yield per plant and number of fruits per plant emerged as most important in direct fruit yield per hectare components. These characters merit due consideration at the time of devising selection strategy aimed at developing high yielding varieties in tomato.

Residual effect

The residual effect appeared too small for both genotypic (0.050) and phenotypic (0.186) path coefficient indicated yield contributing characters have been accounted for present study.

Conclusion

Correlation coefficient studies indicated that genotypic correlation coefficient was found to be higher than phenotypic correlation coefficients for most of the characters, indicating a strong inherent association between various characters and significantly affected by environmental components in regard to phenotypic expression. Fruit per hectare expressed highly significant and positive correlation with fruit weight, number

of fruits per plant and number of primary branches and plant height and days to first fruit set showed positive correlation which implies that these characters were the primer contributing factors to fruit yield. All the combination of traits should be considered, while breeding programme selecting for high yielding genotypes and suitable for breeders to achieving improved plant type.

The highest positive direct effect on weight of fruits per hectare was observed on fruit weight followed by days to first fruit maturity and number of primary branches. Improvement of fruit weight, days to first fruit maturity and number of primary branches the weight of fruits per hectare might be improved.

References

1. Ahirwar CS, Prashad VM. Variability pattern in agromorphological characters in tomato genotypes (*Lycopersicon esculentum* Mill.). Trends In Biosciences 2013;6:758-761.
2. Bajpai RK, Yadav GC, Kumar V. Correlation and path analysis for growth and morpho-economic characters in tomato (*Solanum lycopersicon* (Mill.) Wettsd) Journal of Pharmacognosy and Phytochemistry 2017;6(5):791-795.
3. Dewey DR, Lu KH. A correlation and path co-efficient analysis of components of crested wheat grass seed production. Agronomy Journal 1959;51(9):515-518.
4. Henareh M, Dursun, A, Mandoulakani BA. Study of genetic variation and association among characters in tomato genotypes. J. of Agricultural Faculty 2015;46:63-70.
5. Khapte PS, Jansirani PP. Genetic variability and performance studies of tomato (*Solanum lycopersicum* L.) genotype for fruit quality and yield. Trends in Biosciences 2014;7:1246-1248.
6. Islam BMR, Ivy NA, Rasul MG, Zakaria M. Character association and path analysis of exotic tomato (*Solanum lycopersicum*L.) genotypes. Bangladesh J. Pl. Breed. Genet 2010;23(1):13-18.
7. Manna M, Paul A. Studies on genetic variability and characters association of fruit quality parameters in tomato. Hort Flora Research Spectrum 2012;1:110-116.
8. Meena RK, Kumar S, Meena ML, Kumar A. Correlation and Characters Association Studies in Tomato (*Solanum lycopersicum* L.) Int. J. Pure App. Biosci 2018;6(1):1291-1295.
9. Meitei KM, Bora GC, Singh SJ, Sinha AK. Morphology based genetic variability analysis and identification of important characters for tomato (*Solanum lycopersicum* L.) crop improvement. Journal of agriculture and environmental science 2014;14(10):1105-1111.
10. Nwosu DJ, Onakoya OA, Okere AU, Babatunde AO, Popoola AF. Genetic Variability and Correlations in Rainfed Tomato (*Solanum* spps.) Accessions in Ibadan, Nigeria. Greener Journal of Agricultural Sciences 2014;4(5):211-219.
11. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers (2nd Edn.), Indian Council of Agricultural Research, New Delhi 1985, 381.
12. Phom M, Chaturvedi HP, Kanaujia SP. Genetic variability, character association and path coefficient analysis in tomato (*lycopersicon esculentum* mill.) genotypes Plant Archives 2015;15(1):519-522.
13. Rajolli MG, Lingaiah HB, Ishwaree, Malashetti R, Bhat AS, Aravindkumar JS. Correlation and path co-efficient studies in tomato (*Solanum lycopersicum* L.) Int. J. Pure App. Biosci 2017;5(6):913-917.
14. Ritonga AW, Chozin MA, Syukur M, Sobir AM. Genetic variability, heritability, correlation, and path analysis in tomato (*Solanum lycopersicum*) under shading condition. Biodiversitas 2018;19(4):1527-1531.
15. Sharma AK, Jaipal. Variablity and correlation studies in diallel cross of tomato (*Solanum lycopersicum* L.). Journal of Hill Agriculture 2014;5:168-170.
16. Sharma B, Singh JP. Correlation and path coefficient analysis for quantitative and qualitative traits for fruit yield and seed yield in tomato genotypes. Indian Journal of Horticulture 2012;69(4):540-544.
17. Souza LM, Melo PCT, Luders RR, Melo AMT. Correlations variability, heritability and genetic advance in tomato (*Solanum lycopersicum* L.). Plant Archives 2012;15(2):705-709.
18. Saleem MY, Iqbal Q, Asghar M. Genetic variability, heritability, character association and path analysis in F1 Hybrids of tomato. Pak. J. Agri. Sci 2013;50(4):649-653.
19. Ullah MZ, Hassan L, Shahid SB, Patwary AK. Variability and inter relationship studies in tomato (*Solanum lycopersicum* L.) J. Bangladesh Agril. Univ 2015;13(1):65-69.