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Character association and path analysis in tomato (*Solanum lycopersicon* [Mill.] Wettsd.)

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Abstract
The present investigation was carried out to estimate the correlation and path coefficient among 50 genotypes for eleven yield contributing traits. Number of fruit per plant (0.59), average fruit weight (0.17), equitorial diameter (0.18) and unmarketable fruit per plant (0.66) were significantly and positively correlated with total fruit yield per plant while days to 50% flowering (-0.03) and plant height (-0.02) were significantly and negatively correlated with total fruit yield per plant. Equitorial diameter of fruit (0.77), and polar diameter of fruit (0.76) had highly significant and positive correlation with average fruit weight. While average fruit weight (-0.58), polar diameter of fruit (-0.51), equitorial diameter of fruit (-0.43), and days to 50% flowering (-0.31) were highly significant and negative correlation with number of fruit per plant respectively. The higher magnitude of positive direct effect on fruit yield per plant was exerted by number of fruit per plant (0.9184) followed by average fruit weight (0.5672), polar diameter of fruit (0.3360), unmarketable fruit yield per plant (0.3238), while primary branches per plant (0.0783), days to 50% flowering (0.0229), total soluble solids (0.0154) and plant height (0.0091) showed substantially low positive direct effect. The negative direct effect on fruit yield per plant was showed by equitorial diameter of fruit (-0.2461) and number of fruit per cluster (-0.0086).

Keywords: Tomato (*Solanum lycopersicon* [Mill.] Wettsd.), correlation and path analysis

Introduction
Tomato (*Solanum lycopersicon* [Mill.] Wettsd.) belongs to solanaceae family and the genus *Solanum.* It is a herbaceous annual to perennial in nature and sexually propagated crop plant with perfect flowers. It is a day neutral plant and mainly self-pollinated but a certain percentage of cross-pollination also occurs. It is a warm season crop reasonably resistant to heat, drought and grows under wide range of soil and climatic conditions. It is widely cultivated vegetable throughout the world and ranks second in importance after potato in many countries including India. In India, total area was 0.789 million hectares with production 19.759 million tonnes and there productivity 25.04 tonnes per hectare (Anonymous, 2018) [3].
There are four to eight flowers in each compound inflorescence. Anthesis occurs from 7:00-8:00 AM and dehiscence from 9:00-11:00 AM. All the species of tomato are native to western South America (Rick, 1976) [4]. Growth habit ranged from strongly determinate (bushy type) to indeterminate types.
Tomato is considered as "Poor man's Orange" and universally treated as 'Protective Food'. Tomato fruits are eaten raw or cooked. Tomato in large quantities is used for the preparation of several processed items like soup, juice, ketchup, puree, paste, powder and ripen fruits are used as raw vegetable in salad. Tomato is a good appetizer and its soup is said to be a good remedy for patients suffering from constipation.
Breeding efforts have contributed substantially to improve yield potential, regional adaptation through resistance or tolerance to abiotic and biotic stresses, plant type and grain characteristics. The path coefficient analysis provides the partitioning of correlation coefficients into direct and indirect effect giving the relative impotence of each causes factors. The understanding of association of characters is of prime impotence in developing an efficient breeding programme.
Study of correlation provide an opportunity to study the magnitude and direction of association of one character with another, while path coefficient analysis gives the direct and indirect contribution of independent variables on dependent variable (Yield).
Therefore, present investigation was carried out to assess the magnitude and direction of association, direct and indirect effects between yield and its component traits among 47 different genotypes with 3 checks for 11 characters of tomato under Ayodhya conditions.

Materials and Methods

The experimental material for the present investigation was comprised of 50 genotypes including promising varieties, elite lines, land races and three checks (determinate DVRT 2, NDT-7 and indeterminate Arka Vikas) were replicated thrice in Randomized Complete Block Design. The experiment was carried out at Main Experiment Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Ayodhya, during *Rabi* season of 2016-17. The whole investigation was conducted under the scientific management practices. During study, observations for days to 50% flowering, plant height (cm), number of primary branches per plant, polar diameter of fruit (cm), equatorial diameter of fruit (cm), TSS (^{0}Brix), number of fruits per cluster, average fruit weight (g), number of fruits per plant, unmarketable fruit yield per plant (g) and total fruit yield per plant (g) were recorded on five randomly selected plants from each treatment.

The recorded data from experiment for eleven characters in tomato was subjected to the following statistical analysis such as correlation coefficient (Searle, 1965) and path coefficient analysis (Dewey and Lu, 1959) [1].

Table 1: Estimates of phenotypic correlation coefficients among eleven characters in tomato germplasm

Characters	Plant height (cm)	Primary branches per plant	Polar diameter of fruit (cm)	Equitorial diameter of fruit (cm)	Total soluble solids (TSS)	Number of fruit per cluster	Average fruit weight (g)	Number of fruit per plant	Unmarketable fruit yield per plant (g)	Total fruit yield per plant (g)
Days to 50% flowering	0.11	0.24**	0.40**	0.33**	0.03	-0.27**	0.27**	-0.31**	-0.02**	-0.03*
Plant height (cm)		0.32**	-0.05	-0.02	-0.04	0.18	-0.12	0.01	0.05	-0.02*
Primary branches per plant			0.17	0.21**	-0.12	0.09	0.09	-0.21**	-0.10	-0.09
Polar diameter of fruit (cm)				0.86**	-0.11	-0.19*	0.76**	-0.51**	0.05	0.12
Equitorial diameter of fruit (cm)					-0.05	-0.21**	0.77**	-0.43**	0.20*	0.18*
Total soluble solids (TSS)						-0.21**	-0.08	-0.09	-0.04	-0.09
Number of fruit per cluster							0.26	0.25**	0.02	0.06
Average fruit weight (g)								-0.58**	0.17*	0.17**
Number of fruit per plant									0.30**	0.59**
Unmarketable fruit yield per plant (g)										0.66**

*,** Significant at 5% and 1% probability level respectively

Table 2: Direct and indirect effects of eleven characters on fruit yield per plant (g) at genotypic level in tomato germplasm

Characters	Days to 50% flowering	Plant height (cm)	Primary branches per plant	Polar diameter of fruit (cm)	Equitorial Diameter of fruit (cm)	Total soluble solids (TSS)	Number of fruit per cluster	Average fruit weight (g)	Number of fruits per plant	Unmarketable Fruit yield per plant (g)	Correlation with total fruit yield per plant
Days to 50% flowering	0.0091	0.0023	0.0270	0.1920	-0.1289	0.0011	0.0014	0.1733	-0.3166	-0.0019	-0.0457
Plant height (cm)	0.0013	0.0163	0.0337	-0.0221	0.0096	0.0039	-0.0008	-0.0700	0.0189	0.0227	-0.0268
Primary branches per plant	0.0025	0.0056	0.0986	0.0763	-0.0717	0.0095	-0.0005	0.0536	-0.1977	-0.0437	-0.0977
Polar diameter of fruit (cm)	0.0042	0.0042	0.0180	0.4184	-0.2885	0.0078	0.0009	0.4267	-0.4670	0.0205	0.1262
Equitorial Diameter of fruit (cm)	0.0036	0.0005	0.0215	0.3672	-0.3287	0.0044	0.0009	0.4377	-0.3941	0.0843	0.1883
Total soluble solids (TSS)	0.0002	0.0012	-0.0181	-0.0634	0.0283	0.0516	0.0012	-0.0637	-0.0085	-0.0282	-0.0993
Number of fruit per cluster	0.0029	0.0030	0.0109	-0.0838	0.0708	0.0150	-0.0043	-0.1513	0.2264	0.0104	0.0582
Average fruit weight (g)	0.0028	0.0021	0.0095	0.3221	-0.2596	0.0059	-0.0012	0.5543	-0.5228	0.0702	0.1739
Number of fruits per plant	0.0032	0.0003	-0.0219	-0.2195	0.1455	0.0005	-0.0011	-0.3255	0.8903	0.1235	0.5873
Unmarketable fruit yield per plant (g)	0.0000	0.0010	-0.0112	0.0222	-0.0719	0.0038	-0.0001	0.1011	0.2856	0.3850	0.7059

R SQUARE = 0.8670 RESIDUAL EFFECT =SQRT (0.3648)

Results and Discussion

The correlation among eleven characters were worked out at phenotypic level had been presented in Table-1, indicated a strong genetic association between the characters and the phenotypic expression which was dominated by the influence of environmental factors. Correlations between character pairs are due to linkage of genes or pleiotropy of genes. The result reflecting the better opportunity of selection in the available tomato genotypes.

In this respect, the correlation coefficient provides symmetrical measurement for degree of association between two variables or traits help in understanding the nature and magnitude of association among yield and yield attributing traits.

The most important trait, polar diameter of fruit had exhibited highly significant and positive phenotypic correlation coefficient with equitorial diameter of fruit (0.86). Equitorial diameter of fruit (0.77), and polar diameter of fruit (0.76) had highly significant and positive correlation with average fruit weight. Unmarketable fruit yield per plant (0.66) and number of fruit per plant (0.59) had highly significant and positive correlation with total fruit yield per plant. Emphasis for selection for this trait in desired direction had also been suggested by earlier workers (Singh, 2007, Madhurina and Amitava, 2012, Narolia *et al.*, 2012) [5, 6, 7]. The average fruit weight (-0.58), polar diameter of fruit (-0.51), equitorial diameter of fruit (-0.43), and days to 50% flowering (-0.31) showed significant and negative correlation with number of fruit per plant respectively. Days to 50% flowering (-0.27) was highly significant and negative correlation with number of fruit per cluster.

Yield per plant and yield contributing attributes are interrelated among themselves. It creates interruption in drawing a clear picture of association between characters. The mutual relationship expressed as correlation coefficient between the characters is either positive or negative but complex in nature and sometimes fails to give a meaningful interpretation. In such condition the biometrical tool, path coefficient analysis is used to measure the different ways of contribution of independent characters on the dependent one (yield). The results of path coefficient are presented in Table-2.

The higher magnitude of positive direct effect on fruit yield per plant was exerted by number of fruit per plant (0.9184) followed by average fruit weight (0.5672), polar diameter of fruit (0.3360), unmarketable fruit yield per plant (0.3238), while primary branches per plant (0.0783), days to 50% flowering (0.0229), total soluble solids (0.0154) and plant height (0.0091) showed substantially low positive direct effect. Substantial positive indirect effect was exerted by equitorial diameter of fruit (0.4421), polar diameter of fruit (0.4324) via average fruit weight, unmarketable fruit yield per plant (0.2808), number of cluster per plant (0.2325) via number of fruit per plant, average fruit weight (0.2561) via polar diameter of fruit, days to 50% flowering (0.1582), via average fruit weight, exerted on fruit yield per plant. The average fruit weight (-0.5355), polar diameter of fruit (-0.4733), equitorial diameter of fruit (-0.3988) via number of fruit per plant, number of fruit per plan (-0.3295) via average fruit weight, days to 50 per cent flowering (-0.2849) and primary branches per plant (-0.1964) via number of fruits per plant showed negative indirect effect on fruit yield per plant. Direct selection for number of fruits per plant, average fruit weight and polar diameter of fruit in desired direction would be very effective for yield improvement as also advocated by many workers (Makesh *et al.*, 2006, Madhurina and Amitava, 2012, Narolia *et al.*, 2012 and Rajolli *et al.*, 2017) [8, 6, 7, 9].

Thus, in the light of above findings it may be concluded that generally genotypic correlation coefficients were higher than the corresponding phenotypic correlation coefficients suggesting strong inherent relationship in different pairs of traits. Genetic parameters in association with correlation study indicated that for selection of superior genotypes primary emphasis should be given on fruit yield per plant (g) and average fruit weight (g). Therefore, these characters should be considered in fixing selection criteria to improve the fruit yield per plant in tomato.

References

1. Dewey DR, Lu KH. A correlation and path coefficient analysis of components in crested wheat grass seed production. Agron. J. 1959; 51:515-518.
2. Searle SR. Phenotypic, genotypic and environmental correlations, Biometry. 1961; 17:474-480.
3. Anonymous. Indian Horticulture Database, National Horticulture Board (NHB), Ministry of Agriculture, Government of India, Gurgaon, Haryana, 2018.
4. Rick CM. Tomato evaluation of crop plant. London. 1976, 268-273.
5. Singh AK. Correlation and path coefficient studies in tomato under cold arid conditions of Ladakh. Haryana J Hort. Sci. 2007; 36(¾):346-347.
6. Madhurina M, Paul A. Studies on genetic variability and characters association of fruit quality parameters in tomato. Hort. Flora Res. Spectrum. 2012; 1(2):110-116.
7. Narolia RK, Reddy RVSK, Padma M. Correlation and path coefficient analysis of growth, yield and quality of tomato (*Lycopersicon esculentum* Mill.). Indian J Tropical Biodiversity. 2012; **20**(1):65-69.
8. Makesh S, Ramaswamy N, Puddan M. Character association and path coefficient analysis in tomato (*Lycopersicon esculentum* Mill.). Res. Crops. 2006; 7(2):496-499.
9. Rajolli GM, Lingaiah BH, Malashetti RI, Bhat SA, Kumar SJA. Correlation and path co-efficient studies in tomato (*Solanum lycopersicum* L.) Int. J Pure App. Biosci. 2017; 5(6**):**913-917.