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STUDIES ON CORRELATION AND PATH ANALYSIS IN BRINJAL (*SOLANUM MELONGENA* L.) GENOTYPES

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ABSTRACT
Genetic studies in terms of correlation and path coefficients analysis were studied for twelve horticulture traits in fifty diverse genotypes of brinjal. The results indicated that yield per plant had significant positive association with number of marketable fruits per plant (0.693, 0.653), ascorbic acid content (0.290, 0.271), total harvest duration (0.278, 0.259), fruit weight (0.273, 0.238), fruit breadth (0.203, 0.160) and fruit length (0.163, 0.164) whereas, negative correlation were observed with days to first harvest (-0.502, -0.428), days to 50 per cent flowering (-0.323, -0.273) and plant height (-0.319, -0.279). Therefore main emphasis should be given on these characters, while making selection in brinjal genotypes. The path coefficient analysis revealed that the high positive direct effect towards fruit yield per plant was contributed by marketable fruit number per plant (0.777), fruit weight (0.277), fruit breadth (0.234) and fruit length (0.167) at phenotypic level. Thus, indicating direct selection for these traits as a criterion for yield improvement in brinjal.

INTRODUCTION

Brinjal or eggplant (*Solanum melongena* L.) a member of solanaceae family, is one of the most important vegetable crops grown in India. It is grown throughout the year under tropical and subtropical conditions and usually finds its place in common men's kitchen (Kumar *et al*. 2016). India being the centre of origin is having lot of variability in size, shape and colour. However, it is widely cultivated in both temperate and tropical regions of the globe mainly for its immature fruits as vegetable (Rai *et al*. 1995), but in the temperate regions it is cultivated mainly during warm season. Based upon its highest production potential and availability of the produce to consumers, it is also termed as poor man's vegetable and due to its versatility use in Indian food, brinjal is often described as the "King of vegetables". In India it is commercially cultivated in Odisha, Bihar, Karnataka, West Bengal, Andhra Pradesh, Maharashtra and Uttar Pradesh. The success of any crop improvement programme depends upon the nature and magnitude of genetic variability existing in breeding material with which plant breeder is working, choice of parents for hybridization and selection procedure (Meena and Bahadur, 2013).

Correlation and path coefficient analysis give an insight into the genetic variability present in populations. Correlation coefficient analysis measures the mutual relationship between various plant characters and determines the component characters on which selection can be based for improvement in yield. To design an efficient plant breeding program, adequate knowledge of the magnitude and direction of interrelationship of quantitative traits of economic importance with fruit yield and among themselves is essential. For this purpose correlation studies are helpful to breeder. Path analysis is a standardized partial regression analysis, which splits the correlation coefficients into direct and indirect effects of a set of dependent variables on the independent variable thereby aids in selection of elite genotypes (Wright, 1921). Accordingly, the aim of the present study was to assess the extent of genetic variability present in brinjal genotypes and to find out inter-relationships among different horticultural traits.

MATERIALS AND METHODS

The experiment was carried out at the Experimental Farm of the Department of Vegetable Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, (HP) during summer - rainy season of 2017. The experiment was laid out in randomized complete block design with three replications of each genotype. Seedlings were transplanted at the spacing of 60 cm × 45 cm. The observations were recorded on plant height, number of branches per plant, days to 50 per cent flowering, days to first harvest, total harvest duration, fruit length, fruit breath, fruit weight, number of marketable fruits per plant, marketable fruit yield per plant, total soluble solids and ascorbic acid content.

The genotypic and phenotypic correlations were calculated as per Al- Jibouri *et al.* (1958) by using analysis of variance and covariance matrix in which total variability had been splitted into replication, genotypes and errors. Path coefficient was obtained according to the procedure as suggested by Wright (1921) and as elaborated by Dewey and Lu (1959).

RESULTS AND DISCUSSION

In our investigation, the correlation coefficient among 12 important attributes indicated that yield per plant had significant positive association at genotypic and phenotypic levels with number of marketable fruits per plant, ascorbic acid content, total harvest duration, fruit weight, fruit breadth and fruit length. Significant negative correlations at both genotypic and phenotypic levels of yield per plant were observed with days to first harvest, days to 50 per cent flowering and plant height. As for ascorbic acid content, it had significant positive correlation at both genotypic and phenotypic levels with fruit breadth, number of marketable fruits per plant and number of branches per plant while, it was significant negative with plant height and days to first harvest. TSS was significantly and positively correlated with number of marketable fruits per plant and significantly negative correlation with plant height, days to 50 per cent flowering, number of branches per plant, fruit weight and days to first harvest. Number of marketable fruits per plant had significantly negative (desirable) correlation with days to 50 per cent flowering, days to first harvest, plant height, fruit weight, fruit breadth and number of branches per plant. Fruit weight had significantly positive correlation with fruit breadth and number of branches per plant. Further, fruit breadth had significant positive correlation with total harvest duration and number of branches per plant while, significantly negative with fruit length. Fruit length was significantly and positively correlated with plant height. As far total harvest duration, it was significantly negative correlation with days to 50 per cent flowering. Days to first harvest had significantly positive correlation with plant height, days to 50 per cent flowering and number of branches per plant. Days to 50 per cent flowering had significantly positive correlation with plant height and number of branches per plant. Finally, number of branches per plant was significantly & positively correlated with plant height. The findings of correlation studies concluded in the present study are in the conformity of earlier researchers. Similar correlations of yield with various other horticultural traits had been reported by Chattopadhyay *et al.* (2011), Bashar *et al.* (2015) and Sujin *et al.* (2017). Fruit yield showed highly significant and positive association with number of fruits per plant. Similar observation has also been obtained by Nalini *et al.* (2009), Muniappan *et al.* (2010), Shinde *et al.* (2012), Patel *et al.* (2015), Patel *et al.* (2017) and Yadav *et al.* (2018).

Path coefficient analysis

At phenotypic level, number of marketable fruits per plant had maximum positive direct effect on yield per plant followed by fruit weight, fruit breadth and fruit length, while days to first harvest had negative contribution to it. However, at phenotypic level, fruit breadth had positive indirect effect on fruit yield per plant through fruit weight whereas, it had negative indirect effect through fruit length. Further, fruit weight had positive indirect effect through fruit breadth. The number of marketable fruits per plant had positive indirect effect through ascorbic acid content (0.158) and total soluble solids whereas; it was negative indirect effect through days to 50 per cent flowering, plant height, days to first harvest, fruit weight, fruit breadth and number of branches per plant. At genotypic level, fruit breadth showed high positive direct effect on fruit yield per plant

Table 1: Estimates of genotypic and phenotypic correlation coefficients between different characters in brinjal

Characters		Number of branches per plant	Days to 50 percent flowering	Days to first harvest	Total harvest duration	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g) plant	Number of marketable fruits per (°Brix)	Total soluble solids (mg/100g)	Ascorbic acid content	Fruit yield per plant (kg)
Plant height (cm)	G	0.389**	0.331*	0.549**	-0.134	0.198*	-0.097	0.072	-0.365**	-0.351**	-0.401**	-0.319**
	P	0.382**	0.299**	0.493**	-0.114	0.194*	-0.096	0.064	-0.352**	-0.316**	-0.394**	-0.279**
Number of branches per plant	G		0.203**	0.212**	0.121	0.128	0.215**	0.280**	-0.280**	-0.286**	0.169*	-0.037
	P		0.196*	0.194*	0.131	0.122	0.209**	0.261**	-0.272**	-0.247**	0.163*	-0.035
Days to 50 per cent flowering	G			0.394**	-0.303**	0.027	0.055	0.139	-0.389**	-0.303**	-0.086	-0.323**
	P			0.387**	-0.256**	0.022	0.032	0.099	-0.368**	-0.234**	-0.082	-0.273**
Days to first harvest	G				-0.127	-0.102	-0.064	-0.039	-0.368**	-0.242**	-0.305**	-0.502**
	P				-0.110	-0.093	-0.064	-0.040	-0.342**	-0.205**	-0.282**	-0.428**
Total harvest duration	G					-0.177*	0.273**	0.193*	0.114	-0.056	0.150	0.278**
	P					-0.149	0.254**	0.177	0.098	-0.015	0.136	0.259**
Fruit length (cm)	G						-0.540**	0.035	0.117	0.025	-0.139	0.163*
	P						-0.499**	0.052	0.111	0.033	-0.134	0.164*
Fruit breadth (cm)	G							0.795**	-0.317**	-0.194*	0.327**	0.203**
	P							0.783**	-0.306**	-0.172	0.317**	0.160*
Fruit weight (g)	G								-0.357**	-0.245**	0.144	0.273**
	P								-0.338**	-0.225**	0.137	0.238**
Number of marketable fruits per plant	G									0.209**	0.205**	0.693**
	P									0.193*	0.204**	0.653*
Total soluble solids (°Brix)	G										0.083	0.053
	P										0.079	0.073
Ascorbic acid content (mg/100g)	G											0.290**
	P											0.271**

*Significant at 5% level of significance, **Significant at 1% level of significance

Table 2: Path coefficient analysis showing the direct and indirect effect of different characters on fruit yield per plant (kg) in brinjal at phenotypic level

Characters	Plant height (cm)	Number of branches per plant	Days to 50% flowering	Days to first harvest	Total harvest duration	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Number of marketable fruits per plant	Total soluble solids (°Brix)	Ascorbic acid content (mg/100g)	Phenotypic correlation (r_p) with fruit yield per plant
Plant height (cm)	0.011	0.004	0.003	0.006	-0.001	0.002	-0.001	0.001	-0.004	-0.004	-0.004	-0.279**
Number of branches per plant	0.018	0.048	0.009	0.009	0.006	0.006	0.010	0.013	-0.013	-0.012	0.008	-0.035
Days to 50% per cent flowering	0.013	0.009	0.045	0.017	-0.011	0.001	0.001	0.004	-0.017	-0.011	-0.004	-0.273**
Days to first harvest	-0.073	-0.029	-0.057	-0.147	0.016	0.014	0.009	0.006	0.050	0.030	0.042	-0.428**
Total harvest duration	-0.011	0.012	-0.024	-0.010	0.093	-0.014	0.024	0.017	0.009	-0.001	0.013	0.259**
Fruit length (cm)	0.032	0.020	0.004	-0.016	-0.025	0.167	-0.083	0.009	0.019	0.005	-0.022	0.164*
Fruit breadth (cm)	-0.022	0.049	0.008	-0.015	0.060	-0.117	0.234	0.184	-0.072	-0.040	0.074	0.160*
Fruit weight (g)	0.018	0.072	0.027	-0.011	0.049	0.015	0.217	0.277	-0.094	-0.062	0.038	0.238**
Number of marketable fruits per plant	-0.273	-0.211	-0.286	-0.266	0.077	0.086	-0.238	-0.263	0.777	0.150	0.158	0.653*
Total soluble solids (°Brix)	-0.006	-0.005	-0.005	-0.004	0.000	0.001	-0.003	-0.005	0.004	0.020	0.002	0.073
Ascorbic acid content (mg/100g)	0.013	-0.005	0.003	0.009	-0.005	0.004	-0.011	-0.005	-0.007	-0.003	-0.033	0.271**

Residual factor = 0.547, r_p = phenotypic correlation coefficient, Diagonal bold values are direct effects

Table 3: Path coefficient analysis showing the direct and indirect effect of characters on fruit yield per plant (kg) in brinjal at genotypic level

Characters	Plant height (cm)	Number of branches per plant	Days to 50% flowering	Days to first harvest	Total harvest duration	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Number of marketable fruits per plant	Total soluble solids (°Brix)	Ascorbic acid content (mg/100g)	Genotypic correlation (r_p) with fruit yield per plant
Plant height (cm)	-0.019	-0.007	-0.006	-0.010	0.002	-0.004	0.002	-0.001	0.007	0.007	0.007	-0.319**
Number of branches per plant	0.006	0.015	0.003	0.003	0.002	0.002	0.003	0.004	-0.004	-0.004	0.002	-0.037
Days to 50 per cent flowering	0.008	0.005	0.023	0.009	-0.007	0.001	0.001	0.003	-0.009	-0.007	-0.002	-0.323**
Days to first harvest	-0.064	-0.025	-0.046	-0.116	0.015	0.012	0.007	0.004	0.043	0.028	0.035	-0.502**
Total harvest duration	-0.010	0.009	-0.022	-0.009	0.073	-0.013	0.020	0.014	0.008	-0.004	0.011	0.278**
Fruit length (cm)	0.123	0.079	0.017	-0.063	-0.110	0.621	-0.335	0.022	0.073	0.015	-0.086	0.163*
Fruit breadth (cm)	-0.102	0.224	0.058	-0.067	0.285	-0.564	1.045	0.831	-0.331	-0.203	0.342	0.203**
Fruit weight (g)	-0.021	-0.080	-0.040	0.011	-0.055	-0.010	-0.228	-0.286	0.102	0.070	-0.041	0.273**
Number of marketable fruits per plant	-0.306	-0.235	-0.326	-0.308	0.096	0.098	-0.266	-0.299	0.838	0.175	0.172	0.693**
Total soluble solids (°Brix)	0.004	0.003	0.004	0.003	0.001	0.000	0.002	0.003	-0.002	-0.012	-0.001	0.053
Ascorbic acid content (mg/100g)	0.060	-0.025	0.013	0.046	-0.022	0.021	-0.049	-0.022	-0.031	-0.012	-0.150	0.290**

Residual factor = 0.389, r_g = genotypic correlation coefficient, Diagonal bold values are direct effects

followed by number of marketable fruits per plant and fruit length whereas, fruit weight followed by ascorbic acid content and days to first harvest showed negative direct effect on fruit yield per plant. Fruit length had positive indirect effect on fruit yield per plant through plant height while negative indirect effect through fruit breadth and total harvest duration.

Fruit breadth had positive indirect effect on fruit yield per plant through fruit weight, ascorbic acid content, total harvest duration and number of branches per plant whereas, negative indirect effect through fruit length, number of marketable fruits per plant, total soluble solids and plant height. Fruit weight had positive indirect effect on fruit yield per plant through number of marketable fruits per plant whereas, negative indirect effect through fruit breadth. Number of marketable fruits per plant had positive indirect effect on fruit yield per plant through total soluble solids and ascorbic acid content while, negative indirect effect was observed via days to 50 per cent flowering followed by days to first harvest, plant height, fruit weight, fruit breadth and number of branches per plant. In line with our investigation, positive direct effect of fruit length and fruit girth on yield has also been reported earlier by Thangamani and Jansirani (2012) and number of fruits per plant by Nalini *et al.* (2009), Muniappan *et al.* (2010), Shinde *et al.* (2012), Thangamani and Jansirani (2012), Nayak and Nagre (2013), Neha *et al.* (2017), Patel *et al.* (2017) and Sujin *et al.* (2017).

CONCLUSIONS

A highly significant positive genotypic and phenotypic correlation of yield was found with number of marketable fruit per plant, ascorbic acid content, total harvest duration, fruit weight, fruit breadth and fruit length. Therefore, main emphasis should be given on these characters while making selection in brinjal genotypes. Path coefficient analysis revealed that the high positive direct effects towards fruit yield per plant was contributed by marketable fruit number per plant, fruit weight, fruit breadth and fruit length at phenotypic level. Thus, indicating direct selection for these traits as a criterion for yield improvement in brinjal.

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