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Research Note

Character association and path co-efficient analysis studies on yield and attributing characters in brinjal (*Solanum melongena* L.)

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Abstract
The correlation studies in thirty four genotypes of brinjal comprising ten parents, twenty one F_1 hybrids and three checks during summer season of 2014 indicated strong positive correlation of primary branches per plant, days to final harvest, flowers per cluster, fruits per cluster, fruit length, average fruit weight and fruits per plant with fruit yield per. However, a significant negative correlation of fruit yield per plant was observed with days to 50% flowering. The path analysis study revealed that the fruits length is the most important yield determinant, because of its high direct effect and indirectly influence the yield through primary branches per plant, days to final harvest, fruits per cluster, average fruit weight and fruits per plant followed by fruits per plant is the another most important yield determinant thus, these characters should be given importance in selection programme for yield improvement in brinjal.

Keywords
Brinjal, Character association, Correlation, Path analysis

Brinjal (*Solanum melongena L.*) also known as garden egg is an important solanaceous vegetable crop grown worldwide. It is grown for its immature, unripe fruits which are used in the variety of ways as cooked vegetable in curries. It is popular among people of all social strata and hence, it is rightly called as vegetable of masses (Patel and Sarnaik, 2003). China is the major producing country followed by India. Yield is a complex character determined by several component characters (Singh, 2005). Improvement in yield is possible only through selection for the desired component characters. For evaluating the yield potential of any variety of eggplant, it is necessary to give attention to all the yield contributing characters. It is essential to assess the degree of association of various quantitative characters in order to initiate effective selection programme. Hence, the knowledge of association of the various plant characters with yield and among themselves is required so that a rational choice of characters for selection can be exercised. Studies on this aspect were made earlier by several workers (Bansal and Mehta, 2008; Jadhao *et al*., 2009). A simple measure of correlation of characters does not quantify the relative contribution of causal factors to the ultimate yield. Since the component traits themselves are inter-dependent, they often affect their direct relationship with yield and consequently restrict the reliability of selection indices based upon correlation coefficients. The path coefficient analysis permits the separation of direct effects from indirect effects through other related traits by partitioning the genotypic correlation coefficients. Hence, the present study was undertaken to estimate the genotypic correlations and direct and to determine the indirect effects of component characters on yield in brinjal hybrids and their parents.

The field experiments with 34 genotypes including ten parents, twenty one F_1 hybrids and three checks were laid out in a randomized block design with three replications during summer season of 2014 at three locations *viz.*, Horticultural College and Research Institute, Tadepalligudem, West Godavari; Horticultural Research Station, Pandirimamidi, East Godavari and Horticultural Research Station, Aswaraopet. Hybrids were developed by using seven lines and three testers in Line x Tester fashion. Thirty days old seedlings were transplanted on the ridges adopting a spacing of 90 x 75 cm. Standard horticultural practices and plant protection measures were taken to raise the crop. The crop was maintained healthy till last harvest and observations were recorded on five randomly selected plants in each plot on 12 quantitative characters. Genotypic and phenotypic correlation between fruit yield per plant and other characters *viz.*, plant height, primary branches per plant, days to 50% flowering, days to final harvest, flowers per cluster, fruits per cluster, fruit length, fruit girth, average fruit weight and fruits per plant.

Genotypic and phenotypic correlation coefficients were estimated according to the formulae given by

Johnson *et al*. (1955). The significance of the phenotypic and genotypic correlation coefficients was tested as given by Snedecor and Cochran (1967). Path coefficient analysis as suggested by Dewey and Lu (1959) was used to partition the genotypic correlation coefficients of fruit yield into direct and indirect effects.

In the present study, the yield per plant showed significant positive correlation with primary branches per plant, days to final harvest, flowers per cluster, fruits per cluster, fruit length, average fruit weight and fruits per plant. Similar significant positive association with fruit yield per plant was reported by Shinde *et al*. (2012) for primary branches per plant, fruit length, average fruit weight and number of fruits per plant; Thangamani and Jansirani (2012) for number of branches per plant and number of fruits per plant; Nalini *et al*. (2009) for flowers per inflorescence.

A significant negative correlation of fruit yield per plant was observed with days to 50% flowering. The same negative association on yield was also observed by Shinde *et al*. (2012) and Thangamani and Jansirani (2012). Though the F_1 hybrids for high yield with earliness is desirable for more number of harvest, due to the negative correlation obtaining, hybrids with these two traits may be difficult.

Days to final harvest positively correlated with flowers per cluster, fruits per cluster, fruits per plant and fruit yield per plant, while negatively correlated with primary branches per plant and average fruit weight. Fruit length showed significant and positive association with primary branches per plant, number of fruits per plant, average fruit weight and yield per plant and negative correlation with plant height, flowers per cluster and fruit girth. Fruit girth showed significant positive correlation with primary branches per plant and average fruit weight, whereas negatively correlated with flower per cluster, fruits per cluster and fruits per plant. These results were also confirmed by the findings of Rekha (2011).

Fruit weight showed significant and negative association with plant height, days to final harvest, flowers per cluster, fruits per cluster and number of fruits per plant and similar findings were reported by Singh and Kumar (2004), while positive correlation with primary number of branches, fruit length and fruit girth indicating that the limited number of fruits per plant more efficiently obtain larger share of the metabolites and thereby increase the fruit girth. These results were also confirmed by the findings of Thangamani and Jansirani (2012).

The path coefficient analysis provides an effective means of finding out direct and indirect effect of association and permits a critical examination of specific forces acting to produce given correlation and measure the relative importance of each factor. The direct and indirect effects of different characters on yield at genotypic level are presented in Table 2.

The path analysis study revealed that the characters *viz*., primary branches per plant, days to 50 % flowering, flowers per cluster, fruit length, average fruit weight and number of fruits per plant exerted positive direct effect on yield. Similar results were reported by Jadhao *et al*. (2009) and Rekha (2011).

Lenka and Mishra (1973) have suggested scales for path coefficients with values 0.00 to 0.09 as negligible, 0.10 to 0.19 low, 0.20 to 0.29 moderate, 0.30 to 0.99 high and more than 1.00 as very high path coefficients. Accordingly, in this study, fruit length exhibited high positive direct effect and indirectly influence the yield through primary branches per plant, days to final harvest, fruits per cluster, average fruit weight and numbers of fruits per plant. Number of fruits per plant also exhibited high positive direct effect and indirectly influence *via* plant height, days to final harvest, flowers per cluster, fruits per cluster and fruit length (Table 2). These results are in close conformity with Singh and Kumar (2004), Rekha (2011), Thangamani and Jansirani (2012) and Shinde *et al*. (2012). The indirect contribution of most of the characters was through fruit length. This result suggests that importance has to be given to this trait in the selection of hybrids for higher yield.

The results of correlation studies suggest that fruit yield per plant can be improved by selecting hybrids for primary branches per plant, days to final harvest, flowers per cluster, fruits per cluster, fruit length, average fruit weight, fruits per plant. Emphasis must be given for characters having high direct effects like fruit length and number of fruits per plant while exercising selection to improve the yield. The indirect effect also showed that most of the characters influenced the yield through fruit length and number of fruits per plant and average fruit weight. These traits also to be considered for yield improvement in brinjal.

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Table 1. Estimates of genotypic (G) and phenotypic (P) correlation coefficients in brinjal

Character		Plant height	Primary branches/ plant	Days to 50% flowering	Days to final harvest	Flowers/ cluster	Fruits/ cluster	Fruit length	Fruit girth	Average fruit weight	Fruits/ plant	Fruit yield/ plant
Plant height	G	1										
	P	1										
Primary branches/ Plant	G	-0.076	1									
	P	-0.034	1									
Days to 50% flowering	G	-0.078	-0.106	1								
	P	-0.038	-0.084	1								
Days to final harvest	G	0.245**	-0.217**	0.034	1							
	P	0.145*	-0.152**	0.027	1							
Flowers/ cluster	G	0.309**	-0.331**	-0.093	0.353**	1						
	P	0.177*	-0.204**	-0.105	0.035	1						
Fruits/ cluster	G	0.032	-0.285**	-0.311**	0.384**	0.418**	1					
	P	0.015	-0.219**	-0.142*	0.298**	0.237**	1					
Fruit length	G	-0.221**	0.299**	0.023	0.11	-0.133*	0.088	1				
	P	-0.193**	0.248**	0.039	0.056	-0.08	0.085	1				
Fruit girth	G	-0.066	0.195**	0.097	-0.092	0.033	-0.327**	-0.518**	1			
	P	-0.055	0.139*	0.074	-0.069	0.031	-0.280**	-0.490**	1			
Average fruit weight	G	-0.411**	0.612**	0.045	-0.205**	-0.150**	-0.374**	0.313**	0.552**	1		
	P	-0.365**	0.478**	0.019	-0.142*	-0.097	-0.338**	0.305**	0.532**	1		
Fruits/ plant	G	0.204**	-0.201**	-0.198**	0.412**	0.239**	0.662**	0.131*	-0.362**	-0.442**	1	
	P	0.168**	-0.150**	-0.122*	0.233**	0.167**	0.546**	0.125*	-0.307**	-0.391**	1	
Fruit yield/plant	G	-0.071	0.263**	-0.222**	0.233**	0.187**	0.419**	0.453**	-0.116	0.173**	0.737**	1
	P	-0.062	0.199*	-0.140*	0.119*	0.132*	0.340**	0.407**	-0.094	0.155**	0.778**	1

* - Significant at 5.0% level **- Significant at 1.0% level

Table 2. Genotypic path coefficient (direct and indirect effects) of various yield components on yield per plant in brinjal

Character	Plant height	Primary branches/ plant	Days to 50% flowering	Days to final harvest	Flowers/ cluster	Fruits/ cluster	Fruit length	Fruit girth	Average fruit weight	Fruits/ plant	Fruit yield/plant
Plant height	**-0.048**	0.004	0.004	-0.012	-0.015	-0.002	0.011	0.003	0.020	-0.010	-0.071
Primary braches/ plant	-0.013	**0.167**	-0.018	-0.036	-0.055	-0.048	0.050	0.033	0.102	-0.034	0.263**
Days to 50% flowering	-0.012	-0.017	**0.161**	0.005	-0.015	-0.050	0.004	0.016	0.007	-0.032	-0.222**
Days to final harvest	-0.010	0.009	-0.001	**-0.040**	-0.014	-0.015	-0.004	0.004	0.008	-0.016	0.233**
Flowers/ cluster	0.034	-0.036	-0.010	0.038	**0.109**	0.045	-0.014	0.004	-0.016	0.026	0.187**
Fruits/ cluster	0.000	0.002	0.002	-0.002	-0.002	**-0.006**	0.000	0.002	0.002	-0.004	0.419**
Fruit length	-0.318	0.430	0.033	0.158	-0.191	0.127	**1.438**	-0.744	0.451	0.188	0.453**
Fruit girth	0.039	-0.117	-0.058	0.055	-0.020	0.196	0.310	**-0.599**	-0.331	0.217	-0.116
Average fruit weight	-0.126	0.187	0.014	-0.063	-0.046	-0.114	0.096	0.169	**0.306**	-0.135	0.173**
Fruits/plant	0.174	-0.172	-0.169	0.351	0.204	0.564	0.111	-0.309	-0.376	**0.852**	**0.737****

(Bold with underlined figures are direct effects) Residual effect =0.24