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Character association and path analysis in brinjal (*Solanum melongena*) for yield and yield attributes

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ABSTRACT

Character association and path analysis in thirty five genotypicaly diverse indigenous genotypes of brinjal were studied at experimental farm of Central Institute of Temperate Horticulture, Srinagar during year 2009-2010 for eight important characters. The phenotypic and genotypic association of fruit yield was significantly positive with number of fruits/plant, fruit weight and fruit width, whereas plant height, plant spread, number of primary branches and fruit length was non-significantly negatively associated. The genotypic path coefficient revealed that highest positive direct effect (0.700) on fruit yield followed by number of fruits/plant (0.653), plant spread (0.053), fruit width (0.052), fruit length (0.030), whereas plant height (– 0.153) showed negative direct effects on fruit yield/plant (kg). Overall the path analysis confined that direct effect of fruit weight, number of fruits/plant, plant spread, fruit width, fruit length and number of primary branches, whereas indirect effect of plant height should be considered simultaneously for amenability in fruit yield of brinjal.

Key words: Character association, Correlation, Path analysis, *Solanum melongena*

Brinjal (*Solanum melongena* L.) is one of the most widely grown vegetable in India. Efforts are being made to increase its productivity by developing superior varieties. However, yield is a complex character; its direct improvement is difficult. Knowledge in respect of the nature and magnitude of associations of yield with various component characters is a pre-requisite to bring improvement in the desired direction. A crop breeding programme, aimed at increasing the plant productivity requires consideration not only of yield but also of its components that have a direct or indirect bearing on yield. The necessity of coefficient of correlation to describe the degree of association between independent and dependent variables. Path coefficient analysis measures the direct influence of one variable upon another and permits the separation of correlation coefficient into components of direct and indirect effects.

MATERIALS AND METHODS

The present investigations were conducted at Experimental Farm of Central Institute of Temperate Horticulture, Srinagar during 2009-10. The experimental material comprised thirty five genotypes (B-4-6, B-4-9, B-4-8, B-4-10, B-4-5, B-4-1, B-4-15, B-4-11, B-SB-1, B-SB-2, B-SB-6, B-SB-3, B-4-14, B-SB-8, B-SB-19, B-SB-11, B-SB-09, B-SB-10, SH-BH-2, B-4-18, B-4-20, SH-B-113, B-4-16, Pink Round, SH-B-112, Purple Round, PH-5, SH-B-114, Pusa Kranti, SH-B-122, Sel-4, Pusa Purple Cluster, Cluster and SH-BH-1). The soil of experimental farm was loam with normal pH. Suitable agronomic and cultural practices were adopted to obtain good phenotypic expression of the characters. Observations were recorded on plant height, number of primary branches/plant, number of fruits/plant, fruit weight, fruit length, fruit width and average fruit weight, length and width from five randomly selected competitive plants in each genotype of a replication. The fruit yield was obtained on plot basis. The experiment was conducted under randomized block design replicated three times and pooled data of two years were analyzed as per the method suggested by Gomez and Gomez (1984). Data was analyzed to estimate genotypic and phenotypic correlations as well as direct and indirect effects as per the methods of Aljiboure *et al.* (1958) and Dewey and Lu (1958), respectively.

RESULTS AND DISCUSSION

The major causes underlying association are either due to pleiotropic gene action or linkage or both. The phenotypic correlation includes a genotypic and environmental effects, which provides information about total association between

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the observable characters. The phenotypic correlations were normally of genetic and environmental interaction which provided information about the association between the two characters. Genotypic correlation provided a measure of genetic association between the characters and normally used in selection, while environmental as well as genetic architecture of a genotype plays a great role in achieving higher yield combined with better quality. The genotypic and phenotypic correlation for fruit yield and its components in brinjal are presented in Table 1 and only significant correlations are discussed here. The findings clearly indicated that genotypic correlations were of higher magnitude to the corresponding phenotypic ones, thereby establishing strong inherent relationship among the characters studied. The low phenotypic value might be due to appreciable interaction of the genotypes with the environments. The present findings are in conformity with Naidu (2001) and Jogi (2007). Plant height had positive and significant correlation with plant spread and fruit length at phenotypic and genotypic levels. Plant spread and number of primary branches had significant and positive association. The same trend was observed for fruit weight and fruit width. Fruit yield/plant showed significant positive correlation with fruits/plant, fruit weight and fruit width. The results are in agreement with the general statement that plants producing maximum fruits/plant and higher fruit weight are generally observed to be high yielders. Similar observations have been reported by Randhawa *et al.* (1989); Kumar *et al.* (1990) and Nainar *et al.* (1990).

Path coefficient analysis is an important tool for partitioning the correlation coefficients into the direct and indirect effects of independent variables on a dependent variable. With the inclusion of more variables in correlation study, their indirect association becomes more complex. Two characters may show correlation, just because they are correlated with a common third one. In such circumstances, path coefficient analysis provides an effective means of a critical examination of specific forces action to produce a given correlation and measure the relative importance of each factor. In this analysis, fruit yield was taken as dependent variable and the rest of the characters were considered as in dependable variables. The path coefficient analysis, which splits total correlation coefficient of different characters into direct and indirect effects on fruit yield/plant in such a manner that the sum of direct and indirect effects is equal to total genotypic correlation (Table 2).

The data revealed that fruit weight showed the highest positive direct effect (0.700) on fruit yield followed by number of fruits/plant (0.653), plant spread (0.053), fruit width (0.052), fruit length (0.030) and plant height (– 0.153) showed negative direct effects on fruit yield/plant (kg). Whereas, the sum of direct and indirect effects of fruit weight (0.741) showed positive effect on fruit yield/plant. Plant height showed positive indirect effect on fruit yield via plant spread (0.020), number of primary branches (0.003) and fruit length (0.010) however negative indirect effect through number of fruits/plant (– 0.022), fruit weight (– 0.149) and fruit width (– 0.012). Plant spread exhibited positive indirect effect on fruit yield via number of primary branches (0.007), fruit weight (0.023) , fruit length (0.002) and fruit width (0.003) while negative indirect effect via plant height (– 0.058), number of fruits/plant (– 0.152). Number of primary branches exhibited positive indirect effect on fruit yield through plant spread (0.017), fruit length (0.006) and fruit width (0.004). Number of fruits/plant had positive indirect effect on fruit yield through plant height (0.005) and fruit length (0.007) and negative indirect effect via plant spread (– 0.012), Number

Table 1 Genotypic and phenotypic correlation among important characters in brinjal

Character	Plant height (cm)	Plant spread (cm)	No. of primary branches	No. of fruits/ plant	Fruit weight (g)	Fruit length (cm)	Fruit width (cm)	Fruit yield (kg/plant)
Plant height	G 1.000	0.388*	0.135	– 0.034	– 0.213	0.354*	– 0.246	– 0.300
(cm)	P1.000	0.335*	0.093	0.004	– 0.180	0.294*	– 0.207	– 0.210
Plant spread		G1.000	0.324*	– 0.232	0.033	0.095	0.061	– 0.119
(cm)		P1.000	0.244*	– 0.149	0.028	0.089	0.028	– 0.048
No. of primary			G1.000	– 0.190	0.051	0.207	0.076	– 0.117
branches			P1.000	– 0.123	– 0.033	0.180	0.072	– 0.010
No. of fruits/				G1.000	– 0.043	0.233	– 0.134	0.611**
plant				P1.000	– 0.024	0.193	– 0.151	0.598**
Fruit weight					G1.000	0.0263	0.670**	0.741**
(g)					P1.000	0.135	0.566**	0.653**
Fruit length						G1.000	– 0.312	0.141
(cm)						P1.000	– 0.251	0.138
Fruit width							G1.000	0.466*
(cm)							P1.000	0.338*
Yield (kg/plant)								G1.000
								P1.000

*Correlation is significant at the 0.05 level, **correlation is significant at the 0.01 level

Table 2 Direct (bold) and indirect effects of different yield attributes on fruit yield of brinjal

Character	Plant height (cm)	Plant spread (cm)	No. of primary branches	No. of fruits/ plant	Fruit weight (g)	Fruit length (cm)	Fruit width (cm)	Genotypic correlation with fruit yield (kg/plant)
Plant height (cm)	*–0.153*	0.020	0.003	– 0.022	– 0.149	0.010	– 0.012	– 0.300
Plant spread (cm)	–0.058	*0.053*	0.007	– 0.152	0.023	0.002	0.003	-0.119
No. of primary branches	–0.020	0.017	*0.023*	– 0.124	– 0.023	0.006	0.004	v0.117
No. of fruits/plant	0.005	– 0.012	– 0.004	*0.653*	-0.030	0.007	– 0.007	0.611**
Fruit weight (g)	0.032	0.001	– 0.001	– 0.028	*0.700*	0.001	0.035	0.741**
Fruit length (cm)	–0.053	0.005	0.004	0.152	0.0185	*0.030*	– 0.016	0.141
Fruit width (cm)	0.0371	0.003	0.001	– 0.087	0.468	– 0.009	*0.052*	0.466*

Residual effect 0.128

of primary branches (– 0.004), fruit weight (– 0.030) and fruit width (– 0.007). Fruit weight showed positive indirect via plant height (0.032), plant spread (0.001), fruit length (0.001), fruit width (0.035), whereas negative indirect effect through number of primary branches (– 0.001), number of fruits/plant (– 0.028). Fruit length showed positive indirect effect on fruit yield via plant spread (0.005), number of primary branches (0.004), number of fruits/plant (0.152), fruit weight (0.0185) however negative indirect effect via plant height (– 0.053) and fruit width (0.016). Fruit width had positive indirect effect via plant height (0.032), plant spread (0.003), number of primary branches (0.001) and fruit weight (0.468), whereas negative indirect effect via number of fruits/plant (– 0.087) and fruit length (– 0.009) on fruit yield. Path analysis revealed high direct contribution of plant spread number of primary branches, number of fruits/plant, fruit weight, fruit length and fruit width on fruit yield. Vadivel and Bapu (1989) revealed the direct effect of fruits/plant, branches/plant and fruit weight in decreasing order on fruit yield. Study of Sharma *et al.* (1985) showed fruit yield to be most important contributor to fruit yield which coincides with the conclusions of present study. However, indirect positive contributions of branches/plant, fruits/cluster were appreciable to influence the yield (Mishra and Mishra 1990).

The effect of residual factor (0.128) on fruit yield was negligible, thereby, suggested that no other major yield component is left over. In present investigation, fruit weight showed high positive and direct effect had significant positive correlation with fruit yield/plant. Therefore, the fruits with higher weight should be considered in selection criteria for increasing fruit yield/plant and more emphasis should be given to selecting genotypes with high fruit weight. Overall the path analysis confined that direct effect of fruit weight, number of fruits/plant, plant spread, fruit width, fruit length and number of primary branches, whereas indirect effect of plant height should be considered simultaneously for amenability in fruit yield of brinjal. The unexplained variation in genotypic path coefficient was 0.128. It predicted that 0.879 per cent variation at genotypic level had been determined and further indicated that some more factors not considered in this study contributed to fruit yield/plant. Therefore, some more traits may be considered while selecting the genotypes for high fruit yield in brinjal for temperate region.

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