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CORRELATION AND PATH COEFFICIENT ANALYSIS STUDIES ON YIELD AND ATTRIBUTING CHARACTERS IN BRINJAL (*SOLANUM MELONGENA* L.)

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ABSTRACT

Present investigation was carried out with twenty genotypes along with two hybrid check and two OP check of brinjal hybrids collected from IIVR Varanasi to assess genotypic and phenotypic correlations between yield and its components and also between the contributing components for simultaneous improvement of character through selection on the basis of one of the character Correlation studies revealed that yield per plant showed positive correlation with number of branches per plant and number of fruit per plant. A significant negative correlation of yield was observed with days to first flowering, days to fifty per cent flowering, days to first picking, number of flower per clusters, number of fruit per clusters and total soluble solid (TSS). The path analysis revealed that the number of fruits per plant followed by fruit weight showed high significant positive correlation and direct effect with fruit yield per plant. Therefore, the fruits with higher weight and plant having number of fruits thus, direct selection for any of the character would be effective for yield improvement in brinjal with simultaneous improvement of rest of the character.

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INTRODUCTION

Brinjal *(Solanum melongena* L. 2n = 24) belonging to family Solanaceae is one of the most important and popular vegetable crop grown round the year all over the country. Which holds coveted position among the different vegetables.There is an increasing demand for its varieties, which are used for different preparations. Before initiating an effective selection programme, it is necessary to know the importance and association of various components with yield and among each other. Studies on this aspect were made earlier by several workers. 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-dependant, they often affect their direct relationship with yield and consequently restrict the reliability of selection indices based upon correlation coefficients. 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. Hence knowledge of association between yield and its component characters and between component characters is essential for yield improvement through selection programme. Certain characters might indirectly influence yield, but their correlation with yield may not be statistically significant. In such cases, path coefficient analysis is an efficient technique, which permits the separation of coefficients into components of direct and indirect effects.The path coefficient analysis permits the separation of direct effects from indirect effects through other related traits by partitioning the genotypic correlation coefficients (Thangamani and Jansirani, 2012).Therefore, the present study was undertaken with the objective to understand the correlation coefficient among the various traits and their direct and indirect effects on yield in brinjal hybrids. The intensity of association of characters is determined by correlation studies. Such correlation studies help us to know which character should be chosen for selection to bring about the maximum increase in the ultimate. For planning and execution of a successful breeding program, the most essential pre-requite is the availability of substantial desirable genetic variability for important characters in the germplasm and the extent to which the desirable characters are heritable. Knowledge of correlation between different quality characters are basic and fore most endeavor to find out guidelines for selection of quality genotypes In this regard a good number of works has been reported by Dhanwani *et al.* (2013).

Fruit yield of brinjal is a polygenic trait, which is governed by numbers of gene action; direct selection for yield alone is usually not very effective. Hence, selection based on its contributing traits could be more efficient and reliable (Kumar *et al*., 2013a; Kumar *et al*., 2013b). The achievement of any breeding program mainly depends on genetic diversity, trait interrelationship and direct and indirect effects on yield and its attributing traits. Association of plant characters which is determined by correlation coefficient is although useful in determining the relative influence of the various characters on fruit yield. Path coefficient analysis a mathematical data tools in partitioning the correlation co-efficient into direct and indirect effects. Hence, study of correlations and path coefficient analysis of yield would be of help in selection of yield component traits in the genetic improvement of quantitative

traits, which are positively correlated. Correlation and path coefficient analysis have been studied by several workers to measure the associations between fruit yield and other traits. Certain characters might indirectly influence yield, but their correlation with yield may not be statistically significant. In such cases, path coefficient analysis is an efficient technique, which permits the separation of coefficients into components of direct and indirect effects.The path coefficient analysis permits the separation of direct effects from indirect effects through other related traits by partitioning the genotypic correlation coefficients (Thangamani and Jansirani, 2012).Therefore, the present study was undertaken with the objective to understand the correlation and path coefficient among the various traits and their direct and indirect effects on yield in brinjal hybrids.

MATERIALS AND METHODS

The investigation was carried out at the Research and Instruction farm, Department of Vegetable Science, IGKV Raipur during rabi season of 2014-15. The experiment was comprised of twenty genotypes (16 F_1 + 2 check hybrid and 2 check open Pollinated) collected from IIVR Varanasi *viz*. 2014/BRRHYB-1, 2014/BRRHYB-2, 2014/BRRHYB-3, 2014/BRRHYB-5, 2014/BRRHYB-6, 2014/BRRHYB-7, 2014/BRRHYB-8, 2013/BRRHYB-1, 2013/BRRHYB-2, 2013/BRRHYB-3, 2013/BRRHYB-4, 2013/BRRHYB-5, 2012/BRRHYB-2, 2012/BRRHYB-3, 2012/BRRHYB-4, 2012/BRRHYB-5 and two hybrid check variety EPH-178, Pusa Hybrid-6 and two open pollinated check variety is Kashi Sandesh and Swarna Mani. These genotypes were laid out in Randomized Complete Block Design (RCBD) with three replication to estimate the correlation coefficient and path coefficient in brinjal hybrids. The field was prepared by ploughing and frequent harrowing. All other recommended practices and plant protection measures were adopted to raise healthy crop. The seedlings were transplanted at 75 cm × 60 cm spacing. The observation were recorded from randomly selected five plants for the characters *viz*., plant height at 120 DAT (cm), number of branches per plant at 120 DAT, day to first flowering, days to 50 per cent flowering, days to first picking, number of flowers per cluster, number of fruits per cluster, number of pickings, per cent of fruit set, fruit length (cm), fruit girth (cm), fruit weight (g), TSS (%), pericarp thickness (mm), number of fruits per plant and fruit yield per plant (kg). Genotypic and phenotypic correlation coefficients were estimated according to the formulae given by Johnson *et al*. (1955). Path coefficient analysis as applied by Dewey and Lu (1959) was used to partition the genotypic correlation into components of direct and indirect effects. For this purpose computer software Statistical Package for Agricultural Research (SPAR 2.0) software was used.

RESULTS AND DISCUSSION

The result revealed that there was inherent association between various characters but their phenotypic expression was influenced by the climatic conditions of the four seasons under study. Hence the discussion of the present study is based on correlation coefficient over the environment. Genotypic correlations were higher in magnitude than their respective phenotypic correlations in general also reported by Reddy *et al*., in 2011. Environmental correlations are of least importance to the breeder but they give an idea about how to environmental conditions influence the phenotypic expression of various character

The correlation coefficients were calculated to measure the degree of association between pair of characters at phenotypic and genotypic levels. Among the quality components, the number of flowers, fruit weight and fruit diameter were the de sired quality of fruit, while increase in number of branches per plant and number of fruits per plant were required quality of fruit in brinjal. The remaining characters were related to the components of yield.

The correlation between fruit yield per plant with different yield attributes and among the attributes themselves are presented in tables 1. Out of sixteen characters number of fruits per plant and number of branches per plant exhibited a positive and significant correlation with total fruit yield per plant.Characters was positive and high this indicates that fruit yield in brinjal can be improved by direct selection of fruit character like number of branches per plant and numbers of fruits per plant. The positive correlation between the desirable characters is favourable to the plant breeder because it helps in simultaneous improvement of all the characters. The present findings are in conformity with Lohakare (2008) who reported that fruit yield per plant was closely associated with number of fruits per plant, fruits per cluster, fruit index, average fruit weight. Similar results were also obtained by Bansal and Mehta (2008), Thangamani and Jhansirani (2012). Shabarish *et al*.(2014) and Sheela *et al*. (2014) in Cluster bean.

A significant negative correlation of yield was observed with days to first flowering, days to fifty per cent flowering, days to first picking, number of flower per clusters, number of fruit per clusters and total soluble solid (TSS). The same negative association on yield was also observed by Dharwad *et al*. (2009) who reported that weak association with days to first flowering and number of fruits fruit per cluster.Ansari *et al*. (2011) also reported negative significant correlation with days to first picking, days to flowering and days to first fruiting.

Path coefficient analysis provides an effective means of partitioning direct or indirect causes of association. As yield is influenced by many factors, selection based on correlation may be misleading because it measures only the mutual association between two variables, whereas path coefficient analysis specifically measures the relative importance of different yield components. To find out the direct and indirect effects and to measure the relative importance of causal factors, path coefficient analysis is useful, which permits critical examination of the specific forces acting to produce a given correlation (Bhatt, 1973; Izge *et al*., 2012).

The results of the present investigation on path coefficient analysis as presented in Table 2 and revealed that the direct and indirect effect of yield attributing characters on total fruit yield. In the present study number of fruits per plant (1.825) followed by fruit weight (1.272), fruit length (0.255), TSS (0.202), fruit girth (0.159), days to fifty per cent flowering (0.124) and number of fruits per cluster (0.050) showed positive direct effect on fruit yield. Bansal and Mehta (2008) also reported that fruits per plant had maximum direct positive effect on

Table 1: Genotypic and phenotypic correlation coefficient between fruit yield and its component characters in brinjal

Characters		Plant height (cm)	No. of branches per plant	Day to first flowering	Days to 50% flowering	Days to first picking	Number of flowers per cluster	Number of fruits per cluster	Number of pickings	Per cent of fruit set	Fruit length (cm)	Fruit girth (cm)	Fruit weight (g)	TSS (%)	Pericarp thickness (mm)	Number of fruits /plant	Fruit yield/ plant (kg)
	P	1.000	0.275	0.249	0.075	0.143	-0.115	-0.324	-0.215	-0.4	0.184	-0.149	-0.033	-0.247	-0.303	0.117	0.057
1	G	1.000	0.338	0.314	0.194	0.19	-0.112	-0.35	-0.242	-0.459*	0.191	-0.178	-0.053	0.273	-0.319	0.192	0.141
	P		1.000	0.127	0.268	0.03	-0.147	-0.108	-0.133	0.087	0.078	-0.026	0.187	0.199	-0.086	0.329	0.413
2	G		1.000	0.302	0.419	0.108	-0.149	-0.132	-0.316	0.034	0.1	-0.001	0.198	0.195	-0.101	0.376	0.525*
	P			1.000	0.615**	0.322	0.286	0.005	-0.606**	-0.412	-0.016	-0.492*	-0.352	0.42	-0.464*	0.183	-0.132
3	G			1.000	0.953**	0.481*	0.357	-0.021	-0.896**	-0.572**	0.011	-0.612**	-0.480*	0.482*	-0.578**	0.261	-0.226
	P				1.000	0.306	0.458*	0.224	-0.453*	-0.305	-0.087	-0.44	-0.281	0.337	-0.41	0.233	-0.114
4	G				1.000	0.631**	0.672**	0.274	-0.866**	-0.604**	-0.164	-0.573**	-0.455*	0.437	-0.564**	0.318	-0.32
	P					1.000	0.509**	0.355	-0.549*	-0.189	-0.385	-0.438	-0.455*	0.366	-0.475*	0.331	-0.173
5	G					1.000	0.688**	0.524*	-0.729**	-0.242	-0.627**	-0.702**	-0.711**	0.565**	-0766**	0.646**	-0.121
	P						1.000	0.794**	-0.450*	-0.309	-0.378	-0.488*	-0.643**	0.201	-0.604**	0.483*	-0.136
6	G						1.000	0.823**	-0.604**	-0.281	-0.411	-0.518*	-0.702**	0.217	-0.627**	0.554*	-0.126
	P							1.000	-0.243	-0.305	-0.445*	-0.316	-0.541*	-0.043	-0.312	0.531*	-0.02
7	G							1.000	-0.29	0.312	-0.482*	-0.392	-0.579**	-0.051	-0.318	0.590**	-0.019
	P								1.000	0.329	0.13	0.543*	0.533*	-0.471*	0.634**	-0.303	0.225
8	G								1.000	0.474*	0.234	0.754**	0.747**	-0.664**	0.826**	-0.463*	0.334
	P									1.000	-0.131	0.258	0.211	-0.303	0.424	0.044	0.186
9	G									1.000	-0.188	0.316	0.237	-0.371	0.468*	0.026	0.163
	P										1.000	0.22	0.164	0.096	0.014	-0.323	0.018
10	G										1.000	0.253	0.165	0.108	0.024	-0.339	0.04
	P											1.000	0.740**	-0.226	0.464*	-0.479*	0.266
11	G											1.000	0.832**	-0.226	0.479*	-0.538*	0.334
	P												1.000	-0.085	0.464*	-0.572**	0.279
12	G												1.000	-0.102	0.507*	-0.606	0.337
	P													1.000	-0.707**	-0.058	-0.098
13	G													1.000	-0.730**	-0.08	-0.139
	P														1.000	-0.304	0.056
14	G														1.000	-0.334	0.088
15	P															1.000	0.484*
	G															1.000	0.447*
16	P																1.000
	G																1.000

*Significant at5%, **Significant at1%

Table 2: Direct and indirect effect of component characters on fruit yield in brinjal

Characters	Plant height (cm)	No. of branches per plant	Days to first flowering	Days to 50% flowering	Days to first picking	Number of flowers / cluster	Number of fruits /cluster	Number of pickings	Per cent of fruit set	Fruit length (cm)	Fruit girth (cm)	Fruit weight (g)	TSS (%)	Pericarp thickness (mm)	Number of fruits/ plant	Fruit yield/ plant (kg)
Plant height (cm	-0.180	-0.185	-0.070	0.024	-0.045	0.047	-0.017	0.090	0.096	0.049	-0.028	-0.067	0.055	0.023	0.351	0.141
No. ofbranches per plant	-0.061	-0.548	-0.068	0.052	-0.025	0.062	-0.007	0.118	-0.007	0.026	0.000	0.251	0.039	0.007	0.686	0.525
Days to first flowering	-0.057	-0.165	-0.224	0.118	-0.113	-0.148	-0.001	0.335	0.119	0.003	-0.097	-0.610	0.097	0.042	0.475	-0.226
Days to 50% flowering	-0.035	-0.229	-0.214	0.124	-0.148	-0.279	0.014	0.323	0.126	-0.042	-0.091	-0.5578	0.088	0.041	0.580	-0.320
Days to first picking	-0.034	-0.059	-0.108	0.078	-0.235	-0.285	0.026	0.272	0.050	-0.160	-0.111	-0.904	0.114	0.056	1.178	-0.121
Number of flowers/ cluster	0.020	0.082	-0.080	0.083	-0.161	-0.415	0.041	0.225	0.059	-0.105	-0.082	-0..892	0.044	0.046	1.010	-0.126
Number of fruits/cluster	0.063	0.073	0.005	0.034	-0.123	-0341	0.050	0.108	-0.065	-0.123	-0.052	-0.736	-0.010	0.023	1.077	-0.019
Number of pickings	0.044	0.173	0.201	-0.107	0.171	0.250	-0.014	-0.373	-0.099	0.060	0.119	0.950	-0.134	-0.061	-0.845	0.334
Per cent of fruit set	0.083	-0.019	0.128	-0.075	0.057	0.117	0.016	-0.177	-0.209	-0.048	0.050	0.301	-0.075	-0.034	0.048	0.163
Fruit length (cm	-0.034	-0.055	-0.003	-0.020	0.147	0.170	-0.024	-0.087	0.039	0.255	0.040	0.210	0.022	-0.002	-0.619	0.040
Fruit girth (cm	0.032	0.001	0.137	-0.071	0.165	0.215	-0.016	-0.281	-0.066	0.065	0.159	1.058	-0.046	-0.035	-0.982	0.334
Fruit weight (g)	0.010	—0.108	0.108	-0.056	0.167	0.291	-0.029	-0.279	-0.049	0.042	0.132	1.272	-0.021	-0.037	-1.105	0.337
TSS	-0.049	-0.107	-0.108	0.054	-0.133	-0.090	-0.003	0.248	0.077	0.028	-0.036	-0.130	0.202	0.053	-0.146	-0.139
Pericarp thickness	0.058	0.055	0.130	-0.070	0.180	0.260	-0.016	-0.308	-0.098	0.006	0.076	0.645	-0.147	-0.073	-0.609	0.088
Number of fruits per plant	-0.035	-0.206	-0.058	0.039	-0.151	-0.230	0.029	0.173	-0.005	-0.087	-0.085	-0.770	-0.016	0.024	1.825	0.447

Residual value: 0.1085; Diagonal and bold underline figures shows direct effect on fruit yield

yield while Shinde *et al.* (2012) reported length of fruit, number of fruits per cluster, plant height, days to last picking, average weight of fruit and number of fruits per plant would be selection criteria for yield improvement in brinjal. Kushwah and Bandhopadhya (2007) who also reported that number of fruits per plant, fruit diameter had direct positive effect on fruit yield

Number of branches per plant (-0.548), number of flowers per cluster (-0.415), number of pickings (-0.373), days to first picking (-0.235), days to first flowering (-0.224), per cent of fruit set (-0.209), plant height (-0.180) and pericarp thickness (-0.073) exhibited negative direct effect on yield. The results in accordance with the finding of Kushwah and Bandhopadhya (2007) who reported that days to first picking showed negative direct effect on yield and Ahmad *et al.* (2013) observed plant height showed negative direct effect on yield.

The path analysis exhibited that the traits like number of fruits per plant fruit weight, fruit length, TSS, fruit girth, days to fifty per cent flowering and number of fruits per cluster were the most important yield contributing characters owing to their high direct effects and indirect effects via other traits.

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, the numbers of fruits per plant (1.825) and fruit weight (1.272) exhibited very high positive direct effect on fruit yield. Fruit length (0.255) and TSS (0.202) showed moderate positive direct effect and fruit girth (0.159) and days to fifty per cent flowering (0.124) exhibited low positive direct effect on fruit yield per plant.

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