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Evaluation on genetic parameters, interrelationships and path analysis for yield attributes in Brinjal

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Abstract
Genetic parameters in terms of heritability, genetic advances, correlation and path coefficient, were estimated for yield and related traits in 16 genotypes of brinjal. The highest GCV was recorded in number of flowers per plant, fruit yield per plant, yield per plot, yield per hectare, average weight of fruits. High heritability coupled with high Genetic Advance were observed for fruit weight, fruit yield per plant, leaves per plant, fruit length, yield per plot, yield per hectare and total reducing sugar indicating that the characters are governed by additive gene action. Correlation and path coefficient (genotypic and phenotypic) revealed that the direct contribution of fruit yield per plant, fruit yield per hectare, fruit weight, number of fruits per plant, and number of flowers per plant was of higher magnitude on fruit yield. These traits play a major role and must be considered in selection program for the improvement of the yield potential of brinjal.

Keywords: genetic variability, correlation, path analysis, heritability

Introduction
Brinjal (*Solanum melongena* L.) was first cultivated in India which is regarded as the primary center of origin/diversity. It has ayurvedic medicinal properties because it is a good source of vitamins A, C and minerals. To overcome such situation; genetically stable genotypes having high yield potential are urgently needed. It is, therefore, necessary to estimate relative amounts of genetic and non-genetic variability exhibited by different characters using suitable parameters. Besides estimating the nature and magnitude of the correlation coefficient, path coefficient and genetic association between yield and yield traits, the traits that contributed to yield and are suitable to identify by variability and association analysis between yield and its attributes. In such case, path coefficient analysis is an important technique for partitioning the correlation coefficient into direct and indirect effect of independent variables on the dependent variable. It is, therefore, genetic variability as well as correlation and path coefficient may be important tools for the breeder to enhancing the production and productivity of the eggplant. It is of considerable importance in selection for elite genotype as well as exploitation of heterosis breeding program. The present study was conducted to assess genetic variability, heritability and path coefficient analysis yield and its component characters to provide necessary information that could be useful in brinjal improvement programs aimed at improving yield.

Materials and Methods
In this experiment, sixteen genotypes collected from the Indian Institute of Vegetable Research (IIVR), Varanasi were used for study. All genotypes of brinjal were planted at a spacing 45 x 60 cm in Randomized Block Design (RBD) with three replications at Horticulture Research Farm Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, and Lucknow (U.P.). The observations were recorded on five randomly selected genotype of each plot in all the replication. Fourteen important characters were studied i.e. plant height, number of branches per plant, number of leaves per plant, fruit length, fruit diameter, fruit weight, number of fruits per plant, fruit yield per plot, fruit field per plant, fruit yield per hectare, total soluble solids, total sugars and reducing sugars. The analysis of variance for testing variation among the characters studies was estimated as per the procedure given by Panse and Sukamtme (1967). Phenotypic and genotypic co-efficient of variation (Burton and Devane, 1953), heritability, genetic advance (Johnson *et al*., 1955) and genetic advance as percent mean were calculated.

Results and Discussion
All the traits exhibited highly significant difference among treatments which indicated wide spectrum of genetic variability among the cultivars. Analysis and variance (Table-1) revealed

highly significant difference for almost all the characters studied indicating the existence of sufficient variability. The genotype exhibited large amount of variation for all the fourteen characters. It ranged from 45.83 to 72.63 cm for height of plant, 5.51 to 11.33 c or number of branches per plant. 83.30 to 166.20 for number of leaves per plant, 5.48 to 18.06 for number of flower per plant. 8.36 to 24.43 cm for fruit length, 4.05 to 9.53 cm for fruit diameter, 82.5 to 274.5 g for fruit weight, 5.26 to 16.43 for number of fruits per plant, 2.60 to 21.03 kg for fruit yield per plot, 3.50 to 0.43 for fruit yield per plant, 3.25 to 25.56 for fruit yield per hectare, 5.00 to 6.93°Brix for (TSS) Total soluble solids, 1.05 to 2.62g for total sugars and 0.21to 0.47 for reducing sugars. This wide range of variability for different characters indicated the scope for selection of suitable initial material for breeding, in the improvement of brinjal.

The degree of variability (Table-2) shown by different parameters can be judged by the magnitude of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PVC). The GCV values were low in magnitude compared to PCV values for all the characters studied (Table 1). Among the fourteen traits showed a range of GCV for various characters varied from 11.33 (Total Soluble Solids) to 56.10 (Fruit yield per plant kg). The GCV and PCV values were found to be very distant to each other for most of the characters suggesting the presence of large amount of variability. High amount of phenotypic and genotypic variation was observed for fruit yield per plant (kg). Character like fruit yield per plot (kg), fruit yield per hectare (tonnes), number of fruits per plant, fruit weight (g) and number of flowers per plant moderate PCV and GCV values and rest for all the traits studies GCV values were recorded less than the PCV values. Similar finding was reported by Doshi *et al*., (1999).

To determine the amount of heritable variation estimate of GCV alone is not sufficient. Therefore, heritable variation can be find out with the greater degree of accuracy when heritability is studied conjunction with genetic advance. The value of heritability in broad sense for all the character range from 84.10 (number of branches per plant) to 99.98 (fruit weight). The characters like fruit weight (g), number of leaves per plant, fruit length (cm) and Total reducing sugar (g) had high heritability. This high heritability indicates that the traits are mostly governed by genetic factors with little role of environment in the phenotypic expression of these characters. Moderate heritability was recorded for Total Soluble Solids, fruit yield per hectare, fruit yield per plant (kg) and fruit yield per plot (kg), whereas plant height (cm) exhibited low heritability (93.35). These results are in close conformity with the findings of Singh and Singh (1994). The study also revealed that the character fruit yield per plant (kg), fruit yield per plot (kg), fruit weight (g) and fruit yield per hectare (tonnes) had higher genetic advance and genetic advance as percent of mean. Lower genetic advance was exhibited by Total reducing sugar (g), Total sugar (g) and fruit yield per plant (kg). High heritability accompanied with high genetic advance were observed for all most all the characters studies except number of flowers per plant and fruit yield per plot (kg) which showed high heritability with low genetic advance confirming the preponderance of additive genes in controlling the expression of these characters and thus were found to be providing better opportunity for effective and reliable selection for these characters. These findings were corroborated with the findings of Rai *et al*, (1988) and Mohanty (1999). Heritability estimates provide a measure of the effectiveness with which selection can be exploit the genetic variability.

Genotypic correlation was higher in magnitude than the phenotypic indicating strong inherent relationship among the characters except the few which could be due to the modifying effects in the environment studied. Genotypic correlation provides a measure of genotypic association among different traits and helps in identifying the traits in selection. The result indicates that the genotypic correlation coefficient showed positive and significant between plant height and number of branches per plant, number of fruits per plant, average fruit weight and yield per plot at 5% level of significance. These results are in agreement with the work of Prabhu and Natarajan (2007). Thus, providing that these attributes were more influencing the yield in eggplant and they can serve as important traits for improvement of yield per plant.

The path analysis was carried out at phenotypic and genotypic level to assess the direct and in direct effect of different characters on fruit yield. The direct and in direct effect of yield contributing traits on yield revealed that the maximum positive direct effect was exhibited by fruit yield per hectare followed by fruit yield per plant, fruit weight, number of fruits per plant and number of flowers per plant. High negative direct effect was recorded in total sugars followed by reducing sugar and fruit length. Similar, findings were also observed by Mishra and Mishra (1990). These characters emerged as essential components of yield per plant and should be kept in mind during selection of any genotypes. These characters with in direct effect are not directly involved in increase of yield per plant.

Table 1: Analysis of variance for 16 genotypes of Brinjal.

Source of variance	D.f.	Characters											
		Plant height (cm)	Number of branches/plant	Number of flowers /plant	Fruit length (cm)	Fruit dia. (cm)	Fruit weight (g)	No. of fruits/ plant	Fruit yield/plant (kg)	Fruit yield/plot (kg)	Fruit yield /hectare (kg)	TSS	Total sugar
Replication	2	48.04	3.10	2.54	0.18	0.02	0.22	4.25	0.004	0.38	0.22	0.08	0.46
Treatment	15	196.41	2215.10	44.27	78.78	7.72	8119.44	40.45	1.627	57.71	86.55	1.18	0.76
Error	30	13.05	10.8	1.26	0.24	0.24	1.47	1.41	0.026	1.01	1.23	0.01	0.04

Table 2: Estimate of Range, standard error mean, phenotypic coefficient of variation (PCV), genetic coefficient of variation (GCV), genetic advance (GA) and genetic advance as percent of mean(GAM) for different characters in Brinjal.

S. No.	Characters	Range		S.E. of mean	PCV (%)	GCV (%)	Heritability	Genetic Advance	Genetic advance % of mean
		Min.	Max.						
1	Plant height	45.83	72.63	2.086	13.54	13.08	93.35	15.56	26.04
2	Number of branches/plant	55.51	11.33	0.685	19.04	17.45	84.10	2.97	32.94

3	Number of leaves /plant	83.30	166.2	1.899	21.26	21.20	99.51	55.70	43.58
4	Number of flowers /plant	5.48	18.06	0.650	35.93	35.41	97.13	7.68	71.89
5	Fruit length (cm)	8.36	24.03	0.387	34.22	34.12	99.43	10.49	70.10
6	Fruit dia. (cm)	4.05	9.53	0.287	2.53	26.10	96.80	3.20	52.91
7	Fruit weight (g)	82.56	274.5	0.701	40.40	40.40	99.98	107.15	83.21
8	No. of fruits/ plant	5.26	16.43	0.687	36.35	35.71	96.50	7.29	72.27
9	Fruit yield/plant(kg)	0.43	3.50	0.094	56.57	56.10	98.35	1.49	114.62
10	Fruit yield/plot(kg)	2.60	21.03	0.581	55.80	55.31	98.24	8.87	112.94
11	Fruit yield /hectare(kg)	3.25	25.56	0.641	55.39	54.99	98.57	10.90	112.47
12	TSS	5.00	6.93	0.073	11.41	11.33	98.62	1.27	23.19
13	Total sugar (g)	1.05	2.62	0.128	26.41	25.64	93.58	0.97	51.11
14	Total reducing sugars (g)	0.21	0.47	0.007	25.71	25.61	99.20	0.15	52.55

Conclusion

Based on the result of investigations, it can be concluded that besides direct selection for average fruit yield per plant, indirect selection through number of branches and average number of fruit per plant should also be considered for further improvement in fruit yield of brinjal. Among genotype evaluated DRNKY-01-11-1011, Azad Brinjal-5, JB-7, Punjab Sadabahar and Rajendra Brinjal gave best result as per as yield per plant and other yield component are concerned. These cultivars may be used to breeding programs for development of high yielding varieties.

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