IJPS INTERNATIONAL JOURNAL OF PLANT SCIENCES
e ISSN-0976-593X Volume **12** | Issue 1 | January, 2017 | 21-27

DOI: 10.15740/HAS/IJPS/12.1/21-27
Visit us - *www.researchjournal.co.in*

RESEARCH ARTICLE

Genetic variability and correlation studies in brinjal (*Solanum melongena* L.)

■ **G. SAMLINDSUJIN, P. KARUPPAIAH AND K. MANIVANNAN**

SUMMARY

The present investigation was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University, during the period 2014 - 2015 to asses the extent of genetic variability, heritability, correlation and path co-efficient analysis of 60 genotypes of brinjal for yield and shoot and fruit borer tolerance. The experiment was laid out in Randomized Block Design with three replications. From the analysis of data, it can be concluded that the maximum phenotypic and genotypic variation was noted for fruit yield per plant (67.94 and 67.27%) followed by fruit weight (50.70 and 50.41%), fruit girth (30.72 and 29.88%), number of fruits per plant (29.99 and 29.79%) followed by shoot and fruit borer incidence (21.59 and 21.37%). High heritability along with high estimates of GCV, genetic advance and genetic gain was observed for fruit yield per plant, fruit weight, number of secondary branches per plant and shoot and fruit borer incidence. Among the sixteen morphological characters studied, number of long styled flowers per plant (8.803), number of short styled flowers per plant (5.403), number of fruits per plant (3.099), fruit weight (0.757), days to first harvesting (0.133) and shoot and fruit borer incidence (0.082) showed positive direct effect in path co-efficient analysis. Positive correlation was recorded for fruit weight (0.885), fruit girth (0.644) and number of fruits per plant (0.622).

Key Words : Brinjal, Variability, Heritability, Correlation, Path analysis, Shoot, Fruit borer tolerance

How to cite this article : Samlindsujin, G., Karuppaiah, P. and Manivannan, K. (2017). Genetic variability and correlation studies in brinjal (*Solanum melongena* L.). *Internat. J. Plant Sci.*, **12** (1): 21-27, **DOI: 10.15740/HAS/IJPS/12.1/21-27**.

Article chronicle : Received : 20.08.2016; **Revised :** 09.11.2016; **Accepted :** 05.12.2016

Brinjal (*Solanum melongena* L., 2n = 24) belonging the family Solanaceae is an important and popular vegetable crop of origin, India has accumulated with wide range of variability in this crop. Further, the crop exhibits rich genetic diversity and scope for improvement for various horticultural traits. Heritability is the heritable portion of phenotypic variance. It is a good index of the transmission of characters from parents to offspring Falconer (1981).

The estimates of heritability help the plant breeder in selection of elite genotypes from diverse genetic populations. Development of high yielding as well as shoot and borer tolerance cultivar requires knowledge of existing genetic variation and also the extend of association among yield contributing characters. The variability is a combined estimate of genetic and environmental causes. Correlation and path analysis will establish the extent of association between yield and its

MEMBERS OF THE RESEARCH FORUM

Author to be contacted :
G. SAMLINDSUJIN, Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar, CHIDAMBARAM (T. N.) INDIA
Email: samlindsujin@gmail.com

Address of the Co-authors:
P. KARUPPAIAH AND K. MANIVANNAN,Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar, CHIDAMBARAM (T. N.) INDIA

component and also bring out the relative importance of their direct and indirect effects and thus give a clear understanding of their association with yield. Assessment of variation made on truly diverge germplasm provides an idea about the extent of genetic variation. Greater the genetic variability better the chances of improvement of the crop. The present investigation was carried out, keeping this in view to explore the genetic variability, by determining the magnitude of genetic co-efficient of variation, heritability estimates and expected genetic advance of different biometric traits, their correlation and effects in a group of 60 brinjal genotypes.

MATERIAL AND METHODS

The present experiment was carried out in the Department of Horticulture, Faculty of Agricuture, Annamalai University, Chidambaram during 2014 - 2015. The experiment was laid out in Randomized Block Design with three replications. The row to row and plant to plant spacing were maintained at 60 cm x 45 cm, respectively. Sixty brinjal genotypes were collected from various places from India. Among these 30 accessions were collected from NBPGR, New Delhi, 4 genotypes from Tamil Nadu Agricultural University, Coimbatore, 1 genotype from Horticultural Research Station, Pechiparai, 6 genotypes from Cuddalore district, 1 genotype from Vellore district, 5 genotypes from Kannayakumari district, 2 genotypes from Bihar, 3 genotypes from Madurai, 3 genotypes from Kerala and 5 genotypes from Salem district. All the recommended package of practices was followed to raise a good crop. Five competitive plants were marked in each plot per replication and observations were recorded on these plants for 16 quantitative characters *viz.*, plant height, number of primary branches/plant, number of secondary branches/plant, number of long styled flowers, number of medium styled flowers, number of short styled flowers, number of flowers per plant, days to first flowering, fruit set percentage, number of fruits per plant, shoot and fruit borer incidence, fruit length, fruit girth, fruit weight and fruit yield/ plant. For shoot and fruit borer incidence, the number of fruits affected by fruit borer in each plant was recorded at each harvest, without pesticide and fungicidal application. The percentage was worked out on the basis of total number of fruits harvested and expressed in percentage. The mean of 60 germplasm accessions for 16 quantitative characters were analyzed statistically by the method outlined by Ostle (1966). The analysis of variance for different characters was carried out in order to assess the genetic variability among genotypes as given by Cochran and Cox (1950). The level of significance was tested at 5 per cent and 1 per cent using F table values given by Fisher and Yates (1963). Both phenotypic and genotypic co-efficient of variability for all characters were estimated using the formula of Burton and De Vane (1953). The broad sense heritability (h^2) was estimated for all characters as the ratio of genotypic variance to the total or phenotypic variance as suggested by Lush (1949) and Hanson *et al.* (1956). Path co-efficient analysis as suggested by Dewey and Lu (1959) was used to partition the genotypic correlation co-efficient into direct and indirect effects.

RESULTS AND DISCUSSION

Analysis of variance indicated significant differences among genotypes for all the characters indicating that the present genotypes were appropriate and hence, suitable for further genetic analysis. A wide range of variation was observed for all characters under study, particularly for fruit yield/ plant (g), fruit weight (g), fruit girth (cm), fruit length (cm), shoot and fruit borer incidence (%), number of fruits/ plant, fruit set (%), number of flowers/ plant, number of long styled flowers/ plant and plant height (Table 1). The characters showing high degree of variations have more scope for their further improvement.

A better idea can be gained by comparing the relative amount of co-efficient of phenotypic and genotypic variance for the actual strength of variability. The estimates of phenotypic co-efficient of variation was generally higher than genotypic co-efficient of variation for all the traits studied, indicating positive effect of environment on character expression. Among all the characters studied, high phenotypic and genotypic co-efficients of variation, were observed for fruit yield per plant, fruit weight, number of secondary branches per plant and shoot and fruit borer incidence (Table 2) in comparison of other characters, indicating the presence of high amount of genetic variability for these characters and selection for these characters would be effective because the response to selection is directly proportional to the variability present in the experimental population. These results are in agreement with the findings of Baswana *et al.* (2002) and Nayak and Nagre (2013). Moderate estimates of phenotypic co-efficient of variation and genotypic co-efficient of variation were observed

Table 1 : Analysis of variance for various characters in brinjal

Source	df	Plant height (cm)	No. of primary branches/ plant	No. of Secondary branches/ plant	No. of long styled flowers/ plant	No. of medium styled flowers/ plant	No. of short styled flowers/ plant	No. of flowers/ plant	No. of days to 1st flowering	No. of days to 1st harvesting	Fruit set %	No. of fruits / plant	Shoot and fruit borer incidence (%)	Fruit length (cm)	Fruit girth (cm)	Fruit weight (g)	Fruit yield / plant (g)
Replication	2	5.98	0.18	0.36	0.67	0.77	0.75	0.19	1.23	11.41	0.21	0.84	0.24	0.21	0.25	14.99	55503.56
Genotypes	59	578.74**	4.95**	28.96**	128.29**	51.83**	51.32**	186.08**	46.21**	80.97**	288.71**	206.33**	539.62**	16.54**	7.18**	6144.51**	8803852.11**
Error	118	4.78	0.11	0.57	1.88	0.63	1.45	3.95	0.80	7.85	4.34	0.98	3.71	0.15	0.13	23.27	58082.91

** indicate significance of value at P=0.01

for plant height, number of flowers per plant and number of days to first flowering.

With the help of phenotypic co-efficient of variation and genotypic co-efficient of variation alone it is not possible to determine the amount of variation which is heritable. The heritability along with genetic advance is more meaningful and helps in predicting the resultant effect of selection on phenotypic expression. Heritability indicates the effectiveness with which selection for genotypes can be done on the basis of its phenotypic variation in the experimental population. High heritability along with high estimates of GCV, genetic advance and genetic gain was observed for fruit yield/ plant, fruit weight, number of secondary branches/ plant and shoot and fruit borer incidence. Similar results were also reported by Sharma and Swaroop (2000) in brinjal.

In this study, all the characters except days to first harvesting, number of short styled flowers, number of primary branches/ plant had high heritability. Earlier, Chadha and Paul (1984) had reported high estimates of heritability coupled with high genetic gain for some of these characters in brinjal. High heritability and high percentage of genetic advance had been also reported by Manna and Paul (2012) in tomato.

The potential productivity of any crop is basically valued in terms of yield per unit area as well as its tolerance to pest. Its improvement by direct selection is generally difficult because yield is governed by complex polygenic character largely influenced by its various component characters as well as by the environment. Hence, it becomes essential to estimate association of yield per plant with yield contributing characters and among themselves. The knowledge of magnitude and direction of correlation is used for judging how improvement in one character will cause simultaneous change in the other characters.

Data presented in Table 3 indicated that average fruit weight (0.885), fruit girth (0.644), fruit set percentage (0.622) and number of fruits per plant (0.622) had significant positive correlation with yield per plant at genotypic level. At phenotypic level, the positive correlation was recorded for fruit weight (0.870), fruit girth (0.616), fruit set percentage (0.599) and number of fruits per plant (0.611). Shoot and fruit bore incidence showed a negative and non-significant association with yield, both at genotypic (-0.006) and phenotypic (-0.004) levels.

A negative significant association of fruit yield per plant was observed with days to first harvesting, number

of short styled flowers per plant and days to first flowering at genotypic and phenotypic levels. The genotypic correlation co-efficients were similar to phenotypic correlation co-efficients direction. Results indicated that these attributes were mainly influencing the yield of brinjal. This view was supported previously by Kalda *et al*. (1996).

Path co-efficient analysis is an important tool for partitioning the correlation co-efficients into the direct and indirect effects of independent variables on a dependent variable with the inclusion of more variables in correlation study (Table 4). 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 co-efficient 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 independent variables.

Among the sixteen morphological characters studied, number of long styled flowers per plant (8.803), number of short styled flowers per plant (5.403), number of fruits per plant (3.099), fruit weight (0.757), days to first harvesting (0.133) and shoot and fruit borer incidence (0.082) showed positive direct effect. Number of flowers per plant recorded the maximum negative direct effect (-11.719) followed by fruit set percentage (-1.820) and plant height (-0.088), whereas the trait, fruit length was found to have negligible direct effect (-0.021). Shoot and fruit borer incidence showed positive indirect effect on yield through number of flowers per plant (2.044), number of short styled flowers per plant (1.898), fruit set percentage (0.286), number of secondary branches per plant (0.048), fruit weight (0.043), days to first flowering (0.020) and plant height (0.016). The direct selection for these characters would be beneficial for crop improvement since most of these characters also should have positive co-efficient of correlation. The characters which recorded positive effect on yield had indirect positive effect via each other. Therefore, they do not affect each other adversely and hence, can be selected for improving the yield.

In the present study, the residual path effect made a positive contribution (0.151) which suggested that the characters which hold important role in determining the total fruit yield are included in the present study. For the improvement of yield and shoot and fruit borer tolerance, emphasis should be made on all yield contributing

Table 2 : Estimates of variability, heritability, genetic advances per cent of mean for 60 genotypes of brinjal

Sr.No.	Characters	Range	Mean	PCV %	GCV %	Heritability (h^2)%	Genetic advance as per cent of mean
1.	Plant height (cm)	43.72 - 104.71	73.84	18.96	18.73	97.56	38.11
2.	No.of primary branches/plant	1.88 - 7.75	4.29	30.57	29.57	93.57	58.93
3.	No.of secondary branches/plant	4.83 - 15.56	8.88	35.65	34.62	94.32	69.28
4.	No.of long styled flowers/plant	13.6 - 37.2	24.70	26.86	26.86	95.72	52.97
5.	No.of medium styled flowers/plant	12.82 – 27.65	20.72	20.30	19.93	96.45	40.33
6.	No.of short styled flowers/plant	7.75 - 25.24	18.44	23.06	22.11	91.96	43.68
7.	No. flowers/ plant	52.03 – 78.68	63.83	12.60	12.21	93.89	24.37
8.	Days to Ist flowering	24.32 – 38.89	32.31	12.36	12.04	94.96	24.17
9.	Days to Ist harvesting	41.61 – 65.90	51.98	10.92	9.50	75.63	17.01
10.	Fruit set per cent	19.80 – 59.66	43.13	23.08	22.57	95.62	45.47
11.	No. of fruits/ plant	12.40 – 43.78	27.78	29.99	29.79	98.58	60.92
12.	Shoot and fruit borer incidence (%)	36.47 – 91.76	62.54	21.59	21.37	97.97	43.57
13.	Fruit length (cm)	4.28 – 15.59	8.14	29.10	28.72	97.39	58.40
14.	Fruit girth (cm)	3.16 – 11.63	5.13	30.72	29.88	94.60	59.87
15.	Fruit weight (g)	32.62 – 216.87	89.60	50.70	50.41	98.87	103.27
16.	Fruit yield/ plant (g)	479.10 – 7787.70	2538.20	67.94	67.27	98.05	137.21

Table 3 : Phenotypic (P) and genotypic (G) correlation co-efficient between yield and its component characters

Characters		Plant height	Number of primary branches/ plant	Number of secondary branches/ plant	Number of long styled flowers/ plant	Number of medium styled flowers/ plant	Number of short styled flowers/ plant	Number of flowers/ plant	Number of days to 1st fowering	Number of days to 1st harvesting	Fruit set percentage	Number of fruits/ plant	Shoot and fruit borer incidence	Fruit length	Fruit girth	Fruit weight	Fruit yield / plant
Plant height	G	1.000	0.397**	0.438**	0.399**	0.436**	-0.392**	0.358*	-0.348*	-0.183	0.246	0.361**	-0.186	0.124	0.230	0.206	0.302*
	P	1.000	0.378**	0.424**	0.378**	0.423**	-0.375**	0.335*	-0.331*	-0.152	0.244	0.356*	-0.180	0.118	0.215	0.205	0.296*
Number of primary branches per plant	G		1.000	0.560**	0.438**	0.381**	-0.521**	0.298*	-0.276	-0.369**	0.395**	0.439**	-0.031	0.173	0.003	0.217	0.379**
	P		1.000	0.528**	0.410**	0.368**	-0.470**	0.284*	-0.270	-0.311*	0.363**	0.417**	-0.027	0.165	0.009	0.213	0.363**
Number of secondary branches per plant	G			1.000	0.743**	0.679**	-0.655**	0.633**	-0.687**	-0.590**	0.500**	0.671**	-0.245	-0.042	0.184	0.018	0.311*
	P			1.000	0.711**	0.644**	-0.606**	0.600**	-0.641**	-0.484**	0.474**	0.647**	-0.236	-0.041	0.181	0.017	0.299*
Number of long styled flowers per plant	G				1.000	0.629**	-0.643**	0.829**	-0.646**	-0.739**	0.407**	0.694**	-0.306*	-0.140	0.240	0.133	0.402**
	P				1.000	0.605**	-0.601**	0.805**	-0.620**	-0.635**	0.371**	0.676**	-0.301*	-0.138	0.228	0.130	0.393**
Number of medium styled flowers per plant	G					1.000	-0.428**	0.828**	-0.633**	-0.556**	0.440**	0.701**	-0.192	-0.105	0.201	0.036	0.349*
	P					1.000	-0.406**	0.805**	-0.607**	-0.484**	0.408**	0.681**	-0.181	-0.102	0.194	0.039	0.338*
Number of short styled flowers per plant	G						1.000	-0.243	0.455**	0.332*	-0.401**	-0.438**	0.351*	0.081	-0.240	-0.078	-0.317*
	P						1.000	-0.184	0.418**	0.294*	-0.400**	-0.418**	0.335*	0.077	-0.221	-0.073	-0.300*
Number of flowers per plant	G							1.000	-0.630**	-0.740**	0.368**	0.725**	-0.174	-0.132	0.183	0.092	0.358*
	P							1.000	-0.604**	-0.624**	0.314*	0.696**	-0.167	-0.128	0.175	0.092	0.347*
Days to 1st flowering	G								1.000	0.463**	-0.366**	-0.574**	0.297*	0.053	-0.095	-0.064	-0.310*
	P								1.000	0.412**	-0.343*	-0.555**	0.285*	0.050	-0.093	-0.060	-0.304*
Days to 1st harvesting	G									1.000	-0.571**	-0.772**	0.058	0.080	-0.160	-0.135	-0.396**
	P									1.000	-0.490**	-0.668**	0.059	0.070	-0.128	-0.107	-0.337*
Fruit set percentage	G										1.000	0.904**	-0.158	-0.034	0.297*	0.300*	0.622**
	P										1.000	0.896**	-0.156	-0.033	0.276	0.283*	0.599**
Number of fruits per plant	G											1.000	-0.212	-0.080	0.304*	0.260	0.622**
	P											1.000	-0.211	-0.080	0.290*	0.256	0.611**
Shoot and fruit borer incidence	G												1.000	0.159	0.067	0.057	-0.006
	P												1.000	0.152	0.064	0.061	-0.004
Fruit length	G													1.000	-0.030	0.252	0.165
	P													1.000	-0.001	0.249	0.156
Fruit girth	G														1.000	0.600**	0.644**
	P														1.000	0.584**	0.616**
Fruit weight	G															1.000	0.885**
	P															1.000	0.870**
Fruit yield per plant	G																1.000
	P																1.000

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Table 4 : Path co-efficient analysis depicting the direct (Bold) and indirect effects of various characters on yield per plant

Characters	Plant height	Number of primary branches/ plant	Number of secondary branches/ plant	Number of long styled flowers/ plant	Number of medium styled flowers/ plant	Number of short styled flowers/ plant	Number of flowers/ plant	Days to Ist flowering	Days to Ist harvesting	Fruit set percentage	Number of fruits/ plant	Shoot and fruit borer incidence	Fruit length	Fruit girth	Fruit weight
Plant height	**-0.088**	0.023	-0.086	3.514	2.487	-2.120	-4.199	-0.024	-0.024	-0.447	1.118	-0.015	-0.002	0.010	0.156
Number of primary branches/ plant	-0.035	**0.060**	-0.110	3.857	2.175	-2.812	-3.488	-0.019	-0.049	-0.719	1.361	-0.002	-0.003	0.000	0.164
Number of secondary branches/ plant	-0.038	0.033	**-0.197**	6.544	3.877	-3.538	-7.414	-0.048	-0.078	-0.910	2.079	-0.020	0.000	0.008	0.013
Number of long styled flowers/ plant	-0.035	0.026	-0.146	**8.803**	3.588	-3.475	-9.716	-0.045	-0.098	-0.740	2.152	-0.025	0.002	0.011	0.100
Number of medium styled flowers/ plant	-0.038	0.022	-0.134	5.535	**5.707**	-2.313	-9.708	-0.044	-0.074	-0.800	2.173	-0.015	0.002	0.009	0.027
Number of short styled flowers/ plant	0.034	-0.031	0.129	-5.662	-2.443	**5.403**	2.846	0.031	0.044	0.730	-1.358	0.028	-0.001	-0.011	-0.059
Number of flowers per plant	-0.031	0.017	-0.125	7.299	4.728	-1.312	**-11.719**	-0.044	-0.098	-0.670	2.246	-0.014	0.002	0.008	0.069
No. of days to Ist flowering	0.030	-0.016	0.135	-5.684	-3.612	2.459	7.387	**0.070**	0.061	0.665	-1.777	0.024	-0.001	-0.004	-0.048
No. of days to Ist harvesting	0.016	-0.022	0.116	-6.507	-3.175	1.796	8.671	0.032	**0.133**	1.039	-2.391	0.005	-0.001	-0.007	-0.102
Fruit set percentage	-0.021	0.023	-0.098	3.583	2.510	-2.169	-4.313	-0.025	-0.076	**-1.820**	2.801	-0.012	0.000	0.014	0.227
Number of fruits/ plant	-0.031	0.026	-0.132	6.114	4.003	-2.369	-8.494	-0.040	-0.102	-1.645	**3.099**	-0.017	0.001	0.014	0.197
Shoot and fruit borer incidence	0.016	-0.001	0.048	-2.697	-1.098	1.898	2.044	0.020	0.009	0.286	-0.658	**0.082**	-0.003	0.003	0.043
Fruit length	-0.011	0.010	0.008	-1.233	-0.600	0.436	1.546	0.003	0.010	0.061	-0.248	0.013	**-0.021**	-0.001	0.190
Fruit girth	-0.020	0.000	-0.036	2.112	1.144	-1.296	-2.143	-0.006	-0.021	-0.540	0.943	0.005	0.000	**0.047**	0.454
Fruit weight	-0.018	0.013	-0.003	1.169	0.204	-0.420	-1.081	-0.004	-0.018	-0.547	0.807	0.004	-0.005	0.028	**0.757**

Residual effect = 0.151

characters which are influencing it directly or indirectly.

REFERENCES

Baswana, K.S., Bhatia, M. K. and Duhan, Dharamveer (2002). Genetic variability and heritability studies in rainy season brinjal (*Solanum melongena* L.). *Haryana J. Hort. Sci.*, **31** (1/2): 143-145.

Burton, G.W. and DeVane, E.M. (1953). Estimating heritability in tall fescue (*Festuca arundinaceae*) from replicated clonal material. *Agron. J.*, **45** : 478-481.

Chadha, M.L. and Paul, B. (1984). Genetic variability and correlation studies in egg plant. *Indian J. Hort.*, **41**: 101-107.

Cochran, G.W. and Cox, M.G. (1950). *Experimental designs.* John Wiley and Sons, NEWYORK, U.S.A.

Dewey, D.R. and Lu, K.H. (1959). A correlation and path co-efficient analysis of components of crested wheat grass seed production. *Agron. J.*, **51** : 515-518.

Falconer, D.S. (1981). *Introduction to quantitative genetics*. 2nd Ed. Oliver and Boyd, Edinburg, LONDON, UNITED KINGDOM.

Fisher, R.A. and Yates, F. (1963). *Statistical tables for biological, agricultural and medical research*. Oliver and Boyd, LONDON, UNITED KINGDOM.

Hanson, C.H., Robinson, H.F. and Comstock, R.E. (1956). Biometrical studies of yield in segregating populations of Korean lespedza. *Agron J.*, **48** (6):268-272.

Kalda, T.S., Suran, B.S. and Gupta, S.S. (1996). Correlation and path co-efficient analysis of some biometrics characters in egg plant. *Indian J. Hort.,* **53** : 129 - 134.

Lush, J.L. (1949). Heritability of quantitative characters in farm animals. *Proceedings of 8th Congress of Genetics, Heriditas.,* **35** : 356-375.

Manna, M. and Paul, A .(2012). Studies on genetic variability and character association of fruit quality parameters in tomato. *Hort. Flora Res. Spectrum.,* **1**(2): 110-116.

Nayak, Bhukya Ravi and Nagre, P.K. (2013). Genetic variability and correlation studies in brinjal (*Solanum melongena* L.). *Internat. J. Appl. Biol. & Pharmaceut. Technol.,* **4** :211-215.

Ostle, B. (1966). *Statistics in research.* 1st Ed., Oxford and Indian Book House Private Limited, NEW DELHI, INDIA.

Sharma, T.V.R.S. and Swaroop, K. (2000). Genetic variability and character association in brinjal (*Solanum melongena* L.). *Indian J. Hort.,* **57**: 59-65.