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Research article

GENETIC VARIABILITY AND CORRELATION STUDIES IN BRINJAL (*SOLANUM MELONGENA* L.)

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ABSTRACT: The present investigation was conducted at Department of Horticulture, Horticulture Garden, Dr. PDKV, Akola (M.S.), during kharif 2012-13. The experimental material comprised of 20 genotypes along with one check of brinjal and the experimental was laid out in randomized block design with three replications. Variability studies revealed that highly significant differences were recorded among the varieties for all characters. Correlation and path analysis revealed that fruit length, diameter, weight influenced the fruit yield in plant with high direct effect and significant positive correlation. Therefore, fruit length, diameter, weight are an important characters which may be included in selection criteria for improvement in fruit yield per plant.

Key words: Genetic variability, Correlation, Brinjal

INTRODUCTION

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 is 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 seperation of correlation coefficient into components of direct and indirect effects.

MATERIAL AND METHODS

The present investigations were conducted Horticulture Garden, Department of Horticulture, Dr. PDKV, Akola during Kharif 2012-13. The experimental material comprised of 20 genotypes viz., BJL-12-01-Bamnod, BJL-12-02-Kingaon-2, BJL-12-03-Atraval-1, BJL-12-04-Atraval-2, BJL-12-05-Nimgaon-1, BJL-12-06-Nimgaon-2, BJL-12-07-rajore-1, BJL-12-08-Rajore-2, BJL-12-09-Rajore-3, BJL-12-10-Chitode-1, BJL-12-11-Chitode-2, BJL-12-12-Sangavi-1, BJL-12-13-Sangavi-2, BJL-12-14-Yaval-1, BJL-12-15-Yaval-2, BJL-12-16-Yaval-3, BJL-12-17-Wagodha, AKGB-1, AKGB-2, along with 1 check Phule Harith. The experiment was laid out in Randomized Block Design (RBD) with 3 replications were sown in 1st week of June 2012 in the Nursery beds. The seedling were transplanted in RBD with 3 replications at the spacing of 60 cm between rows and 45 cms between plant to plant. All the recommended cultural practices and plant protection measures were followed data were recorded for 28 characters viz., plant height (30,60,90,120 DAT), plant spread (30,60,90,120 DAT), No. of primary branches (30,60,90,120 DAT), No. of secondary branches (30,60,90,120 DAT), Days to First Flowering, No. of Flower Cluster, Fruit Set (%), Avg. Fruit Weight (g), No. of fruits/ plant. Yield per plant (kg), Yield per hectare (g) Incidence of fruit and shoot borer (%), Quality parameters like, Chlorophyll content (mg/g), Fruit length (cm), fruit diameter (cm), No. of seeds per fruit.

RESULTS AND DISCUSSION

Highly significant differences were recorded among the varieties for all the characters. Thus, suggesting that the present genotypes was appropriate and hence suitable for further genetic analysis. A wide range of variation was observed for all characters under study, particularly for yield per plant, fruit weight, yield per hectare, No. of seeds per fruits. The characters showing high degree of variations have more scope for their further improvement.

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The high phenotypic and genotypic of variations and genetic advance was recorded for incidence of fruit and shoot borer (%), No. of seeds/ fruit and fruit weight. These results are in agreement with the findings of Baswane et al. (2002)

High heritability along with high estimates of GCV, genetic advance and genetic gain was observed for incidence of fruit and shoot borer per cent and fruit weight. Similar results were also reported by Sharma and Swaroop. The remaining characters had low phenotypic and genotypic coefficient of variations. The characters which had shown wide range of phenotypic and genotypic coefficient of variations may have good scope for the improvement.

In the present study, heritability estimates were high for all the characters which suggested that selection in these characters would be effective. Heritability coupled with genetic advance are more useful than heritability alone in predicting the resultant effect for selecting the best individual. In this study, all the characters except plant height 30 DAT, No. of primary branches 120 DAT, No. of secondary branches 120 DAT had high heritability. Earlier, Chadha and Paul had reported high estimates of heritability coupled with high genetic gain for some of these characters in Brinjal. Direct selection for fruit weight should be practised, while the emphasis on the other characters should be given for their relative contribution of Non-additive gene effect. The genotypic and phenotypic correlation coefficients were estimated to measure the degree of association between yield and its contributing characters. Average fruit weight (0.544), No. of marketable fruits/ plant (0.489), plant height 120 DAT (0.274) had significant positive correlation with yield per plant at phenotypic level at genotypic level. The positive significant correlation was recorded for plant height 120 DAT (0.280), Average fruit weight (0.606), No. of marketable fruits/ plant (0.508). A negative significant association of fruit yield per plant was observed with plant spread 120 DAT at genotypic and phenotypic levels. The genotypic correlation coefficients were similar to phenotypic correlation coefficients direction. This indicated that greater Number of marketable fruits per plant, average fruit weight. Fruit length, diameter of fruits encourages towards average meting high fruit yield among brinjal cultivars. This view was supported earlier by Kalda et al. (1996). Singh and Singh. A negative significant correlation of fruit weight of days to first flowering was observed with No. of marketable fruits per plant (-0.337, -0.348) at (-0.262, -0.332), respectively. The similar results were obtained. No. of fruits per plant, fruit diameter out fruit length had significant positive correlation with yield per plant both at genotypic and phenotypic levels. High variability among genotypes has indicated that there is a scope for these characters by selection of brinjal genotypes. 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 is 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 independent variables.

Table 1. Analysis of variance for yield and yield attributes in white fruited brinjal

Source	DF	Plant height (cm) 30 DAT	Plant height (cm) 60 DAT	Plant height (cm) 90 DAT	Plant height (cm) 120 DAT	Plant spread (cm) 30 DAT	Plant spread (cm) 60 DAT	Plant spread (cm) 90 DAT	Plant spread (cm) 120 DAT	No of primary branches 30 DAT	No of primary branches 60 DAT	No of primary branches 90 DAT	No of primary branches 120 DAT	No of secondary branches 30 DAT	No of secondary branches 60 DAT
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Replication	2	3.702	1.776	1.913	0.429	1.026	0.991	0.512	1.181	0.026	0.162	0.010	0.015	0.058	0.007
Treatment	19	13.84**	64.11**	46.83**	219.56**	19.97**	79.25**	49.19**	289.49**	0.783**	0.517**	0.117**	0.533**	0.914**	0.776**

Source	DF	No of secondary branches 90 DAT	No of secondary branches 120 DAT	Days to first flowering	No of flower clusters	Fruit set %	Fruit weight (g)	No of market-able fruits	Yield per plant (kg)	Yield per hector (q)	Fruit length (cm)	Fruit diameter (cm)	Chlorophyll content (mg/g)	Incidence of fruit and shoot borer%	No of seeds per fruit
1	2	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Replication	2	0.004	0.076	0.708	0.176	2.299	285.02	1.138	0.049	1600.8	0.006	0.012	0.0001	0.0002	3742.35
treatments	19	1.184**	2.328**	53.272**	13.90**	161.23**	28664.6**	13.34**	0.96**	99641.7**	6.43**	1.95**	0.021**	16.58**	547953.75**

Significant at 5% level - * Significant at 1% level - **

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Table 2.Estimates of variability, heritability, genetic advances per cent of mean for 20 genotypes of white fruited brinjal

S. No.	Character	Range	Mean	PCV (%)	GCV (%)	EV (%)	Heritability (h^2) %	Expected genetic advance as % over mean
1	Plant height (cm) 30 DAT	22.86-30.60	26.50	8.906	7.67	4.52	74.0	13.61
2	Plant height (cm) 60 DAT	44.20-61.40	51.00	9.221	8.98	2.07	95.0	18.03
3	Plant height (cm) 90 DAT	61.60-74.00	68.71	5.847	5.70	1.29	95.1	11.45
4	Plant height (cm) 120 DAT	75.83-111.60	84.52	10.141	10.11	0.75	99.4	20.77
5	Plant spread (cm) 30 DAT	29.53-37.93	33.71	7.808	7.57	1.88	94.2	15.14
6	Plant spread (cm) 60 DAT	46.16-61.70	54.29	9.565	9.41	1.67	96.9	19.09
7	Plant spread (cm) 90 DAT	71.96-84.63	77.97	5.265	5.15	1.06	95.9	10.40
8	Plant spread (cm) 120 DAT	90.7-120.86	105.57	9.318	9.28	0.61	99.6	19.11
9	No of primary branches 30 DAT	0.70-2.36	1.66	31.541	30.38	8.45	92.8	60.30
10	No of primary branches 60 DAT	1.39-2.81	1.99	23.663	19.24	13.77	66.1	32.23
11	No of primary branches 90 DAT	2.17-2.92	2.54	8.443	7.44	3.98	77.7	13.51
12	No of primary branches 120 DAT	3.4-4.8	4.11	11.009	9.82	4.97	79.6	18.04
13	No of secondary branches 30 DAT	2.18-3.93	2.98	18.870	18.27	4.70	93.8	36.45
14	No of secondary branches 60 DAT	4.15-5.80	5.00	10.695	9.88	4.09	85.4	18.80
15	No of secondary branches 90 DAT	7.10-9.10	8.09	8.009	7.63	2.43	90.8	14.98
16	No of secondary branches 120 DAT	10.26-13.36	11.95	8.074	6.99	4.03	75.0	12.48
17	Days to first flowering	67.36-7940	73.00	5.995	5.65	1.98	89.0	10.99
18	No of flower clusters	2.86-11.03	6.86	31.498	31.30	3.49	98.8	64.08
19	Fruit set %	32.40-54.03	44.37	16.598	16.48	1.93	98.6	33.72
20	Fruit weight (g)	134.26-609.0	228.62	44.045	42.09	12.95	91.3	82.88
21	No. of marketable fruits per plant	5.10-14.56	7.79	28.175	26.48	9.59	88.4	51.31
22	Yield per plant (kg)	1.04-3.10	1.72	33.495	32.61	7.61	94.8	65.43
23	Yield per hector (q)	361.6-976.0	615.91	29.801	29.48	4.34	97.9	60.08
24	Fruit length (cm)	9.26-15.2	13.28	11.068	10.99	1.24	98.7	22.51
25	Fruit diameter (cm)	6.36-9.40	7.78	10.385	10.35	0.84	99.3	21.25
26	Chlorophyll content (mg/g)	0.79-1.13	0.91	9.526	9.29	2.08	95.2	18.68
27	incidence of fruit and shoot borer%	1.26-8.09	4.72	49.864	49.73	3.58	99.5	102.18
28	No of seeds per fruit	282.6-1744.0	1001.6	42.820	42.59	4.42	98.9	87.26

Table 3.Genetic and phenotypic correlation coefficient (r)

Characters		Plant height (cm) 120 DAT	Plant spread (cm) 120 DAT	No of primary branches 120 DAT	Days to first flowering	Fruit weight (g)	No of marketable fruits per plant	Yield per plant (kg)	Yield per hectare (q)	Fruit length (cm)	Fruit diameter (cm)	Incidence of fruit and shoot borer%
Plant height (cm) 120 DAT	P	1.000	0.456**	-0.106	0.027	0.085	0.303*	0.274*	0.192	-0.082	0.006	0.152
	G	1.000	0.456**	-0.110	0.028	0.097	0.318*	0.280*	0.193	-0.085	0.005	0.153
Plant spread (cm) 120 DAT	P		1.000	0.108	0.314*	0.216	-0.536**	-0.259*	-0.346**	0.292*	0.217	0.408**
	G		1.000	0.129	0.336*	0.232	-0.569**	-0.267*	-0.350**	0.296*	0.219	0.410**
No of primary branches 120 DAT	P			1.000	-0.091	0.144	-0.159	-0.074	-0.044	-0.103	0.063	0.098
	G			1.000	-0.086	0.162	-0.171	-0.051	-0.057	-0.115	0.079	0.121
Days to first flowering	P				1.000	0.242	-0.262*	-0.005	-0.051	0.318*	0.336**	-0.013
	G				1.000	0.275	-0.332*	0.003	-0.042	0.335*	0.357**	-0.013
Fruit weight (g)	P					1.000	-0.337**	0.544**	0.489**	0.351**	0.597**	-0.187
	G					1.000	-0.348**	0.606**	0.521**	0.366**	0.627**	-0.201
No of marketable fruits per plant	P						1.000	0.489**	0.528**	-0.275*	-0.240	-0.214
	G						1.000	0.508**	0.563**	-0.297*	-0.262	-0.231
Yield per plant (kg)	P							1.000	0.959**	0.172	0.359**	-0.400**
	G							1.000	0.981**	0.175	0.369**	-0.413**
Yield per hectare (q)	P								1.000	0.208	0.365**	-0.418**
	G								1.000	0.208	0.371**	-0.421**
Fruit length (cm)	P									1.000	0.652**	-0.348**
	G									1.000	0.658**	-0.350**
Fruit diameter (cm)	P										1.000	-0.397**
	G										1.000	-0.400**
Incidence of fruit and shoot borer%	P											1.000
	G											1.000

Significant at 5% level - * R SQUARE = 1.0184R RESIDUAL EFFECT = SQRT (1- 1.0184) Significant at 1% level - **

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Table 4.Direct and indirect effects of different characters on yield

S.No.	Characters		Plant height (cm) 120 DAT	Plant spread (cm) 120 DAT	No of Primary branches 120 DAT	Days to first flowering	No of flower clusters	Fruit set%	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	No of marketable fruits/plant	No of seeds per fruit	Yield per plant (kg)
1	Plant height (cm) 120 DAT	P	**0.3131**	0.1429	-0.0332	0.0087	-0.2048	-0.0319	0.0267	0.0950	-0.0259	0.0019	0.0774	0.2743
		G	**0.0798**	0.0365	-0.0088	0.0022	-0.0526	-0.0082	-0.0068	0.0005	0.0078	0.0255	0.0198	0.2807
2	Plant spread (cm) 120 DAT	P	-0.0286	**-0.0627**	-0.0068	-0.0197	0.0245	0.0330	-0.0136	0.0336	-0.0183	-0.0136	-0.0124	-0.2592
		G	0.0622	**0.1362**	0.0177	0.0458	-0.0534	-0.0723	0.0404	0.0299	0.0316	-0.0775	0.0269	-0.2672
3	No of Primary branches 120 DAT	P	0.0115	-0.0117	**-0.1079**	0.0099	-0.0169	0.0197	-0.0156	0.0172	0.0112	-0.0069	0.0522	-0.0742
		G	0.0083	-0.0098	**-0.0754**	0.0065	-0.0128	0.0151	0.0087	-0.0060	-0.0123	0.0129	0.0407	-0.0514
4	Days to first flowering	P	0.0020	0.0227	-0.0066	**0.0723**	-0.0124	-0.0211	0.0175	-0.0190	0.0230	0.0243	-0.0005	-0.0053
		G	0.0032	0.0386	-0.0100	**0.1149**	-0.0223	-0.0366	0.0385	0.0411	0.0317	-0.0382	-0.0017	0.0036
5	No of flower clusters	P	-0.1982	-0.1184	0.0475	-0.0522	**0.3030**	0.1105	-0.0119	0.0244	0.1079	0.0359	-0.1275	0.1475
		G	-0.1653	-0.0985	0.0424	-0.0487	**0.2511**	0.0926	0.0909	0.0300	-0.0097	0.0179	-0.1063	0.1438
6	Fruit set%	P	-0.0299	-0.1544	-0.0535	-0.0858	0.1070	**0.2934**	-0.1285	0.1809	0.0324	-0.0439	-0.0446	0.2598
		G	-0.0408	-0.2102	-0.0790	-0.1260	0.1460	**0.3960**	0.0436	-0.0599	-0.1816	0.2593	-0.0609	0.2649
7	Fruit length (cm)	P	0.0693	0.1767	0.1175	0.1969	-0.0318	-0.3560	**0.8130**	-0.2743	0.2855	0.4856	-0.1910	0.5442
		G	0.0214	-0.0746	0.0289	-0.0844	-0.0911	-0.0277	**-0.2517**	-0.1656	-0.0922	0.0748	0.0217	0.1757
8	Fruit diameter (cm)	P	0.1214	-0.2146	-0.0638	-0.1051	0.0322	0.2466	-0.1350	**0.4000**	-0.1103	-0.0961	-0.0226	0.4897
		G	0.0002	0.0055	0.0020	0.0090	0.0030	-0.0038	0.0166	**0.0253**	0.0159	-0.0066	-0.0083	0.3690
9	Fruit weight (g)	P	0.0163	-0.0576	0.0204	-0.0628	-0.0701	-0.0218	-0.0692	0.0543	**0.1969**	-0.1284	0.0163	0.1728
		G	0.1019	0.2421	0.1694	0.2873	-0.0404	-0.4781	0.3817	0.6543	**1.0425**	-0.3629	-0.2595	0.6062
10	No of marketable fruits per plant	P	0.0006	0.0210	0.0062	0.0325	0.0115	-0.0145	0.0577	-0.0232	0.0631	**0.0967**	-0.0314	0.3596
		G	0.1938	-0.3459	-0.1041	-0.2022	0.0434	0.3979	-0.1807	-0.1595	-0.2115	**0.6077**	-0.0368	0.5089
11	No of seeds per it	P	-0.0031	-0.0025	0.0062	0.0001	0.0054	0.0019	0.0030	0.0007	0.0011	0.0041	**-0.0127**	-0.2969
		G	0.0159	0.0127	-0.0346	-0.0009	-0.0271	-0.0099	-0.0055	-0.0211	-0.0160	-0.0039	**0.0641**	-0.3002

Phenotypic Residual effect = 0.3555; Genotypic Residual effect= 1-1.0184; Diagonal (under lined) values indicate direct effects G: Genotypic P: Phenotypic

The path coefficient analysis which splits totla correlations coefficient of different characters into direct and in direct effects on fruit yield per plant in such a manner that the sum of direct and indirect effects in equal to total genotypic correlations. The data revealed that at phenotypic level, fruit length (0.813) had highest direct effect on yield followed by fruit diameter (0.400), fruit weight (0.313) and No. of flower clusters (0.303). Days to first flowering (0.072) and No. of marketable fruit/plant (0.096) had also expressed positive direct effect but in low magnitude. The direct selection for these characters would be beneficial for crop improvement since most of these characters also showed positive coefficient of correlation. At genotypic level, maximum positive direct effect of fruit weight (1.042) upon yield was observed. Plant spread 120 DAT, No. of primary branches 120 DAT, had also showed indirect negative effects towards yield via No. of marketable fruits/ plant. The charactes which recorded positive effect on yield had indirect positive effect via each other. Therefore, they do not effect each other adversely and hence can be selected for improving the yield. The contribution of residual accounted 0.3555 and 1 - 1.0184 for phenotypic and genotypic path, respectively.

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