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Genetic variability, heritability and genetic advance for yield, yield related components of brinjal *Solanum melongena* (L.) genotypes

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Abstract

Eggplant or brinjal *Solanum melongena* (L.) is the most popular and widely cultivated vegetable crop in the central, southern and Southeast Asia and in some African countries. In the present investigation 30 genotypes of brinjal were evaluated for genetic diversity and yield related traits with randomized block design (RBD) with three replications during *Kharif* 2017. Ten quantitative traits were considered to obtain information on the nature and magnitude of genetic variability, degree of association among different yield contributing traits with yield and related traits and the degree of genetic divergence and molecular analysis at morphological level. Observations were recorded on various characters viz. days of 50% flowering, plant height, number of primary branches per plant, plant spread, fruit length, fruit diameter, fruits per plant, average fruit weight, fruit index and yield per plant. Analysis of variance revealed substantial amount of variability among the genotypes for all the characters, under study, indicated wide spectrum of variability among the genotypes. High genotypic and phenotypic coefficient of variation was observed for fruit index (33.30, 34.40), moderate PCV and GCV was recorded for yield per plant (29.47, 29.88), average fruit weight (28.84, 28.94), fruit diameter (27.16, 27.89), fruits per plant (25.92, 26.59). High heritability coupled with high genetic advance was observed for average fruit weight (99.36, 59.23), yield per plant (97.27, 59.87), plant spread (95.94, 30.35), fruits per plant (95.01, 52.04). Moderate heritability was recorded for fruit diameter (94.84, 54.50), fruit length (94.68, 50.26), fruit index (93.74, 66.43).

Keywords: solanum melongena, mean performance, genetic variability, heritability, genetic advance

Introduction

Vegetables are increasingly becoming important as produce for domestic and export markets. They have a great potential to improve the nutrition and thereby health of consumers as most are good sources of vitamins, minerals and proteins needed for the proper functioning and development of the human body (Wills *et al.*, 1998) [13]. Brinjal *Solanum melongena* (L.) is popularly known as egg plant is a part of the family solanaceae has the chromosome number $2n=24$. Brinjal originated in India and is one of the most popular and major vegetable crop grown in South Asia and other parts of the world. Brinjal *Solanum melongena* (L.) is an economically important Solanaceous vegetable, widely consumed in Asia, Europe, Africa and America (Harish *et al.*, 2011; Ali *et al.*, 2011) [6, 1]. Brinjal is nutritious vegetable and has got multifarious use as a dish item. It is a valuable source of minerals (particularly iron) and vitamins. The fruit and other parts of the plant are used in traditional medicine. It also provides little amounts of essential nutrients. Manganese is present in a moderate percentage in the egg plant (Kashyap *et al.*, 2003) [8]. Genetic divergence is the one of the criteria of selection of parents to produce potential hybrids and for isolation of transgressive segregants from hybrids in further filial generations. This study is important in the view that germplasm lines have their wide varied origin and are highly variable with respect to plant and fruit morphological aspects. More diverse parents within reasonable range have better chances of improvement in yield and other yield parameters. In view of this an investigation was carried out to understand the relationship between heterosis and parental divergence in germplasm lines (Dharwad *et al.*, 2010) [3]. The present studies were, therefore, initiated with an objective to determine genetic variability for fruit yield and related attributes along with quality components in relationships in a collection of 30 genotypes of brinjal.

Materials Methods

The present investigation was carried out at the research plot of Horticulture Research Centre (HRC) during the *khariif* season of the year 2017. Experimental material consisted of 30 genotypes and it was laid out in Completely Randomized Block Design (RCBD) with 3 replications. All the scientific agronomic package of practices was followed to raise a healthy crop except spraying of insecticides to control the shoot and fruit borer, leaf hopper and white fly and phomopsis blight diseases.

Experimental finding

Five plants of each accession in each replication were randomly selected for recording the 10 observations viz. days of 50% flowering, plant height (cm), number of primary branches, plant spread (cm), fruit length (cm), fruit diameter (cm), fruits per plant, average fruit weight (g), fruit index and fruit yield per plant (kg). The mean replicated data on various biometric traits were subjected to analysis of variance as per the standard statistical procedure. Phenotypic and genotypic components of variance, phenotypic and genotypic coefficients of variation and the broad sense heritability the expected genetic gain or advance under selection were calculated.

Results and Discussion

Analysis of variance and genetic variability The ANOVA (Table 1) showed highly significant differences among the genotypes for all the traits indicating thereby the presence of sufficient variability in the experimental materials. similar result shown by Nayak *et al.*, (2014) [12]; Leuta and Nedelea (2010) [9]. The mean performances of the different genotypes for different trait are presented in table 2. The genotype Pusha bindu recorded highest mean performance for days of 50% flowering (63.80) and lowest by Aruna (47.30), for plant height the genotype Pusa bindu (85.30 cm) showed highest and lowest recorded by Utkal madhuri (54.90 cm), for primary branches per plant the genotype Arka partibha (11.53) recorded maximum and the genotype PLR-1(3.20) minimum, for plant spread (97.93 cm) Pusha shyamal genotype showed highest and the lowest genotype JB-6 (57.10 cm), the genotype Pusha bindu (21.10 cm) showed highest fruit length and the genotype RCMBL-1 (8.60 cm) showed shortest fruit length, for fruit diameter the genotype showed highest by Green long (9.60 cm) and lowest by the genotype DBL-24 (4.20) and JB-26 (4.20 cm), for fruits per plant the genotype showed highest by bhagyawati (31.00) and lowest by the genotype Pusha bindu(11.40), for average fruit weight the genotype showed highest by Pusha shyamal (172.80g) and lowest by the PB-67 (62.00g), for fruit index the genotype showed maximum by Pusha shyamal (141.38) and minimum by the RCMBL-1 (38.03), for yield per plant highest yield per plant was observed in Utkal madhuri (2801.20g) and lowest in Pusha bindu (958.90g) similar results shown that by Dhaka *et al.*, (2012) [4]; Dhameliya *et al.*, (2007) [2]. The estimates of mean, range, genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) for 10 quantitative traits in brinjal genotypes are presented in table 3. The PCV was highest for fruit index (34.40%) followed by yield per plant (29.88%) and average

fruit weight (28.94%). Similarly GCV was also highest for fruit index (33.30%) followed by yield per plant (29.88%) and average fruit weight (28.84%). Similar result shown by Golany *et al.*, (2007) [5]; Madhavi *et al.*, (2015) [11]. In general for all the characters under study, PCV were slightly higher than the corresponding GCV indicating prevalence of environmental influence on expression of these traits. However, the difference between PCV and GCV being very low for majority of the characters suggesting more prevalence of genetic governance of these characters and thus selection on phenotypic basis would holds good. The PCV and GCV values were classified as low (<10.00 %), moderate (10.00-20.00%) and high (>20.00%). In the present investigation it was also evident that difference between PCV and GCV were low for all the character studied. It indicates more of genetic control than environment in governing these traits and scope and importance of germplasm used in future selection for crop breeding.

Heritability and Genetic advance

Heritability and genetic advance Estimates of heritability in broad sense (h^2), genetic advance (GA) and genetic advance as percentage of mean are presented in table 3 and figure 1. Heritability, GA and GA as percent of mean values ranged between 88-100%, 3.03-1046.71, 17.10- 66.43% respectively. The heritability values were classified as low (<50.00%), moderate (50.00- 70.00%) and high (>70.00%) while by that of GA and GAM as low (<20.00 %), moderate (20.00-50.00%) and high (>50.00%) as suggested by Johnson *et al.*, (1955). Estimates of heritability were high (>70.00%) for all the traits viz, for days of 50% flowering (89.08%), plant height (90.47 %), primary branches per plant (88.67%), plant spread (95.94 %),fruit length (94.68%), fruit diameter (94.84%), fruits per plant (95.01%), average fruit weight (99.36%), fruit index (93.74%)and fruit yield per plant (97.27 %).The result showed that the magnitude of heritability were higher than the genetic advance. The estimates of GA as percent of mean were also high (>50)for fruit index (66.43%), yield per plant (59.87%), average fruit weight (59.23%), fruit diameter (54,50%), fruits per plant (52.04%), fruit length (50.26%). The moderate GAM (>20) was recorded for primary branches per plant (43.24%), plant spread (30.35%), plant height (20.59%). The low GAM(<20%) was recorded for days of 50% flowering (17.10%). The result showed that the magnitude of heritability were higher than the genetic advance. Similar result shown by Madhvi *et al.*, (2015) [11]; Mili *et al.*, (2014) [10]; Patel *et al.*, (2013) [14]; Shekar *et al.*, (2012) [15].

Conclusion

Generally, substantial variability in the considered traits among the brinjal genotypes was observed and this might be used as important input for the future breeding programme. It is expected that from these results new brinjal varieties can be obtained to increase the production and productivity to the crop substantially. On the basis of mean performance of genotypes it can be concluded that genotypes Utkal madhuri, Arka nidhi and Bhagyamati performed best for fruit yield per plant in the present investigation.

Table 1: Analysis of variance (ANOVA) mean sum square for ten characters of brinjal.

Source of Variation	DF	Days of 50% flowering	Plant height (cm)	Primary branches per plant	Plant spread (cm)	Fruit length (cm)	Fruit diameter (cm)	Fruits per plant	Average fruit weight (g)	Fruit index	Yield per plant
Replication	2	0.66	0.37	0.02	1.25	0.17	0.00	0.38	1.47	14.91	472.06
Treatment	29	74.25**	155.86**	7.64**	433.53**	34.25**	10.04**	98.27**	2230.09**	2688.40**	803699.82**
Error	58	2.92	5.29	0.31	6.03	0.63	0.18	1.69	4.75	58.51	7440.52

** Significant at 1% level

Table 2: Mean performance of the brinjal genotypes for ten characters.

SL.	Genotype	Days Of 50% Flowering	Plant height (cm)	Primary branches per plant	Plant spread (cm)	Fruit length (cm)	Fruit Diameter (cm)	Fruits Per plant	Average fruit weight (g)	Fruit index	Yield per plant
1	ARUNA	47.30	65.90	7.00	82.40	10.50	7.40	16.60	74.30	77.85	1133.80
2	RCMBL-04-04-04	54.11	73.50	4.80	66.87	11.50	8.90	14.00	112.80	102.48	1365.20
3	JB-67	51.50	65.40	5.20	58.90	11.40	6.60	24.80	78.80	75.42	1757.19
4	JB-18	48.08	68.00	6.80	85.00	9.50	4.50	29.00	69.50	42.95	1815.70
5	Bhagyamati	49.50	58.60	10.10	83.50	9.70	5.10	31.00	93.60	49.49	2689.60
6	JBH-3	55.83	63.10	9.00	94.90	18.10	4.30	18.60	92.13	77.91	1513.60
7	Sweata	58.12	61.63	7.03	97.90	12.60	8.70	13.10	93.90	109.77	1030.90
8	DRNKV-02-026	53.51	71.40	6.60	82.63	9.10	6.20	19.00	101.50	56.57	1728.50
9	Utkal Madhuri	52.13	54.90	5.03	76.30	20.20	5.70	27.30	113.63	115.03	2801.20
10	Jawahar Brinjal	57.20	67.80	7.50	86.17	11.30	7.40	24.00	70.90	83.97	1504.60
11	PB-67	50.10	64.10	8.80	72.00	13.10	6.80	27.20	62.00	89.19	1479.40
12	Green long	52.50	60.40	7.80	73.40	14.40	9.60	18.90	71.50	138.85	1151.37
13	RCMBL-1	57.30	60.87	5.60	61.30	8.60	4.40	26.93	82.97	38.03	1932.70
14	PLR-1	56.10	66.73	4.10	76.40	13.20	8.30	25.40	112.10	109.77	2547.20
15	JB-69	51.50	72.20	8.10	72.70	10.60	7.10	21.80	78.10	75.42	1543.50
16	Arka Nidhi	55.80	69.10	6.30	63.10	12.10	8.70	29.10	106.80	105.52	2707.80
17	A. Kushamakar	63.10	59.00	7.19	97.70	12.40	9.20	17.30	81.50	114.39	1209.90
18	BCB-464	60.80	63.73	5.90	85.40	15.80	8.80	13.50	130.87	139.32	1565.10
19	Utkal Jyoti	58.30	66.30	6.60	95.30	11.90	4.90	30.10	87.70	58.47	2339.70
20	KS-331	59.35	64.70	6.83	68.90	17.90	4.70	19.70	108.40	84.33	1712.50
21	DBL-24	63.10	78.40	5.97	75.80	10.20	4.20	22.60	68.20	42.89	1480.10
22	A. Abhilomb	61.50	81.70	8.27	86.23	11.60	8.70	16.80	165.10	101.01	1929.60
23	A. Pratibha	57.80	83.50	11.53	85.60	12.80	9.40	18.30	172.80	120.62	2302.40
24	JB-6	62.71	64.27	8.13	57.10	16.10	4.20	27.90	70.93	67.94	1703.80
25	Pusha Bindu	63.80	85.30	6.90	76.30	21.10	5.10	11.40	97.20	107.67	958.90
26	Punjab Shree	47.50	66.30	5.20	62.50	17.20	6.30	15.60	82.50	108.49	1087.00
27	DRNKV-02-104	59.63	68.70	7.90	92.60	15.30	6.90	23.80	82.60	105.74	1765.80
28	Pusha Shyamal	49.50	63.10	7.00	97.93	17.40	8.10	18.90	126.20	141.38	2175.10
29	KKM-1B	53.40	65.90	7.40	82.30	9.70	4.70	28.80	79.90	45.73	2091.50
30	VR-11	52.53	68.50	5.70	83.80	15.20	5.30	25.30	64.30	80.86	1426.70
	Mean	55.45	67.43	7.01	79.36	13.35	6.67	21.89	94.42	88.90	1748.35
	Range (minimum)	47.30	54.90	4.10	57.10	8.60	4.20	11.40	62.00	38.03	958.90
	(maximum)	63.80	85.30	11.53	97.93	21.10	9.60	31.00	172.80	141.38	2801.20
	SE(d)	1.39	1.88	0.46	2.01	0.65	0.35	1.06	1.78	6.25	70.43
	C.D.	2.80	3.77	0.92	4.02	1.30	0.69	2.13	3.57	12.53	141.34
	C.V.	3.08	3.41	7.97	3.09	5.95	6.33	5.94	2.31	8.60	4.93

Table 3: Estimation of mean, range, Phenotypic variance (PV), genotypic variance (GV), phenotypic coefficient of variance (PCV) genotypic coefficient of variance (GCV), heritability (h²), genetic advance (GA) and genetic advance as per cent of mean (GAM) for 10 characters of brinjal genotypes

Characters	Heritability (%)	GA	GA as %	GCV (%)	PCV (%)
Days of 50% flowering	89.08	9.48	17.10	8.79	9.32
Plant height (cm)	90.47	13.88	20.59	10.51	11.05
Primary branches per plant	88.67	3.03	43.24	22.29	23.67
Plant spread (cm)	95.94	24.09	30.35	15.04	15.36
Fruit length (cm)	94.68	6.71	50.26	25.08	25.77
Fruit diameter (cm)	94.84	3.64	54.50	27.16	27.89
Fruits per plant	95.01	11.39	52.04	25.92	26.59
Average fruit weight (g)	99.36	55.93	59.23	28.84	28.94
Fruit index	93.74	59.05	66.43	33.30	34.40
Yield per plant	97.27	1046.71	59.87	29.47	29.88

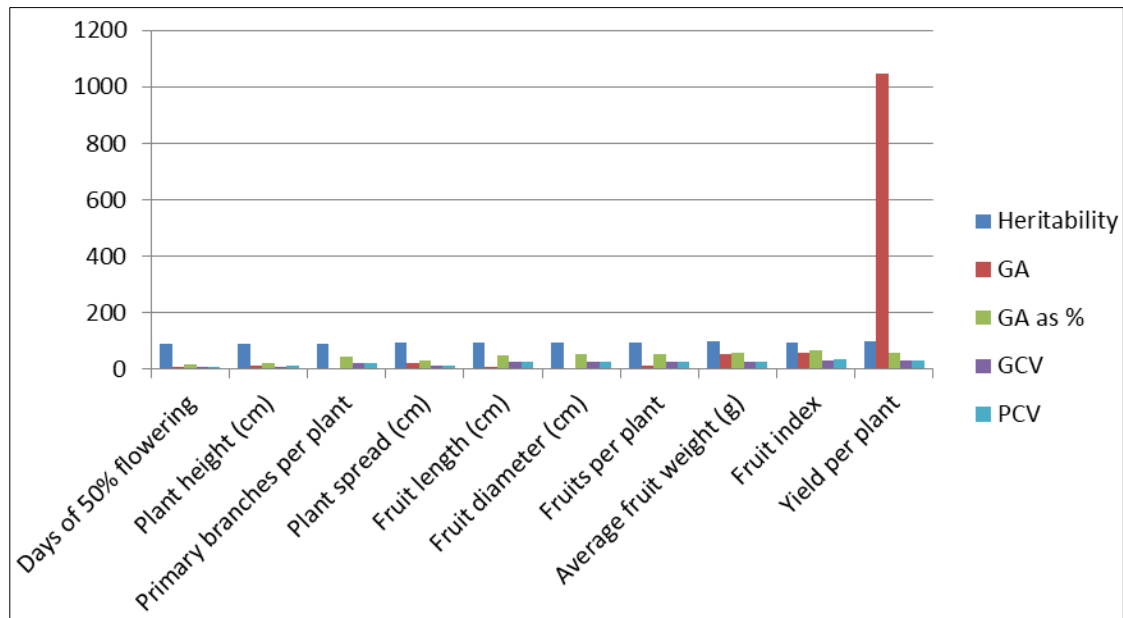


Fig 1: Estimation of phenotypic coefficient of variance (PCV) genotypic coefficient of variance (GCV), heritability (h^2), and genetic advance as per cent of mean (GAM) for 14 characters of brinjal genotype

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