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Studies on variability, heritability and genetic advance for yield and its attributes in brinjal (*Solanum melongena* L.)

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Abstract
The present investigation was conducted during Rabi season at vegetable Research Farm, Department of Horticulture, Naini Agricultural Institute, SHUATS, Allahabad (Uttar Pradesh) during 2016 - 2017. Eighteen genotypes were used to study the genetic variability, heritability, genetic advance, correlation coefficient and path coefficient analysis for growth and yield contributing characters in brinjal with 14 different characters *viz.* plant height at 30 days (cm), plant height at 60 days (cm), plant height at 90 days (cm), number of branches at 60 days, number of branches at 90 days, day to first flowering, days to 50% flowering, days to first fruit set, fruit length (cm), fruit weight (g), number of fruits per plant, fruit yield per plot (kg), TSS (^{0}Brix) and ascorbic acid (mg /100g) were taken into consideration parameter studied. Analysis of variance in the present investigation shows that the genotypes evaluated differed significantly among all the 14 traits. The results revealed that among the all genotypes Punjab barsati also produced qualitative fruit in highest T.S.S content and highest value for the ascorbic acid content. The genotype Punjab barsati, followed by kashi prakash, V. R -2 and J. B. Round produced higher fruit yield per plot. High heritability in broad sense along with high genetic advance in percent of mean was observed for fruit length, single fruit weight, plant height 60 days. High genotypic coefficient of variation (GCV) was recorded for number of fruits per plant, fruit yield per plot and phenotypic coefficient of variation (PCV) for number of fruits per plant followed by fruit yield per plant.

Keywords: Rejected lac, *Flemingia semialata*, Lac host, *Siris*, *Kusmi lac*

Introduction
Brinjal (*Solanum melongena* L.) is an admired vegetable crop that grown all over the world though there is a heavy concentration in Asia. It also called eggplant. It belongs to the family Solanaceae and is a diploid species (2n = 24). In Uttar Pradesh the production of brinjal is around 151.9 tonnes with an area of about 4.5 hectares having productivity of 33.75 tonnes per hectares (Anon, 2017) [2]. Brinjal (*Solarium melongena* L.) is an important vegetable crop cultivated throughout the warmer region of the world and has its centre of origin as India (Bhaduri, 1951 and Thompson *et al.*, 1957). It is one of the major vegetable crops grown in Maharashtra after onion occupying an area of 29,900 ha (Anon, 1994). In Maharashtra, the crop is grown during all the seasons viz., Kharif, Rabi and summer, usually under irrigated condition except at higher altitudes. It is an important article of diet, consumed in a great variety of ways and it has also considerable Ayurvedic medicinal properties. Thus they are highly beneficial for regulation of blood sugar levels and also help to control the absorption of glucose. It also recommended for the remedy of liver problems (Shukla and Naik, 1993). It is grown in tropics and sub tropics. The demand for its use is increasing irrespective of season.

Materials and Methods
The present experiment was carried out in the Vegetable Research Farm, Department of Horticulture, Naini Agricultural Institute, SHUATS, Allahabad (Uttar Pradesh) during 2016 - 2017.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. Eighteen genotypes were collected from IIVR, Varanasi. All the recommended practices *viz* incorporation of FYM @250 q/ha was applied prior to transplanting and inorganic fertilizer schedule of 120:60:60 kg/ha of NPK was followed to raise a good crop. Full quantity of FYM, one third nitrogen and entire quantity of P and K were applied prior to transplanting. Remaining dose of nitrogen was applied in two splits at 30 and 60 days after transplanting. Five competitive plants were marked in each plot per replication and observations were recorded on these plants for 12 quantitative and two quality characters viz., plant height at 30 days (cm), plant height at 60 days (cm), plant height at 90 days (cm), number of branches at 60

days, number of branches at 90 days, day to first flowering, days to 50% flowering, days to first fruit set, fruit length (cm), fruit weight (g), number of fruits per plant, fruit yield per plot (kg), TSS (^{0}Brix) and ascorbic acid (mg /100g). 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% and 1% 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 computed for all the characters as the ratio of genotype at variance to the total variance as suggested by Hanson *et al*., (1956) and the values were expressed in percentage and interpreted as per the method of Robinson *et al.*, (1949).

Results and Discussion

Highly significant differences were recorded among the varieties for all the characters suggesting that the genotypes included in the experiment were having appropriate variation for genetic analysis. The characters showing high degree of variation have more scope for their further improvement (Mohanty, 2002). The relative variability of different characters is presented in (Table 1). The phenotypic and genotypic coefficient of variance was calculated for all the 14 characters (Table 2) and observed that phenotypic coefficient of variance was in general higher than the genotypic coefficient of variance for all the characters indicating that under studied are influenced to various degrees by the environmental factors.

The estimates of genotypic as well as phenotypic coefficient of variability were observed higher for fruit yield per plot followed by single fruit weight, fruit length whereas, plant height of 30 days, vitamin 'C', primary branches of 60 days and primary branches of 90 days were moderate coefficient of variability while plant height of 90 days, plant height of 30 days, no. of fruit per plant, day to first flowering, day to 50% flowering and day to first fruit set were the lowest coefficients of variation. High genotypic and phenotypic variances have also been reported by Sabolu *et al*., (2014), Singh *et al*., (2014), Mohanty (2002), Prasad *et al*., (2004), Kumar *et al*., (2014), Chaudhary and Kumar (2014) and Mohammad *et al*., (2015**)**. The phenotypic coefficients of variation (PCV) were greater than their corresponding genotypic coefficients of variations (GCV) in respect of all quantitative traits indicating that the apparent variation is not only due to genotypes, but also due to influence of environment although the difference between GCV and PCV were narrow Arivalagan *et.al*., (2013). The characters showing high degree of variations have more scope for their further important. The ECV is a unit less value and can be used to measure relative variation existed among characters. ECV values among characters were found less than 10 % this indicated low environmental effect on expression of characters. Nayak and Nagre (2013) have reported higher ECV values for fruit yield per plant in their finding in brinjal. Heritability and genetic advance when estimated together are more useful for predicting the genetic progress in selection as high heritability coupled with high genetic advance reflect preponderance of additive gene action. For this consideration, fruit yield which is high heritability (98.5) and high genetic advance (53.28) revealed preponderance of additive gene action. The other characters showing high heritability with high GA are single fruit weight, fruit yield per plot, plant height 60 days and plant height 90 days. High heritability and moderate GA was recorded in primary branches in (60 and 90 days). Thus, simple mass selection for these characters would be effective. High heritability estimates with high GA was also reported by Babu *et al*., (2008) and Sharma *et. al.*, (2000) for single fruit weight, fruits per plant and yield, Prasad *et al.*, (2004) for fruit yield and single fruit weight. Moderate heritability accompanied by low GA were observed for day to 50 per cent flowering, days to first flowering, days to first fruit set indicating predominant role of non additive gene action for these traits. Similar results have also been reported by Mili *et al*., (2014).

From the collection of eighteen genotypes of brinjal (*Solenum melongena* L.), it was observed that the cultivars Kashi prakash, V.R-2 and J.B. Round could be the promising parents for future breeding programmes, as they had more than one desirable traits. On the basis of variability, heritability and genetic advance. Studies, it was concluded that the selection of genotypes to improve fruit yield per plant under Utter Pradesh state

Table 1: Analysis of Variance for fruit yield and its components in brinjal

Source of variation	df	Plant height (cm) 30 DAT	Plant height (cm) 60 DAT	Plant height (cm) 90 DAT	No. of branches 60 DAT	Primary Branches(90 days)	Day to first flowering	Day to 50% flowering	Day to first fruit set	Fruit length (cm)	Single fruit weight (gm)	No. of fruits/ plant	Fruit yield / plot (kg)	TSS (^{0} Brix)	Vitamin 'C' (mg /100gm)
Replication	2	0.53	2.97	3.16	1.01	2.03	1.67	1.96	1.85	0.06	1.17	0.76	0.61	0.01	0.04
Genotypes	17	5.38**	195.9**	96.93**	4.79**	7.92**	14.89**	19.07**	26.66**	19.20**	1400.3**	4.79**	74.49**	2.61**	2.82**
Error	34	0.43	3.77	1.81	0.75	1.30	0.68	0.59	0.65	0.03	3.46	0.41	0.37	0.29	0.22

*Significant at 5%, ** significant at 1%

Table 2: Estimate of mean, range, coefficient of variances, heritability, genetic advance and genetic advance as percent of mean for 14 characters of Brinjal genotypes

S. No.	Characters	Mean	Range		Coefficient of variance		h^2 (b.s.) (%)	Genetic Advance (5%)	Genetic Advance as % of mean (5%)
			Min.	Max.	GCV	PCV			
1.	Plant height (30days)	16.33	14.14	19.31	7.86	8.84	79.13	2.53	14.41
2.	Plant height (60days)	51.47	38.8	66.72	15.55	16.00	94.43	16.02	31.13
3.	Plant height (90 days)	69.56	57.68	77.78	7.97	8.20	94.41	11.09	15.94
4.	Primary Branches (60 days)	10.52	8.53	13.46	11.03	13.77	64.12	1.91	18.19
5.	Primary Branches (90 days)	14.36	11.86	18.60	10.34	13.04	62.93	2.43	16.90
6.	Day to first flowering	45.09	41.66	51.00	4.68	5.07	85.22	4.02	8.90
7.	Day to 50% flowering	50.13	46.93	53.73	4.93	5.16	91.12	4.87	9.69

8.	Day to first fruit set	50.88	41.66	54.86	5.79	6.00	92.96	5.85	11.49
9.	Fruit length (cm)	10.92	8.19	15.78	22.45	22.51	99.39	5.04	46.10
10.	Single fruit weight (gm)	93.44	71.13	139.06	23.09	23.18	99.26	44.29	47.39
11.	No. of fruits/ plant	17.45	15.40	20.93	6.92	7.85	77.77	2.19	12.57
12.	Fruit yield / plot (kg)	18.70	13.40	29.23	26.57	26.77	98.5	10.16	53.28
13.	TSS (^{0} Brix)	5.48	4.73	8.83	16.03	18.86	72.27	1.54	28.08
14.	Vitamin 'C' (mg /100gm)	6.25	4.94	9.03	14.89	16.71	79.38	1.71	27.33

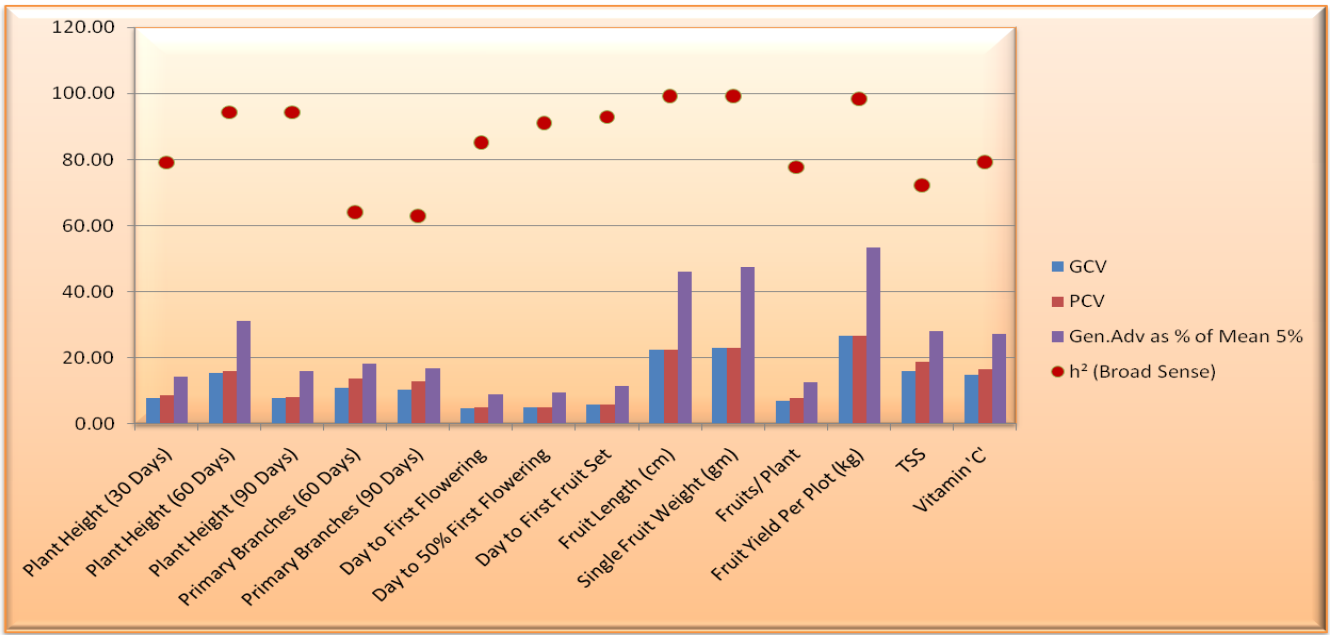

Fig 1: Estimate of mean, range, coefficient of variances, heritability, genetic advance and genetic advance as percent of mean for 14 characters of Brinjal genotype.

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