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Studies on variability components for yield and its attributes in Brinjal (*Solanum melongena* L.) under hill zone of Karnataka

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Abstract
Thirty genotypes of Brinjal were assessed for genetic variability of eleven characters. Highly significant differences were observed among the genotypes studied. High phenotypic and genotypic coefficient of variation was observed for flowers per cluster, fruits per cluster, per cent fruit set, fruits per plant, fruit length, fruit diameter and fruit yield per plant indicating the presence of wide variability among the genotypes for different characters. High heritability in broad sense along with high genetic advance in per cent of mean was observed for branches per plant, days to first flowering, days to fifty per cent flowering, flowers per cluster, fruits per cluster, per cent fruit set, fruits per plant, fruit length, fruit diameter and fruit yield per plant suggesting that these can be improved through direct selection due to predominance additive gene action.

Keywords: GCV, PCV, heritability, genetic advance, fruit yield

Introduction
Brinjal or eggplant or Aubergine or (*Solanum melongena* L.) is one of the most important vegetable crops grown in India. It belongs to the family Solanaceae, having a chromosome number of 2n=24. It is originated in Indo-Burma region (Vavilov, 1928) [17]. Bangladesh and Myanmar region is believed to be the center of diversity (Isshiki *et al*., 1994) [8]. In India, it is grown under varied agro-climatic regions as an annual crop on an area of 7.30 lakh hectares with a production of 128.01 lakh tonnes, and the productivity is 17.54 tonnes per hectare. In Karnataka, it is being cultivated on an area of 0.16 lakh hectares with the production of 4.09 lakh tonnes and productivity of 25.31 tonnes per hectare (NHB, 2018) [1].

Brinjal fruit (unripe) is essentially consumed as cooked vegetable in various forms and the dried shoots are used as fuel in rural areas. However, the recent nutritional and medicinal findings proved that eggplant is highly nutritious and possesses excellent medicinal properties. It is a rich source of minerals and vitamins (especially B-complex), low in calories and fat. Brinjal is good for diabetic patients and also as an excellent remedy for those who are suffering from liver complaints (Shukla and Naik, 1993) [13].

Genetic improvement of any crop mainly depends on the amount of genetic variability present in the population and the germplasm serves as a valuable source of base population and provide scope for wide variability (Gavade and Ghadage, 2015) [7]. Further, the crop exhibits rich genetic diversity and hence there is a scope for improvement for various horticultural traits in Brinjal.

Phenotypic variance is the total variance, which is the total effect of genotypic variance (heritable) and environmental variance (non-heritable). Genetic variability is a measure of variation in a population that is due to genotype, which can be studied by using different genetic parameters like the phenotypic coefficient of variation, genotypic coefficient of variation, heritability, genetic advance, etc. Selection based on genetic variability is effective and reliable as it is heritable. Hence, it is necessary to assess the relative extent of genetic and non-genetic variability exhibited by individual characters. Partitioning of overall variability is necessary into heritable and non-heritable components by calculating genetic parameters such as the genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) (Chadha and Sindhu, 1983) [3].

The estimates of heritability help the plant breeder in selection of elite genotypes from diverse genetic populations. Heritability indicates only the effectiveness with which selection of a genotype can be based on phenotypic performance but it fails to indicate the expected genetic progress in one cycle of selection.

Heritable variation can be effectively used with greater degree of accuracy when heritability is studied in conjunction with genetic advance (Johnson *et al*., 1955) [9]. Genetic advance denotes the improvement in the mean genotypic values of selected families over base population and thus helps the breeder to select the progenies in the earlier generation itself. An improvement in yield and quality of Brinjal is normally achieved by selecting the genotypes with desirable character combination existing in nature or by hybridization. Hence, the present investigation was carried out to assess the variability, heritability and genetic advance for eleven quantitative traits in Brinjal under hill zone of Karnataka, India.

Material and Methods

The experiment was conducted at Department of Vegetable Science, College of Horticulture, Mudigere, Karnataka, India. The materials for this study comprised of thirty genotypes collected from different sources, (Table 1.) were laid out in a Randomized Complete Block Design (RCBD) with two replications during *Rabi* 2016. Each treatment (genotypes) in each replication was represented by a plot size of 3.0 × 2.0 m with the spacing of 75 cm between rows and 60 cm between plants within the rows. Five weeks old seedlings were transplanted to the main field from the nursery and planting was done by adopting ridges and furrow method. The recommended package of practices as per the University of Horticultural Sciences (UHS) Bagalkote was followed to raise the crop and the observations on various yield and yield parameters were recorded. The data were analyzed by the methods of Cochran and Cox (1957) [6] using mean values of random plants in each replication from all genotypes to determine significance of genotypic effects. Genotypic and phenotypic coefficients of variation were calculated using the formulae of Burton (1952) [2]. Broad sense heritability was calculated as per Lush (1940) [10] and genetic advance estimated by the method of Johnson *et al.* (1955) [9]. Categorization of genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV) and genetic advance as per cent of mean (GAM) were done as per Sivasubramanian and Menon (1973) [14] and heritability categorized as by Johnson *et al*. (1955) [9].

Results and Discussion

Analysis of variance revealed highly significant differences among genotypes for all eleven characters (Table 2). The results pertaining to mean, range, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability in broad sense (h^2) and expected genetic advance as per cent of mean (GAM) for all the eleven characters are furnished in table 3.

Variability is essential for wide adaptability and resistance to biotic and a biotic factors and hence, an insight into the magnitude of genetic variability present in a population is of paramount important to a plant breeder for starting a judicious breeding programme. The phenotypic and genotypic variances measure the magnitude of variation arising out of difference in phenotypic and genotypic values. The absolute values of phenotypic and genotypic variances cannot be used for comparing the magnitude of variability for different characters, since the mean and units of measurement of the characters may be different. Hence, the coefficients of variation expressed at phenotypic and genotypic levels have been used. High magnitude of genotypic as well as phenotypic coefficient of variations were recorded for the traits viz., flowers per cluster, fruits per clusters, per cent fruit set, fruits per plant, fruit length, fruit diameter, fruit yield per plant, indicating the existence of wider genetic variability for these traits in the genotypes under study. Further, the narrow range of difference between PCV and GCV indicated that less influence of environment on the expression of characters and selection on these characters might help to realize improvement in an early generation. Moderate GCV and PCV were recorded for branches per plant, days to first flowering and days to fifty per cent flowering. Similar results were also reported by Chaudhary and Kumar (2014) [5]. Vidya and Kumar (2015) [18]. Chaitanya (2015) [4], Ravali *et al*. (2017) [12] and Sujin *et al*. (2017) [15].

Estimate of heritability gives an idea of gene action involved in the expression of various polygenic traits. Genetic advance and heritability are the major factors in improvement of the mean genotypic value of selected plants over parental population. The success of genetic advance mainly depends on genetic variability, heritability and selection intensity. High heritability observed for branches per plant, days to first flowering, days to fifty per cent flowering, flowers per cluster, fruits per cluster, per cent fruit set, fruits per plant, fruit length, fruit diameter, fruit yield per plant, indicating predominance of additive gene action in the expression of these traits. High heritability estimates for these characters revealed lesser influence of environment and fixable in nature. Hence, considerable progress is expected through appropriate selection scheme.

High genetic advance as per cent of mean was observed for branches per plant, days to first flowering, days to fifty per cent flowering, flowers per cluster, fruits per cluster, per cent fruit set, fruits per plant, fruit length, fruit diameter, fruit yield per plant. Results suggested that inheritance of the characters is mainly governed by additive gene action and therefore improvement could be brought about by phenotypic selection. Heritability estimates along with genetic advance as per cent of mean is more useful than the heritability value alone for selecting the best individual. High heritability coupled with high genetic advance was observed for all characters under study indicative of greater proportion of additive genetic variance and consequently a high genetic gain is expected from selection. Similar findings were also reported by Chaitanya (2015) [4], Madhavi *et al*. (2015) [11], Ravali *et al.* (2017) [12], Sujin *et al*. (2017) [15] and Tirkey *et al*. (2018) [16].

Table 1: List of Brinjal genotypes used in the experiment

Sl. No.	Name of the Genotypes	Sl. No.	Name of the Genotypes
1	Arka Keshav	16	Punjab Sadabahar
2	Arka Kusumakar	17	Pusa Bindu
3	Arka Neelkant	18	Pusa Kranthi
4	Bethapudi Local	19	Pusa Purple Long
5	Bhagyamathi	20	Pusa Shymala
6	CARI-1	21	Pusa Utham
7	Dommeru Vanga	22	Ramapura Local WF
8	Harita	23	Ramapura Local PF
9	Hiriyur Local	24	Rayadurga Badane
10	Kaateri Vange	25	Sarparam Vanga
11	Khasi Prakash	26	Surya
12	Khasi Taru	27	Swetha
13	Madurai 3	28	Udupi Mattigulla
14	Mritunjaya	29	Utkal Anushree
15	Poluru Vanga	30	Utkal Keshari

Table 2: Analysis of variance for growth, flowering, yield and quality parameters among thirty Brinjal genotypes.

Sl. No.	Source of variation/characters	Replication	Treatments (genotypes)	Error	S. Em ±	CD @ 5%
	Degrees of freedom	1	29	29		
1.	Branches per plant	0.006	2.010**	0.09	0.21	0.43
2.	Days to first flowering	4.26	159.13**	25.93	0.88	1.33
3.	Days to fifty per cent flowering	11.26**	140.48**	0.58	0.52	1.08
4.	Flowers per cluster	0.004	2.47**	0.010	0.07	0.14
5.	Fruits per cluster	0.04	1.68**	0.007	0.059	0.12
6.	Per cent fruit set	6.94	1038.25**	9.99	2.19	4.49
7.	Fruits per plant	0.08	136.27**	0.99	0.69	1.42
8.	Fruit length (cm)	0.01	29.79**	0.38	0.42	0.87
9.	Fruit diameter (mm)	4.41	381.19**	2.37	1.07	2.19
10.	Fruit yield per plant (kg)	0.01	0.154**	0.04	0.02	0.05
11.	Fruit yield (t/ha)	1.26	76.41**	0.78	0.61	1.25

** - Significant at 1% level

Table 3: Estimates of mean, range and genetic components for various parameters in thirty Brinjal genotypes.

Characters	Mean ± S. Em	Range	GCV (%)	PCV (%)	h^2 (bs)	GA	GAM (%)
Branches per plant	8.10 ± 0.21	5.70 - 9.70	12.02	12.59	91.20	1.92	23.66
Days to first flowering	58.86 ± 0.66	37.00 - 2.50	15.11	15.19	97.90	18.22	30.95
Days to fifty per cent flowering	66.36 ± 0.53	48.00 - 9.50	12.60	12.65	98.20	17.15	25.85
Flowers per cluster	3.53 ± 0.07	1.00 - 5.45	31.42	31.55	98.00	2.27	64.46
Fruits per cluster	2.13 ± 0.06	1.00 - 4.10	42.97	43.15	97.10	1.87	88.13
Per cent fruit set	61.98 ± 2.23	28.17 - 100	36.58	36.93	96.10	46.26	74.16
Fruits per plant	19.28 ± 0.70	7.50 - 42.50	42.65	42.95	98.05	16.81	87.20
Fruit length (cm)	10.14 ± 0.43	6.00 - 20.55	35.03	35.48	97.50	7.80	71.26
Fruit diameter (mm)	45.68 ± 1.08	20.94 - 4.50	30.12	30.39	97.50	28.17	61.67
Fruit yield per plant (kg)	1.30 ± 0.02	0.61-1.93	21.15	21.36	96.00	0.56	43.13
Fruit yield (t/ha)	29.07 ± 0.62	13.66 - 2.88	21.14	21.36	96.50	12.53	43.12

PCV: Phenotypic coefficients of variation h2 (bs): Heritability in broad sense,
GCV: Genotypic coefficients of variation GA: Genetic advance
GAM: Genetic advance as per cent mean

Conclusion

From the study, it is evident that a vast genetic variability exists among eggplant genotypes for flowers per cluster, fruits per cluster, per cent fruit set, fruits per plant, fruit length, fruit diameter, fruit yield per plant, with high heritability and genetic advance as per cent mean. Further, these genotypes can be can be improved through direct selection due to presence of additive genetic variation.

References

1. Anonymous. National Horticultural Board (NHB), Indian Horticulture Database. Ministry of Agriculture, Government of India 85, Institutional Area, Sector-18, Gurgaon-122 015, India. 2018.
2. Burton GW. Quantitative inheritance in grasses. Proc. 6th Int Grassland Cong. 1952; 1:277-283.
3. Chadha ML, Sidhu S. Studies on hybrid vigour in Brinjal (*Solanum melongena* L.). The Indian J Hort. 1983; 39:233-238.
4. Chaitanya V. Genetic diversity, heterosis, combining ability and stability analysis for yield and yield components in purple Brinjal (*Solanum melongena* L.). Ph.D. (Hort.), Dr. Y.S.R.H.U., Andra Pradesh (India), 2015.
5. Chaudhary P, Kumar S. Variability, heritability and genetic advance studies in egg-plant (*Solanum melongena* L.). Plant Arch. 2014; 14(1):483-486.
6. Cochran WG, Cox GM. Experimental Designs. 1957; 127-131.
7. Gavade RT, Ghadage BA. Genetic variability, heritability and genetic advance in generation of Brinjal (*Solanum melongena* L.). Bioinfolet. 2015; 12(1C):325-328.
8. Isshiki S, Okubo H, Fujieda K. Genetic control of isozymes in eggplant and its wild species. Euphytica. 1994; 80:145-150.
9. Johnson HW, Robinson HF, Comstock RE. Estimates of genetic and environmental variability of Soyabeans. Agron J. 1955; 47:314-318.
10. Lush JL. Inter-size correlation regression of offspring on dairy as a method of estimating heritability of characters. Proc. Amer. Soc. 1940; 33:293-301.
11. Madhavi N, Mishra AC, Om Prasad J, Bahuguna N. Studies on variability, heritability and genetic advance in Brinjal (*Solanum melongena* L.). Plt. Arch. 2015; 15(1):277-281.
12. Ravali BK, Reddy RP, Saidaiah, Shivraj N. Variability, heritability and genetic advance in Brinjal (*Solanum melongena* L.). Int. J Curr. Microbiol. App. Sci. 2017; 6(6):42-47.
13. Shukla V, Naik LB. Agro-techniques of solanaceous vegetables. In Advances in Horticulture. Vegetable Crops, Part 1 (Ed. K. L. Chadha and Kalloo G.). Malhotra, Pub. House, New Delhi. 1993; 5:365.
14. Sivasubramanyam MS, Menon MP. Path analysis of yield components in rice. Madras Agric. J. 1973; 60:1217-1221.
15. Sujin SG, Karuppaiah P, Saravanan K. Genetic variability and correlation studies in Brinjal (*Solanum melongena* L.). Ind. J Agric. Res. 2017; 51(2):112-119.
16. Tirkey M, Saravana S, Pushpa Lata. Studies on variability, heritability and genetic advance for yield and its attributes in Brinjal (*Solanum melongena* L.). J Pharmacognosy and Phytochemi. 2018; 1:1181-1183.

17. Vavilov NI. Proceedings of 5th International Congress of Genetics, New York. 1928, 342-369.
18. Vidhya C, Kumar N. Genetic variability studies in Brinjal (*Solanum melongena* L.) for fruit yield and quality. Electronic J Pl. Breed. 2015; 6(3):668-671.