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Genetic variability and correlation studies in brinjal

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Abstract

The extent of genetic variability, heritability, genetic advance and correlations in respect of eight economic characters in 30 genotypes of brinjal were studied under hot arid environment. The phenotypic and genotypic coefficients of variation were high for number of fruits and fruit yield per plant and fruit weight. High heritability estimates along with high genetic advance for number of fruits and fruit yield per plant and fruit weight indicated the role of additive gene action. Correlation studies revealed that fruit yield per plant was significantly and positively associated with number of fruits per plant and fruit weight. The genotype AHB 02, KSB 73, KSB 33, KSB 39 and F_2 (AHB 04 x PPC) showed high mean performance for fruit yield per plant along with earliness trait which can be further tested for direct use as variety or may be used in breeding programme for improving fruit yield.

Key words : *Brinjal, genetic variability, arid environment*

Introduction

Brinjal (*Solanum melongena* L.) is the most popular vegetable and has regional consumer's preferences in the country. There is increasing demand of its varieties for different culinary purposes. In the arid and semi arid regions it is an important rainy-autumn season crop, and also to some extent it is taken as a *rattoon* and summer crop. A wide variation in the form of size, shape, colour, and quality of fruits and fruit yield potential is available in the land races being grown in these regions. The main reasons might be consumer's preferences for specific types of brinjal in the different localities/communities and different level of selection pressure for the maintenance of desirable land races/local types in this indigenous crop by the growers and tribal community (Samadia, 2004).

For crop improvement, the information on magnitude of genetic variability, heritability and extent of genetic advance of the desirable traits is essentially important because phenotypic selection depends on the range of genetic diversity present in the population. In spite of its commercial significance in the arid and semi arid regions of the country, not much has been done for the varietal improvement in the brinjal. Hence, an attempt was made to assess the genetic variability in the brinjal genotypes so as to develop superior genotypes for the environmentally stressed areas.

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Materials and methods

The study was conducted at Central Institute for Arid Horticulture (ICAR), Bikaner (28° N latitude and 73° 18' E longitude at an altitude of 235 m above mean sea level) in the rainy-autumn season of 2002-03 under hot arid agro - climatic conditions. However, the research work on germplasm evaluation (more than 100) was started from year 2000 but a set of thirty genotypes, of which 25 land races collected from parts of Rajasthan and Gujarat under NATP on sustainable management of plant bio-diversity and five potential genotypes, were employed for the analysis. The experiment was laid down in a randomized block design with three replications. Thirty-five days old seedlings were transplanted at 60 cm x 45 cm spacing in rows (20-25 cm deep furrows) of five meters in length accommodating eleven plants for each genotype/ replication. The observation were recorded from randomly selected five plants for each genotype in each replication for days to first harvest after transplanting (DFH, DAT), number of fruits per plant (NF/P), fruit weight (FW, g), fruit length (FL, cm), fruit diameter (FD, cm), plant height (PH, m), number of branches per plant (NB/P) and total fruit yield per plant (FY/P, kg). Fruit characters were assessed at marketable stage from ten randomly selected fruits. To assess the yield potential of the genotype, total number of fruits harvested per plant was taken into consideration i.e. 120 days of the harvesting period. The data were analyzed adopting standard procedures suggested by Panse and Sukhatme (1985), Burton and De Vane (1953), Johnson *et al.* (1955), Robinson *et al.* (1949) and Al Jibouri *et al.* (1958) using computer packages.

Results and discussion

Analysis of variance revealed highly significant genotypic differences for all the eight characters depicting greater diversity in the experimental material (land races/ genotypes) under study (Table 1 and 2). Among the land races, the earliest harvest (< 55 DAT) was recorded in KSB 61 (49.77 DAT) followed by KSB 73, KSB 77, KSB 78, KSB 63, KSB 67, KSB 39, KSB 46 and AHB 02. The number of fruits per plant ranged from 43.06 to 132.24. The genotypes, F_2 (AHB 04 x PPC), Pusa Kranti, KSB 52, KSB 33, KSB 64 and KSB 39 recorded higher number of fruits (>100) per plant. A wide spectrum of variations for weight (49.76 – 141.6 g), length (5.81 – 12.46 cm) and diameter (3.40 – 6.47 cm) of the fruits were recorded at marketable stage. The plant height and number of branches per plant ranged from 51.03-79.34 cm and 5.81-10.18, respectively. Among the tested genotypes, total fruit yield per plant ranged from 2.85-8.69 kg with a population mean of 5.58 kg. Maximum fruit yield per plant was recorded in AHB 02 (8.69 kg) followed by KSB 73 while minimum in KSB 78. The genotype AHB 02, KSB 73, KSB 33, KSB 39 and F_2 (AHB 04 x PPC) were found to be potential genotypes for higher early yield along with more number of fruits per plant. These five genotypes also possess good fruit quality characters like size, shape and colour for consumer's preferences. It is noteworthy that the land races/genotypes under investigation were diverse and had great potential for improvement for quality fruit yield of brinjal under arid environment.

Genotypic and phenotypic coefficient of variation (GCV and PCV) study indicated that there is an ample scope for the improvement of this crop (Table 2). In general, the

Table 1. Plant growth and fruit yield characters in brinjal genotypes under hot arid environment.

Genotypes	Days to first harvest (DAT)	Fruits/ plant	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)(cm)	Plant height	Branches /plant	Fruit yield plant^{-1} (kg)
KSB 8	68.31	58.37	59.27	8.23	5.76	66.63	7.30	3.42
KSB 12	72.42	59.62	75.19	11.18	4.34	71.55	8.40	4.39
KSB 20	64.61	55.29	100.31	7.82	6.46	66.74	7.13	5.32
KSB 21	63.42	71.56	80.80	6.58	6.75	72.69	6.10	5.68
KSB 31	58.30	54.39	80.54	6.34	5.83	71.20	9.10	4.34
KSB 33	58.51	119.00	65.53	7.44	5.60	79.34	8.30	7.66
KSB 35	56.26	81.11	58.54	9.30	4.55	56.68	7.10	4.67
KSB 39	55.62	106.28	67.99	6.15	5.47	61.48	10.18	7.13
KSB 42	56.53	55.70	98.51	9.65	5.21	59.22	7.21	5.36
KSB 46	55.27	72.76	74.64	6.75	5.79	66.98	9.25	5.23
KSB 47	56.77	98.38	52.55	6.51	5.19	62.30	9.25	5.14
KSB 52	67.32	122.78	65.18	8.36	4.74	65.35	10.14	7.79
KSB 55	72.28	56.14	85.01	8.64	6.21	71.05	8.22	4.76
KSB 59	70.89	51.89	141.67	8.46	6.46	57.51	8.14	7.15
KSB 61	49.77	75.36	68.38	12.46	4.14	63.32	7.19	5.08
KSB 63	52.32	89.34	50.80	11.30	3.40	60.41	8.52	4.47
KSB 64	66.41	115.48	59.83	8.22	5.63	58.06	8.21	6.67
KSB 67	52.37	59.31	75.52	10.80	5.83	63.56	9.27	4.37
KSB 73	50.82	82.79	100.27	7.55	6.46	65.28	8.38	8.28
KSB 77	51.54	43.06	69.03	5.81	5.29	61.35	5.81	2.91
KSB 78	51.60	55.79	52.16	11.48	6.22	67.05	7.04	2.85
AHB 01	57.52	72.73	77.71	6.34	5.43	55.99	8.15	7.13
AHB 02	55.21	85.00	104.90	6.71	5.81	63.40	7.19	8.69
AHB 03	70.22	48.51	72.84	6.64	6.47	60.01	8.69	3.45
AHB 04	70.57	62.32	106.28	7.24	5.24	57.41	9.25	6.48
F_2 (AHB 04 x PPC)	55.12	132.34	58.91	6.67	4.76	62.48	8.02	7.65
PKM 1	55.34	97.65	56.06	6.24	4.83	59.81	6.16	5.19
Pusa Kranti	53.24	123.78	53.81	8.48	4.19	61.21	8.06	6.30
Pusa Bindu	55.26	89.89	49.76	6.35	5.35	51.03	7.32	4.31
Arka Kusumkar	53.89	84.75	68.93	10.33	5.75	57.75	8.29	5.48
Mean	59.26	79.38	74.36	8.13	5.44	63.23	8.04	5.58
CV	3.14	4.42	3.94	1.76	2.59	3.71	6.04	3.42
C D at 5%	3.04	5.74	4.79	0.23	0.23	3.84	0.79	0.31

Table 2. Genetic variability characters for brinjal genotypes

Characters	Mean	SE	F Value	GCV (%)	PCV (%)	h^2 (broad sense)	Genetic advance	Genetic advance % of mean
Days to first harvest	59.26	1.07	45.75	12.13	12.33	97.81	14.64	24.71
Fruits/plant	79.38	2.02	157.76	31.98	32.18	99.37	52.14	65.68
Fruit weight	74.36	1.69	153.16	28.10	28.22	99.35	42.88	57.66
Fruit length	8.13	0.08	517.62	23.12	23.14	99.81	3.87	47.58
Fruit diameter	5.44	0.08	97.30	14.73	14.81	98.97	1.64	30.18
Plant height	63.23	1.35	19.26	9.18	9.42	94.81	11.63	18.40
Branches/plant	8.04	0.28	15.46	13.27	13.72	93.53	2.12	26.43
Fruit yield/plant	5.58	0.11	208.68	28.48	28.58	99.52	3.27	58.55

Table 3. Genotypic and phenotypic correlations among various characters in brinjal

Character		DFH	NF/P	FW	FL	FD	PH	NB/P	FY/P
DFH	G	-	-0.251	0.376*	-0.097	0.286	0.186	0.208	0.008
	P		-0.246	0.373*	-0.095	0.283	0.175	0.199	0.008
NF/P	G		-	-0.468**	-0.155	-0.431*	-0.054	0.274	0.602**
	P			-0.466**	-0.154	-0.429*	-0.052	0.260	0.598**
FW	G			-	-0.087	0.497**	0.032	0.033	0.378*
	P				-0.087	0.493**	0.027	0.034	0.375*
FL	G			-		-0.351	0.061	-0.005	-0.275
	P					-0.349	0.062	-0.003	-0.274
FD	G					-	0.252	-0.071	0.026
	P						0.238	-0.067	0.029
PH	G						-	0.031	0.001
	P							0.046	0.003
NB/P	G							-	0.311
	P								0.304
FY/P	G								-
	P								-

Significant * 5 % and ** 1 %

estimates of PCV were higher than GCV for all the characters. A close correspondence between PCV and GCV values in respect of all the characters indicate that environment has very little influence on the expression of the characters. Number of fruits per plant exhibits a high (> 25) estimate of PCV and GCV followed by fruit yield per plant and fruit weight. Thus, indicating better scope for phenotypic selection to enhance fruit yield in brinjal.

High heritability estimate was recorded in respect of all the characters. Though heritability estimates gives a useful indication of the relative value of selection based on phenotypic expression. Still it cannot give more reliable conclusion, unless genetic advance under selection is not taken in to consideration along with heritability (Johnson *et al.*,1955). Genetic advance in the present study ranged from 18.40 to 65.68% of mean. High heritability accompanied with high genetic advance for number of fruits per plant, fruit yield per plant and fruit weight characters indicates additive type gene action. Simple selection therefore could be effective for the improvement of these traits. High heritability accompanied with low genetic advance in respect of plant height, days to first harvest, branches per plant and diameter and length of fruit was probably due to non-additive type of the gene action and selection for these characters will be less effective, Panse and Sukhatme (1957). The present studies on genetic variability components are in agreement with the results of Sharma and Swaroop (2000) and Baswana *et al.* (2002) in brinjal.

The genotypic correlation coefficients were higher in magnitude than the corresponding phenotypic correlation coefficient (Table 3) except for plant height with number of branches and yield per plant. These findings are in agreement to those of Singh and Singh (1981), Khurana *et al.* (1988) and Sharma and Swaroop (2000) in brinjal. Correlation coefficient studies indicate that fruit yield per plant was significantly and positively correlated with number of fruits per plant and fruit weight both at genotypic and phenotypic level. Thus selection programme based on these traits might bring an improvement in fruit yield of brinjal. Sharma and Swaroop (2000) also reported similar results in brinjal. Number of branches per plant showed non-significant positive correlation with fruit yield. Fruit

weight had significant and positive correlation with fruit diameter. Fruit weight and diameter had significant and negative correlation with number of fruits per plant.

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