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Genetic variability and response to selection in brinjal (*Solanum melongena* L.)

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Abstract

Highly significant differences were observed among the 20 diverse brinjal genotypes for different characters. Average fruit weight showed the highest phenotypic and genotypic coefficient of variation closely followed by yield per plant. The lowest values were recorded for days to first flowering followed by days to first picking. The heritability estimates were high (above 85%) for all the characters. The maximum heritability was observed for number of fruits per plant and average fruit weight. The genetic advance as percentage of mean was high for average fruit weight, yield per plant, number of fruits per plant and number of leaves per plant. High GCV and heritability coupled with high genetic advance was observed for yield per plant and followed by number of fruits per plant indicating that they are governed by additive genes and could be effectively improved through selection.

Keywords: variability, heritability, genetic advance, brinjal

Introduction

Brinjal or eggplant (*Solanum melongena* L.) is worldwide known as aubergine or guinea squash and is one of the most important vegetable crops grown in India. Based upon its highest production potential and availability of the produce to consumers, it is also termed as poor man's vegetable. The unripe fruit is primarily used as cooked vegetable for the preparation of various dishes in different region of the world. It has got much potential as raw material in pickle making the dehydration industries and fruits have got medicinal properties, particularly, white brinjal is said to be good for diabetic patients (Choudhary, 1996) ^[5] and has also been recommended as an excellent remedy for those suffering from liver complaints (Chauhan, 1981) ^[4]. In India, brinjal is cultivated in an area of about 5.50 lakh hectares with the annual production of 8.2 lakh tonnes (Dhas and Srivastava, 2010) ^[6]. In Rajasthan, the area is estimated around 0.055 lakh hectares with an annual production of 0.23 lakh tonnes (anonymous, 2005) ^[1]. India being one of the primary centre of its origin (Thompson and Kelly, 1957) ^[16] has accumulated wide range of variability in brinjal. For crop improvement, the genetic variability plays an important role in a selecting the best genotypes for making rapid improvement in yield and other desirable characters as well as to select the potential parent for hybridization programmers. Heritability is an index for calculating the relative influence of environment on expression of genotypes. It becomes very different to judge how much of the variability is heritable and how much is non-heritable. Therefore, the present investigation was carried out to study the variability, heritability and genetic advance for ten important characters in brinjal.

Materials and Methods

The experiment was carried out at Horticulture Farm, Department of Horticulture, S.K.N. College of Agriculture, Jobner during kharif season of 2007-08 with 20 brinjal genotypes. The experiment was laid out in Randomized Block Design (RBD) with three replication. Thirty days old seedlings were transplanted at a spacing of 75 cm between rows and 60 cm between the plants in the first week of August. All the recommended cultural practices were followed under irrigated conditions. The observations were recorded on five randomly selected plants per replication for each genotype on ten important characters as given in table 1. The analyses of variance were carried out as suggesting by Panse and Sukhatme (1995) ^[13]. The genotypic and phenotypic coefficients of variations (GCV and PCV) were obtained the method suggested by Burton and De Vane (1953) ^[3]. Heritability in broad sense and genetic advance (GA) were estimated as per the formula described by Hanson *et al.* (1956) ^[7] and Johnson *et al.* (1955) ^[8] respectively.

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Results and Discussion

The extent of variability present in the brinjal genotypes was measured in terms of mean, range, mean sum of squares (MSS), phenotypic variance (σ_p^2), phenotypic coefficient of variation (PCV), genotypic variance (σ_g^2), genotypic coefficient of variation (GCV), heritability (broad sense) and genetic advance (GA). (Table 1 and 2). All the genotypes differed significantly with respect to different characters studied. Thus, suggesting that the present genotype was appropriate and hence suitable for further genetic analysis. A wide range of variation was observed for all the characters. Plant height varied from 70.87 (PPL) to 125.17 cm (Ramnagar Giant), number of branches per plant varied from 5.07 (KT-4) to 10.08 cm (PPR), number of leaves per plant from 21.37 (Dolly-5) to 54.87 cm (Local-1), days to first flowering from 52.47 (PPL) to 82.17 days (Pusa Kranti), days to first picking from 70.17 (PPL) to 109.30 days (Pusa Kranti), number of picking from 2.97 (Dolly-5) to 6.10 (Local-1), fruits per plant from 5.42 (Ramnagar Giant) to 27.97 (Pusa Ankur), average fruit weight from 41.33 (Hisar Pragati) to 613.70 g (Ramnagar Giant), yield per plant per picking from 0.35 (Hisar Pragati) to 3.03 kg (Ramnagar Giant) and Iron content in fruit from 59.00 (Rajendra Brinjal-64) to 110.20 ppm (Pant Rituraj). The characters showing high degree of variation have more scope for their future improvement. A perusal of data in Table 2 showed the differences between the genotypic and phenotypic variable for all characters were relatively low this indicated that these characters were comparatively stable and highly heritable. This also suggested that selection for such characters could be made effectively on the basis of phenotypic performance. The PCV was greater than the corresponding GCV for all the characters indicating the importance of environment in expression of characters. The GCV and PCV values were close to each other for most of the traits indicated less influence of environment for most of the characters. High GCV and PCV were recorded for average weight of fruit, which indicated the presence of high amount of genetic variability for this characters, thus selection may be more effective for this character because the response to selection is directly proportional to the variability present in the experimental material. The results was supported by Singh and Kumar (2005) [15] and Kushwah and Bandhyopadhy (2005) [10]. The moderate value of GCV and PCV for yield per plant and number of fruits per plant was observed indicating moderate variability for this character. Similar findings were reported for yield per plant by Kabir and Som (1993) [9]. On the other hand, low value of GCV and PCV were noted for remaining characters which indicated that selection might not be effective for these characters. To determine the amount of

heritable variation, estimation of GCV alone is not sufficient. Heritable variation can be found out with greater degree of accuracy when heritability is studied in conjunction with genetic advance. Burton and De Vane (1953) [3] suggested that GCV along with heritability give a better idea about the efficiency of selection. If the heritability of a character is very high more than 80 per cent, selection for such a character should be fairly easy. But for a character with a low heritability say low the 50 per cent selection may be considerably difficult virtually impractical due to masking effect of environment on the genotypic effect. The estimates of heritability were high for all the characters and ranges from 85.87 per cent (number of picking) to 99.70 per cent (number of fruits per plant). The high heritability indicates that the characters were less governed by environmental factors. These findings corroborate the earlier results obtained by Bora and Shadeque (1993) [2] who recorded high heritability for most of the traits in brinjal. High heritability along with high estimates of GCV, genetic advance and genetic gain was observed for average weight of fruit. Similar results were also reported by Sharma and Swaroop (2000) [14]. Expected genetic advance and its estimates as percentage of mean for various characters revealed that average weight of fruit, yield per plant and number of fruits per plant had high genetic advance, whereas number of leaves per plant, iron content in fruit, number of branches per plant, number of picking and plant height showed moderate values of genetic advance. The low values of genetic advance were noted for days taken to first flower and days taken to first picking. The estimates of heritability along with genetic advance were more reliable than heritability alone for predicting the effect of selection (Johnson *et al.*, 1955) [8]. High heritability coupled with high genetic advance was recorded for average weight of fruit, number of fruits per plant and yield per plant which indicated the major role of additive gene action in inheritance of these characters and would be improved through simple selection. This view was supported earlier by Negi *et al.* (2000) [11]. The high heritability and low to moderate genetic advance values were observed in other characters namely days taken to first flower, days taken to first picking, plant height, number of branches per plant, number of leaves per plant, number of picking and iron content in fruit revealed the major role of non-additive gene action in the transmission of these characters from parents to offspring's. Panse (1957) [12] viewed that if a character is governed by non-additive gene action; it may give high heritability but low genetic advance. Whereas, if it is governed by additive gene action, heritability and genetic advance both would be high. A high estimate of heritability alongwith high genetic advance provides good scope for further improvement in advance generations.

Table 1: Mean values for fruit yield and other traits in brinjal

Genotypes	Plant height at harvest (cm)	Number of branches per plant	Number of leaves per plant	Days taken to first flower	Days taken to first picking	Number of picking	Number of fruits per plant	Average weight of fruit (g)	Yield per plant (kg)	Iron content in fruit (ppm)
Neelam long	71.87	7.67	24.10	60.21	79.33	4.67	8.32	105.17	1.06	66.30
BR-112	75.33	6.28	27.73	62.08	78.80	3.10	9.60	58.51	0.56	74.63
Pusa Purple Long	70.87	6.23	28.47	52.47	70.17	4.53	12.93	42.37	0.54	62.63
Pusa Purple Round	74.53	10.08	41.97	79.87	107.40	5.00	8.57	120.43	1.00	61.53
Dolly-5	74.67	5.73	21.37	60.40	77.67	2.97	6.13	84.23	0.50	69.20
KT-4	76.10	5.07	30.07	73.30	93.37	3.83	9.47	60.57	0.56	77.57
Hisar Pragati	75.63	7.07	26.60	75.42	92.50	5.00	8.83	41.33	0.35	70.48
Pusa Kranti	72.13	6.00	28.53	82.17	109.30	4.10	13.20	70.50	1.16	60.23
Pusa Ankur	84.37	7.08	32.43	65.04	83.47	5.87	27.97	80.47	1.96	80.43
HLB-25	101.00	6.05	24.70	75.13	94.37	3.70	12.53	70.11	1.10	63.13
Pant Rituraj	75.53	7.63	28.00	73.29	97.23	4.40	8.37	98.60	1.24	110.20
Rajendra Brinjal-2	85.63	7.37	32.17	67.13	85.50	4.93	7.57	125.30	1.21	84.25
Ram nagar Giant	125.17	6.90	34.30	70.20	87.93	3.63	5.42	613.70	3.03	62.97
DBSR-31	85.33	7.13	28.10	72.13	94.33	4.77	7.10	74.23	0.49	66.13
Local-1	91.93	9.82	54.87	71.27	92.97	6.10	22.53	100.50	2.12	60.70
Hisar Brinjal -1	86.53	8.37	35.40	62.27	79.23	5.13	10.90	77.27	1.43	60.20
Rajendra Brinjal - 64	84.07	8.53	33.43	70.70	86.37	5.40	9.07	80.10	0.70	59.00
Azad Kranti	79.57	8.40	27.60	72.20	90.00	5.33	6.62	87.37	0.54	89.90
Punjab Sadabahar	108.63	7.52	31.80	72.03	92.30	4.80	6.80	76.70	0.50	60.07
Hisar Shayamal	72.50	7.97	39.40	74.60	96.03	4.97	7.97	73.30	0.56	71.90
C.D. at 5%	6.00	0.40	3.19	4.70	5.68	0.55	0.50	12.63	0.26	3.59

Table 2: mean, range, genotypic and phenotypic coefficient of variation, heritability (Bs) and genetic advance as percentage of mean for different characters in brinjal

Characters	Mean	Range	SEM \pm	Variation		Coefficient of Variation		Heritability in broad sense (%)	GA	GA as %age of mean
				Genotypic	Phenotypic	Genotypic	Phenotypic			
Plant height at harvest (cm)	83.57	70.87-125.17	2.10	191.84	205.11	16.57	17.13	93.53	27.59	33.01
Number of branches per plant	7.35	5.07-10.08	0.14	1.65	1.71	17.49	17.80	96.56	2.60	35.42
Number of leaves per plant	31.55	21.37-54.87	1.12	53.85	57.60	23.25	24.05	93.49	14.61	46.33
Days taken to first flower	69.60	52.47-82.17	1.65	50.30	58.42	10.19	10.98	86.09	13.55	19.47
Days taken to first picking	89.41	70.17-109.30	1.99	91.17	103.07	10.67	11.35	88.45	18.49	20.69
Number of picking	4.61	2.97-6.10	0.19	0.67	0.78	17.79	19.20	85.87	1.56	33.96
Number of fruits per plant	10.49	5.42-27.97	0.18	30.88	30.97	52.95	53.03	99.70	11.43	108.92
Average weight of fruit (g)	107.04	41.33-613.70	4.42	14686.18	14744.87	113.21	113.44	99.60	249.14	232.76
Yield per plant (kg)	1.03	0.35-3.03	0.009	0.45	0.48	65.81	67.52	94.98	1.36	132.12
Iron content in fruit (ppm)	70.57	59.0-110.20	1.26	164.18	168.93	18.15	18.41	97.18	26.02	36.87

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