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Original Article

Genetic studies for quantitative traits and resistance to bacterial wilt in brinjal (*Solanum melongena* L.)

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ABSTRACT

Eleven diverse genotypes of brinjal along with twenty four F_1s developed in line x tester fashion were evaluated for genetic variability, correlation and path coefficient for yield, its contributing traits and resistance to bacterial wilt. High estimates of genotypic coefficient of variation, heritability and genetic advance as percent of mean for fruit yield, fruit weight, fruit length and fruit breadth indicated presence of additive gene action and suitability of these characters for further improvement by selection. Days to 50% flowering, number of branches/plant, plant height and percent plant survival against wilt have recorded preponderance of non additive gene action. Fruit yield showed positive significant association with fruit length, number of branches/plant, plant height and percent plant survival against wilt and negative association with fruit breadth. Path analysis revealed that fruit breadth followed by plant height and percent plant survival against wilt had highest direct effect on fruit yield.

Keywords: Correlation, Genetic advance, GCV, Heritability, Path coefficient, PCV.

INTRODUCTION

Brinjal (*Solanum melongena* L.) is important solanaceous vegetable crop grown extensively throughout the year. Many biotic and abiotic stresses limit its yield realization and among them bacterial wilt caused by *Ralstonia solanacearum* Smith is one of the most dreaded diseases causing considerable yield loss. Hence the choice of a suitable resistant cultivar is needed. Success of plant breeding program largely depends on genetic variability present in any given crop species. Burton (1952) suggested that genetic variability along with heritability should be considered for making effective selection and improvement in the base population. A relative comparison of heritability values and expected genetic advance expressed as percent of mean gives an idea of the nature of gene action governing a particular character. Correlation and path coefficient analysis furnishes information regarding the nature and magnitude of various associations and help in the measurement of direct and indirect influences of yield components for selecting suitable genotype for improving yield. Although character association between different yield components has been studied in brinjal, information regarding its correlation with resistance to bacterial wilt is very less. Hence the present investigation was carried out to assess the nature and magnitude of genetic parameters and their utilization for development of superior genotypes of brinjal that are wilt resistant.

MATERIALS AND METHODS

The experimental material consisting of eleven genotypes *viz.*, HABR-5, HABR-6, BL-22, HABL-11, HABL-3, BL-5, Swarna Pratibha, HAB-898, HAB-899 and HAB-381 and their 24 F_1s developed through line x tester mating design, were planted in randomized block design at ICAR-RCER Research Centre, Ranchi during 2009-10. Data was recorded on fruit yield (q/ha), fruit weight (g), fruit length (cm), fruit breadth (cm), days to 50 percent flowering, number of branches/plant, plant height (cm) and percent plant survival against wilt after 90 days after transplanting. The genotypic and phenotypic coefficients of variation were calculated as suggested by Burton, 1952, while heritability and genetic advances were estimated as per the procedure of Allard, 1960. Correlation and path analysis were carried out using statistical package SPAR version 2.0.

RESULTS AND DISCUSSION

The analysis of variance showed significant differences among the genotypes for all the eight characters. High estimates of genotypic and phenotypic coefficients of variation (Table 1) were recorded for fruit yield, fruit weight, fruit length and fruit breadth. Heritability and genetic advance as percent of mean were also high for these traits indicating the presence of additive gene action

in controlling their expression. Hence response to selection would be expected in improvement of these characters. Similar results were obtained for some of these characters (Sharma and Swaroop, 2000; Sunitha and Bandhopadhya, 2005). Low estimates of genotypic and phenotypic coefficients of variations with moderate to low heritability and low genetic advance as percent of mean were recorded for days to 50 per cent flowering, number of branches/plant, plant height and percent plant survival against wilt indicating preponderance of non additive gene action in controlling these traits. Selection and intermating the selected plants will improve these traits. Mohanty (2001) reported similar results for number of branches/plant and plant height.

The genotypic and phenotypic correlation coefficients between different characters are depicted in Table 2. The estimates of correlation coefficients showed positive significant association of fruit yield with fruit length, number of branches/plant, plant height and percent plant survival against wilt and significant negative association with fruit breadth. Positive association of fruit yield with fruit length was reported (Patel and Sarnaik, 2004) and with number branches/plant and plant height (Prasath *et al.*, 2001). Among the other components fruit weight was positively correlated with fruit breadth and negatively correlated with number of branches/plant and percent plant survival. Fruit length and fruit breadth were negatively correlated. Fruit length showed positive significant association with plant height and percent plant survival against wilt whereas fruit breadth and number of branches/plant showed negative significant association with percent plant survival against wilt. Number of branches/plant showed positive significant association with plant height. Significant association among the characters indicated correlated response to selection for these traits increases fruit yield.

Path analysis to estimate direct and indirect contributions of various traits for recommending reliable selection criteria revealed that fruit breadth followed by plant height and percent plant survival against wilt had highest direct effect on fruit yield. Although fruit breadth showed highest direct effect on yield, this direct effect was nullified by negative indirect effects resulting in significant negative correlation. At phenotypic level percent plant survival and fruit weight showed highest direct effect on fruit yield. Highest direct effect on fruit yield by plant height was observed (Mohanty, 1999) and fruit breadth (Singh *et al.*, 2003). Indirect contributions to fruit yield were expressed by fruit weight through fruit breadth, fruit length through plant height and percent plant survival against wilt, fruit breadth through fruit length, number of branches/plant through plant height and plant weight through percent plant survival against wilt and hence simultaneous selection for these characters can be made for the improvement of yield. Mishra *et al.*, (2007); Singh *et al.*, (2003) and Sharma and Swaroop (2000) observed similar indirect effects on fruit yield.

Hence during selection, due importance should be given to fruit breadth, fruit length, plant height and percent plant survival against wilt for development of high yielding wilt resistant cultivars of brinjal. Plant height and fruit length as important selection criteria were reported by many researchers (Singh and Kumar, 2004; Sharma and Swaroop, 2000; Pathania *et al.*, 2005; Patel and Sarnaik, 2004).

Table 1: Estimates of GCV, PCV, Heritability, Genetic advance and Genetic advance as percent of mean

Character	Mean + S.E	Range	GCV (%)	PCV (%)	Heritability (%)	Genetic advance	Genetic advance as % of mean
Fruit yield (q/ha)	798.33 + 33.27	445.62-1089.31	19.62	29.33	0.45	180.12	22.8
Fruit weight(g)	129.11 + 7.673	55.13-242.50	33.06	37.14	0.79	72.81	56.39
Fruit length(cm)	15.75 + 0.721	9.51-28.93	26.55	27.62	0.92	7.97	50.61
Fruit breadth (cm)	4.99 + 0.199	2.91-8.28	22.83	24.32	0.88	2.10	42.14
Days to 50% flowering	56.37 + 0.667	48.90-62.80	4.74	8.70	0.29	2.33	4.13
No. of branches /plant	4.57 + 0.095	3.38-5.50	5.48	16.63	0.10	0.11	2.51
Plant height (cm)	76.54 + 1.579	51.80-97.50	8.80	14.85	0.35	6.64	8.67
%plant survival against wilt	85.64 + 2.271	37.50-100.00	9.50	20.06	0.22	6.00	7.01

Table 2. Estimates of genotypic and phenotypic correlation coefficients

Genotypes	Fruit yield (q/ha)	Fruit weight (g)	Fruit length (cm)	Fruit breadth (cm)	Days to 50% flowering	No. of branches/plant	Plant height (cm)	% plant survival against wilt
Fruit yield (q/ha)	1.0000	-0.1307 -0.0415	0.4556** 0.2800	-0.3666* -0.1993	-0.0294 -0.0391	0.0326* 0.1609	0.7572** 0.3179	0.7933** 0.7282**
Fruit weight(g)		1.0000	-0.1070 -0.0323	0.6866** 0.6520**	0.1885 0.1605	-0.3562* -0.0001	-0.0874 -0.1143	-0.3909* -0.1369
Fruit length (cm)			1.0000	-0.6545** -0.5770**	0.0028 0.0304	-0.5710** -0.1056	0.3614* 0.1864	0.5194** 0.2420
Fruit breadth (cm)				1.0000	0.3077 0.1475	0.1503 0.1302	-0.2726 -0.2314	-0.6869** -0.2700
Days to 50% flowering					1.0000	0.0227 -0.1840	0.2095 -0.0561	-0.1164 -0.1494
No. of branches /plant						1.0000	0.5463** 0.0966	-0.5336** 0.1614
Plant height (cm)							1.0000	0.2026 0.2463
% plant survival against wilt								1.0000

Figures in "bolds" are genotypic correlation coefficients

*P = 0.05, **P = 0.0

Table 3: Direct and indirect effects of yield components on fruit yield

Characters	Fruit weight (g)	Fruit length (cm)	Fruit breadth (cm)	Days to 50% flowering	No. of branches /plant	Plant height (cm)	% plant survival against wilt
Fruit weight (g)	-0.4052 1.0229	0.0433 -0.0330	-0.2782 0.6668	-0.0763 0.1642	0.1443 -0.0001	0.0354 -0.1169	0.1583 0.1399
Fruit length (cm)	-0.0124 0.04184	0.1158 -1.2952	-0.0758 0.7472	0.0003 -0.3935	-0.0661 0.1368	0.0418 -0.2414	0.0601 -0.3133
Fruit breadth (cm)	0.7067 -1.3701	-0.6735 1.2125	1.0293 -2.1017	0.3166 -0.3098	0.1547 -0.2734	-0.2806 0.4863	-0.7069 -0.5675
Days to 50% flowering	-0.0691 0.4824	-0.0010 0.0913	-0.1128 0.0443	-0.3666 0.3006	-0.0083 -0.0553	-0.0768 -0.0168	0.0426 0.0449
No. of branches/plant	0.0893 -0.00001	0.1432 -0.0143	-0.0377 0.0177	-0.0057 -0.0250	-0.2508 0.1357	-0.1370 0.0131	0.1338 0.0219
Plant height (cm)	-0.0866 0.0185	0.3581 -0.0301	-0.2701 0.0374	0.2075 0.0091	0.5413 -0.0156	0.9910 -0.1616	0.2007 -0.0398
% plant survival against wilt	-0.3535 0.1973	0.4700 0.3488	-0.6212 0.3893	-0.1052 0.2154	-0.4826 0.2327	0.1832 0.3551	0.9045 1.4419
'r' values Fruit yield (q/ha)	-0.1307 -0.0415	0.4556** 0.2800	-0.3666* -0.1993	-0.0294 -0.0391	0.0326* 0.1609	0.7572** 0.3179	0.7933** 0.7282**

Residual effect = 0.4459 (0.1482)

Underlined values are direct effects and all other values are indirect effects

Figures in 'bold' are genotypic estimates

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