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GENETICS OF FRUIT YIELD AND ITS COMPONENT CHARACTERS IN BRINJAL (*Solanum melongena* L.)

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ABSTRACT

A half diallel se involving eight genotypes was used to study the inheritance of fruit yield and its components characters in brinjal. The estimate of H_1 and H_2 (dominant genetic variance) was significant for fruit yield per plant and its components in both the generations, while both additive as well as dominance components of genetic variances were important for days to first flowering, days to first picking and plant height in F_1 and F_2 generations, respectively. The values of H_1 and H_2 as well as H_2 /4H_1 indicated there were unequal frequencies of the alleles at all the loci. An excess of recessive alleles was involved in seven out of the ten traits of interest. The mean degree of dominance was more than unity for the all the characters under studied including fruit yield in both the generations. Estimates of narrow sense heritability were high for days to first flowering, days to first picking and plant height in F_1 generation only, while in case of F_2 generation for days to first flowering, days to first picking, single fruit weight, plant height, and fruit yield per plant exhibited moderate narrow sense heritability.

Key words : *Diallel mating design, genetic parameter, narrow sense heritability*

The choice of plant breeding methodology for upgrading the yield potential largely depends on the availability of reliable information on nature and magnitude of gene effects present in the population. Hayman's methods of diallel analysis, which provides the estimates of the six components such as D-additive genetic variance, H_1-dominance variance, H_2-positive and negative gene effect, E-environmental components of variance, F-covariance of additive and dominant effect and h^2-dominant effect help in understanding the performance of parents used in the cross and in determining the characters. Therefore, the present study was undertaken with the objective to study the gene action of fruit yield and other important traits in brinjal using the half diallel technique involving eight parents.

MATERIALS AND METHODS

Eight genotypes namely, GBL 1, JBR 02-11, JBOB 03-04, Punjab Sadabahar, K 331, PB 69, DBL 02 and BB 85 were mated in a half diallel fashion. Resultant twenty eight hybrids (F_1) and their 28 F_2's were evaluated along with their 8 parents for fruit yield and its component characters namely, days to first flowering, days to first picking, fruit length (cm), fruit girth (cm), single fruit weight (g), number of fruits per plant, plant height (cm), primary branches per plant, fruit borer infestation: (%) and fruit yield per plant (kg) and were laid out in Randomized Block Design with three replications during Rabi 2009-10. Each entry consisted of a single row of 4.8 m length for each of parents and F1s and four rows each of F2 progenies. Inter and intra row spacing adopted was 75 and 60 cm, respectively. Observations were recorded in five random plants in each plot from F_1 and parents and 20 plants of from F_2 generation on ten fruit yield traits. The genetics parameters were estimated as per Hayman's analysis of daillel cross.

RESULTS AND DISCUSSION

Estimates of genetic variance due to additive (D) was significant for days to first flowering, days to first picking and plant height in F_1 and F_2. The dominance (H_1 and H_2) were significant for all the ten traits studied in both the generations (Table-2). Hence the genetic components of variance viz., D, H_1 and H_2 were suggested the importance of both additive and dominant genes for above said traits. This was also supported by the significant of ?2gca/?2sca variances (Table-1) for these traits. Similar results were also

reported by (2,3,4). The additive and non-additive gene effects may be exploited following intermating among the progenies with and between promising crosses in early segregating generations. While in case of remaining characters, only dominant component was found significant. This indicated the role of dominant gene action in the inheritance of fruit yield and its components. These findings are in agreement with those of (2, 5).

The positive F value and ratio of KD/KR (more than unity) suggested the distribution of more dominant alleles for single fruit weight, plant height and fruit borer infestation in both the generations. The negative value of F component and ratio of KD/KR (less than unity) indicated the distribution of more recessive alleles for days first flowering and picking, fruit length, fruit girth, number of fruits per plant number of primary branches per plant and fruit yield per plant in F_1 and F_2 generations

The environment effect (E) was non-significant for all the traits except days to first flowering and picking, plant height and number of primary branches per plant. The potence ratio $(H/D)^{1/2}$ was more than unity, indicating the presence of over dominance in the inheritance of all the traits including fruit yield per plant in both the generations (Table-2). Similar results were observed by (3,4,6). The ratio of $H_2/4H_1$ was less than 0.25 for all the traits studied indicating unequal allelic frequency or asymmetrical distribution of positive and negative genes in the parents at the loci exhibiting dominance in F_1 and F_2 generations. These results are in agreement with those obtained by (2,3,4,6). The ratio of h2/ H2 was less than one for all the traits studied except fruit borer infestation in both the generation. This revealed that all the traits were under control of at least single group of genes. These results are also corresponding with those of (6,7,8). The narrow sense heritability was higher for days to first flowering, days to first picking and plant height in F_1 generation this indicated the importance of additive genetic variance in the inheritance of these traits and suggested that genotype could be evaluated readily from the phenotypic expression. Simple selection would be more effective in the sets of materials exhibiting greater additive genetic variability and desirable mean performance. Moderate heritability was noticed for fruit

Table-1: Analysis of variance for combining ability for different characters in brinjal.

Source	Generation	d.f.	Mean squares									
			Days to first flowering	Days to first picking	Fruit length	Fruit girth	Single fruit weight	Number of fruits per plant	Plant height	No. of primary branches per plant	Fruit borer infestation	Fruit yield per plant
gca	F_1	7	150.16 **	150.16**	4.61**	4.13**	123.78**	37.90**	540.91**	1.23**	3.75**	0.34**
	F_2	7	159.77 **	154.19**	03.07**	6.65**	117.60**	20.50**	492.34**	1.51**	2.26**	0.70**
sca	F_1	28	15.35 **	15.35**	01.83**	12.13**	89.56**	15.91**	20.00**	0.43**	9.41**	0.32**
	F_2	28	38.17 **	37.41**	02.66**	15.44**	103.84**	20.50**	26.82**	0.57**	9.67**	0.41**
Error	F_1	70	08.67	09.62	0.56	0.57	06.23	02.70	9.23	0.11	0.85	0.12
	F_2	70	06.75	07.01	0.69	01.11	13.91	02.59	12.26	0.16	1.56	0.07
?2gca	F_1		02.12	02.45	0.32	0.03	0.14	0.27	4.93	0.35	0.03	0.11
sca	F_2		1.10	1.48	0.12	0.04	0.12	0.01	3.30	0.34	0.01	0.19

*, ** Significant at 5 % and 1 % levels, respectively

Table-2: Estimates of genetic components and ratio for ten characters in brinjal.

Components	Days to first flowering		Days to first picking		Fruit length		Fruit girth		Single fruit weight	
	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2
D	30.23** ±05.50	31.53** ±15.49	29.30** ±05.51	31.70* ±16.00	0.19 ±0.46	0.06 ±0.63	0.41 ±07.88	0.96 ±9.06	12.54 ±45.45	6.14 ±50.92
H_1	41.50** ±12.66	554.62** ±142.45	38.98** ±12.66	38.86** ±149.62	6.46** ±1.05	4.86** ±5.81	46.33* ±18.13	236.04** ±83.38	358.01** ±104.49	1592.36** ±468.26
H_2	38.36** ±11.01	515.82* ±123.93	36.52** ±11.01	513.7** ±130.17	4.69** ±0.91	1.64** ±5.06	44.64** ±15.77	219.48** ±72.54	290.91** ±90.91	1321.41** ±407.38
h^2	14.45* ±7.34	92.94** ±83.11	14.05 ±7.39	70.67 ±87.29	05.01** ±0.61	5.56** ±3.39	14.57 ±10.57	84.48 ±48.65	183.80** ±60.97	809.44 ±273.21
F	-31.81** ±13.01	-60.40** ±13.21	-33.18* ±13.01	-59.96 ±76.89	-0.45** ±1.08	-1.15 ±2.99	-1.03 ±18.63	-1.58 ±42.85	10.00 ±107.41	15.70 ±240.65
E	8.47** ±1.83	7.16** ±1.16	09.38** ±1.84	6.99** ±1.42	0.505** ±0.15	0.67 ±0.21	0.57 ±2.62	1.08 ±3.02	7.28 ±15.15	13.68 ±16.97
$(H_1/D)_{1/2}$	1.17	2.10	1.15	2.06	5.82	4.11	10.62	7.99	5.34	8.05
$H_2/4H_1$	0.23	0.23	0.23	0.24	0.18	0.22	0.24	0.23	0.20	0.21
KD/KR	0.38	0.37	0.34	0.37	0.66	0.22	0.79	0.81	1.16	1.38
h^2/H^2	0.38	0.18	0.39	0.14	1.07	0.99	0.33	0.39	0.63	0.61
Heritability (ns) %	64.40	32.40	63.70	30.10	41.30	20.50	9.00	13.30	30.30	27.50
t^2	1.05	2.08	1.06	1.12	1.00	1.75	1.80	1.84	1.63	1.45
D	0.75 ±08.13	0.67 ±6.17	21.8** ±05.79	21.5** ±5.91	0.05 ±0.10	0.09 ±0.26	5.22 ±4.31	4.63 ±4.51	0.05 ±0.10	0.01 ±0.23
H1	0.73* ±18.70	299.40** ±56.78	55.69** ±13.31	58.52** ±13.91	1.57** ±0.23	8.08* ±2.39	42.49** ± 9.91	162.21 ** ±41.53	0.94** ± 0.23	6.17** ± 2.16
H2	45.42** ±16.27	257.05** ±49.40	56.49** ±11.58	28097**. ±79.28	1.15** ±0.20	5.82* ±2.08	30.75** ±8.62	125.64** ± 36.13	0.88** ± 0.20	5.11** ± 1.88
h2	22.71 ±10.91	235.1** ±33.13	21.29** ± 07.76	264.09** ±53.17	1.15** ± 0.13	5.46** ±1.39	-0.25 ±5.78	-0.07 ±24.23	0.76** ±0.13	2.90 ±1.26
F	-68.21** ±19.22	-3.42 ±29.18	4.82 ±13.68	56.37 ±46.83	0.30 ±0.24	-0.73 ±1.23	14.37 ±10.18	25.02 ± 21.34	-0.14 ± 0.24	-0.23 ± 1.11
E	2.65 ±02.71	2.56 ±2.05	8.99** ±01.93	11.93** ±3.30	0.11** ±0.03	0.16* ± 0.08	0.95 ±1.43	1.5 ±1.50	0.12 ±0.03	0.07 ± 0.07
$(H_1/D)_{1/2}$	9.57	10.61	1.59	1.64	5.83	4.63	2.96	1.53	4.56	4.87
$H_2/4H_1$	0.17	0.22	0.23	0.24	0.18	0.18	0.18	0.19	0.23	0.21
KD/KR	0.90	0.60	1.05	1.59	0.28	0.18	2.86	2.10	0.50	0.95
h^2/H_2	0.50	0.92	0.38	0.94	0.99	0.94	-0.01	-0.01	0.87	0.57
Heritability (ns) %	44.80	25.20	82.20	50.00	45.90	47.30	13.00	19.70	18.50	32.30
t^2	2.44	1.08	3.30	1.31	14.92**	16.84**	2.57	1.40	1.24	1.27

*, ** Significant at 5 % and 1 % levels, respectively

length, single fruit weight and number of fruits per plant in F_1 generation, while in case of F_2 generation for days to first flowering, days to first picking, single fruit weight, plant height, and fruit yield per plant exhibited moderate narrow sense heritability. also reported the similar findings.

This study revealed the importance of dominance gene action in the improvement of fruit yield and its most of the component characters. The dominance genetic components could be exploited by heterosis breeding or by intermating the selected progenies in early segregating generations which would results in the accumulation of favourable genes for the respective characters. Hence, biparental mating followed by pedigree selection may give fruitful results for genetic improvement of yield components in brinjal .

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