GAU Res. J. 1995. 21 (1) : 78-82

Genetic Studies in Bottle Gourd (*Lagenaria siceraria* (Mol.) Stand l.)

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ABSTRACT

The nature of gene action involved in the inheritance of days to first picking, crop span, fruit length, fruit girth, number of fruits per plant and yield per plant was studied in bottle gourd (*Lagenaria siceraria* (Mol.) Stand l.) in a half diallel involving 6 parents. Estimates of the components of variance indicated predominance of additive genetic effects for crop span, length of fruit and girth of fruit and dominance genetic effects for days to first picking, number of fruits per plant and yield per plant. Graphical analysis revealed the prevalence of non-allelic interactions for number of fruits per plant and yield per plant and additive gene effects for other traits. Overdominance for number of fruits per plant and yield per plant; partial dominance for crop span, length of fruit and girth of fruit and complete dominance for days to first picking were recorded. Narrow sense heritability estimates were high for crop span, length of fruit. girth of fruits; moderate for days to first picking and low for yield per palnt and number of fruits per plant. In view of their parallel role, both additive and non-additive genetic effects may be simultaneously exploited through recurrent selection for improvement of yield in bottle gourd.

(Received on 22nd April, 1994)

INTRODUCTION

Bottle gourd is an important vegetable crop grown extensively throughout tropical and sub-tropical regions of the world. Information on the nature and magnitude of genetic variability and its appropriate exploitation is important to direct the breeding research in any crop. Such information is scanty for yield and its related characters in this crop. Hence the present study was undertaken to determine the genetics of seven important characters in bottle gourd.

MATERIALS AND METHODS

Six genetically diverse lines of bottle gourd, viz., Pattiwali, BP-11, Pusa Manjari, B. Dang, JLT (Junagadh Long Tender) and J. Sel. 1 were crossed in all possible combinations, excluding reciprocals to obtain 15 F_1s. The 6 parental lines and 15 F_1s were sown at the Instructional Farm, Gujarat Agricultural University, Junagadh during summer 1993 in randomized block design with three replications. Each plot consisted of 14 m long single row. The crop was planted at a distance of 3.5 m between rows with 2 m spacing between plants. The observations were recorded on five plants for days to first picking, crop span, length of fruit (cm), girth of fruit (cm), number of fruits per plant and yield per plant (kg). The mean values were utilized for component and graphical analysis following the

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techniques of Jinks and Hayman (1953) and Hayman (1954). Heritability in narrow sense was calculated following Mather and Jinks (1971).

RESULTS AND DISCUSSION

The slope of regression line in the variance – coveriance graph deviated significantly from zero, but not deviated significantly from unity, indicating the fitness of additive-dominance model for all these characters.

The estimates of components of variation and their different ratios are given in Table 1. Both the additive (D) and dominance

TABLE 1

Components of genetic variance for different characters.

Components	*Days to first picking*	*Crop span*	*Length of fruit*	*Girth of fruit*	*Number of fruits per plant*	*Yield per plant*
D	6.06** ± 0.71	19.78** ± 1.57	116.02** ± 2.05	107.51** ± 7.74	1.54* ± 1.63	2.73* ± 0.77
H_1	6.45* ± 1.80	11.71* ± 3.98	31.39** ± 5.14	88.55* ± 19.64	13.56* ± 4.14	6.15* ± 1.94
H_2	6.87* ± 1.60	9.28 ± 3.56	29.30** ± 4.59	76.35* ± 17.55	10.32* ± 3.70	4.44 ± 1.74
h^2	9.04** ± 1.08	8.33* ± 2.39	73.27** ± 3.09	50.58* ± 11.81	5.17 ± 2.49	1.35 ± 117
F	– 2.11 ± 1.73*	7.89 ± 3.83	4.57 ± 4.95	68.25* ± 18.90	– 2.19 ± 3.99	0.29 ± 1.87
E	1.24* ± 0.27	2.40* ± 0.59	1.16 ± 0.77	2.21 ± 2.92	1.21 ± 0.62	1.07* ± 0.29
$(H_1/D)^{0.5}$	1.03	0.77	0.52	0.91	2.97	1.50
$H_2/4H_1$	0.27	0.20	0.23	0.22	0.19	0.18
$\frac{(4\,DH_1)^{0.5} + -P}{(4\,DH_1)^{0.5} - -F}$	0.71	1.70	1.07	2.11	0.61	0.93
h^2 / H_2	1.31	0.89	2.50	0.66	0.50	0.30
Heritability (ns.) %	30.93	59.56	78.66	78.68	6.95	20.30

*, ** Significant at 5% and 1 % level, respectively.

FIG. 1. Vr, Wr DAYS TO FIRST PICKING

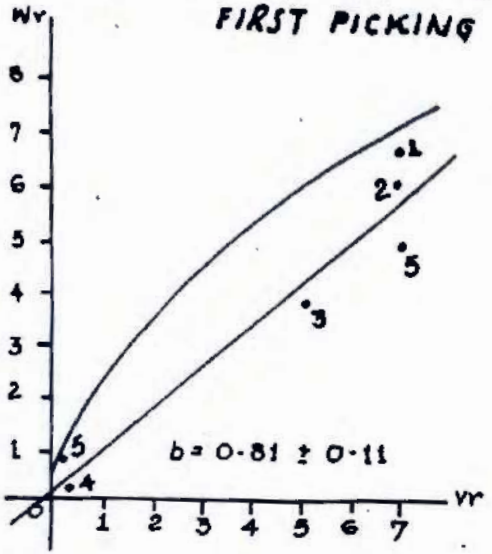


FIG. 3. Vr, Wr LENGTH OF FRUIT

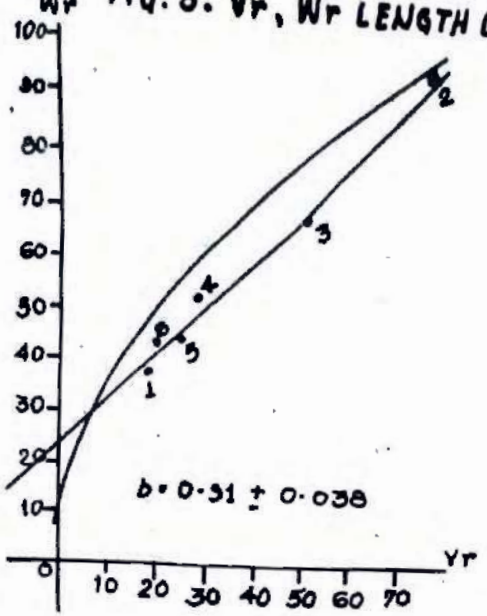


FIG. 5. Vr, Wr NUMBER OF FRUITS PER PLANT

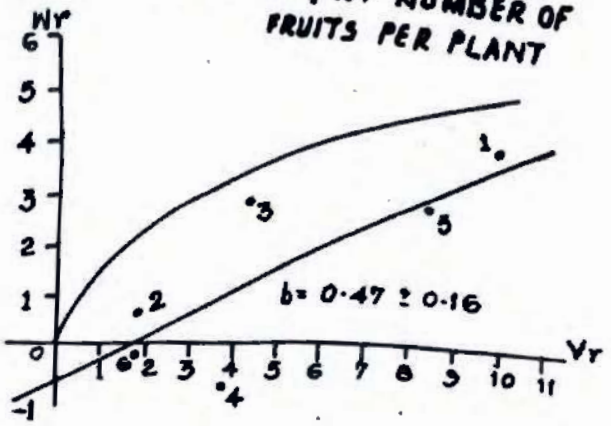


FIG. 2. Vr, Wr CROP SPAN

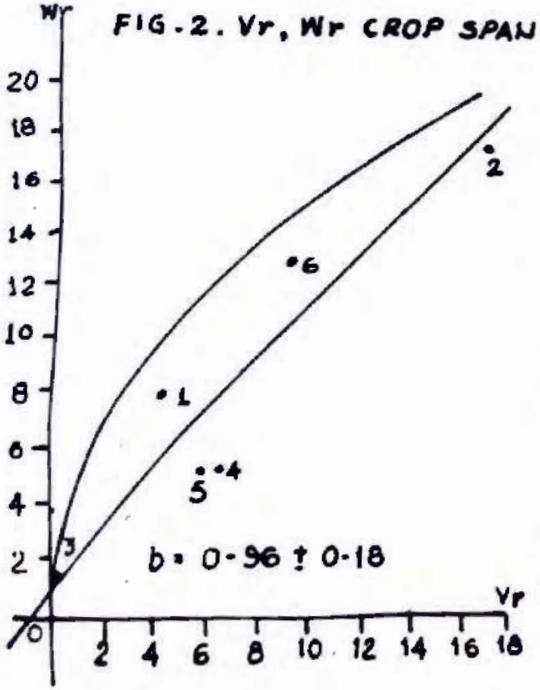


FIG. 4. Vr, Wr GIRTH OF FRUIT

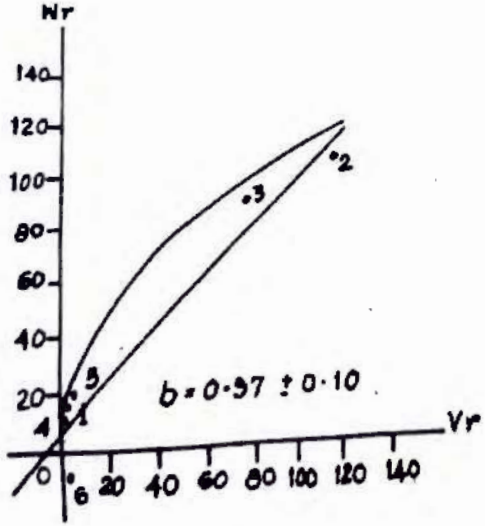
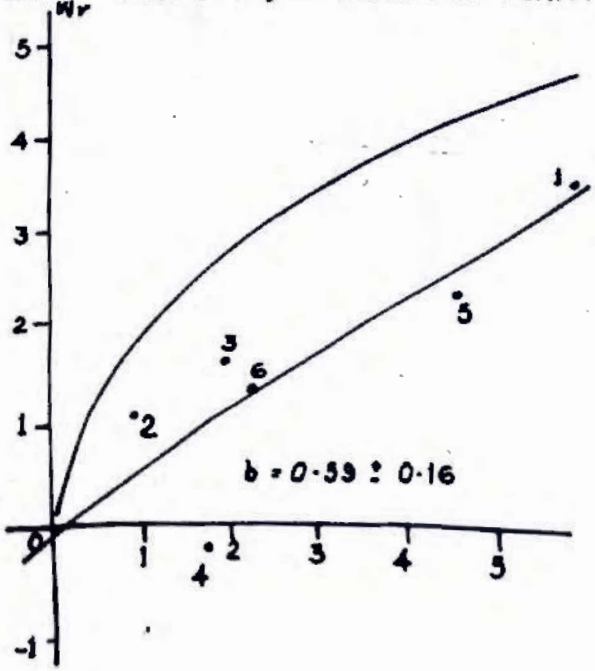


FIG. 6. Vr, Wr YIELD PER PLANT



P_1 = Pattiwali
P_2 = B.P.-11
P_3 = Pusa Manjari
P_4 = B. Dang
P_5 = JLT
P_6 = J. Sel.-1

component (H_1) of variances were significant for all the characters studied, except number of fruits per plant. This indicated the presence of both additive and non-additive gene action in the expression of these characters. Magnitude of non- additive variance was higher for days to first picking, number of fruits per plant and yield per plant, indicating preponderance of non-additive gene effects for the inheritance of these traits. There was a predominance of additive genetic variance for crop span, length of fruit and girth of fruits. Hence, these could be fixed by selection in later generations of hybrid progeny. H_1 was greater in magnitude than H_2 for crop span, girth of fruit and number of fruits per plant suggesting that genes with positive and negative effects were not in equal proportion in the parents for these characters. The non-significant value of F for all the characters except girth of fruit indicated an equal distribution of dominant and recessive genes in the parents. The degree of dominance suggested partial dominance for crop span, length of fruit and girth of fruits; overdominance for number of fruits per plant and yield per plant; and complete dominance for days to first picking. These results were also further confirmed by graphical analysis. Similar results were observed by Sharma *et al.,* (1983) and Sirohi *et al.,* (1988) in bottle gourd. The proportion of $H_2/4H_1$ indicated asymmetrical distribution of genes with positive and negative effects in the parents. The ratio h^2/H_2 is an estimate of the number of gene groups controlling the character suggested that one to three genes or gene groups were responsible for the inheritance of different traits under study.

The estimates of heritability in narrow sense were high for crop span, length of fruit and girth of fruit; moderate for days to first picking and low for yield per plant and number of fruits per plant. Low to high heritability estimates for different characters in bottle gourd have been also reported by Tyagi (1972) and Sharma and Dhankhar (1990).

The wider scattering of array points on the regression line indicated diversity among the parents for all the characters studied. The position of array points suggested that a higher proportion of dominance genes observed in different parents, viz. Pattiwali for crop span, fruit length and fruit girth; BP-11 for number of fruits per plant and yield per plant; Pusa Manjari for crop span and yield per plant; B. Dang for days to first picking, crop span and fruit girth; JLT for crop span, fruit length and fruit girth and J. Sel. 1 for days to first picking, fruit length, fruit girth, number of fruits per plant and yield per plant.

On the other hand a higher proportion of recessive genes was found in the parent Pattiwali for days to first picking, number of fruits per plant and yield per plant; BP-11 for days to first picking, crop span, fruit length and fruit girth; Pusa Manjari for days to first picking, fruit length and fruit girth; JLT for days to first picking, number of fruits per plant and yield per plant; and J. Sel. 1 for crop span. Parent B. Dang exhibited complementary type of gene interaction was for number of fruits per plant yield per plant.

For the characters, viz., days to first picking, length of fruit, crop span and girth of fruit there were high heritability estimates coupled with preponderance of additive gene actions indicating that simple selection would be effective for imprvement of these traits. Low heritability estimates for number of fruits per plant and yield per plant indicated that both additive and

non-additive components were important in the inheritance of these traits. Therefore, recurrent selection would be fruitful for effective utilization of both type of gene actions, as it would select for desirable alleles and at the same time it maintain sufficient heterozygosity for the exploitation of dominance gene action in the population.

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