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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences, 2(3): 948-951, 1999 Research Article

Genetic Mechanism For Some Spike Characteristics and Grain Yield In Bread Wheat

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Abstract

Five wheat varieties/lines viz; HABA-4, HABA-12, Pitic-62, Pak-81 and LU26S were crossed in a diallel fashion to determin the mode of inheritance of some important spike characteristics. Number of spikes per plant, number of grains per spi and grain yield per plant were governed by over dominance type of gene action. Number of spikelets per spike, spike leng and 1000-grain weight were ruled by partial dominance with additive type of gene action except spike length in which n additive type of gene action was observed. Epistasis was absent for all the traits studied.

Introduction

Wheat, the major food crop of Pakistan has always been an object of extensive research, wheat productivity can be maximized through the development of improved varieties from crosses. To evolve new wheat varieties, a plant breeder has to deal with hundreds of new crosses and thousands of progenies to pick up a desired combination. Thus he is in dire need of such techniques that will help him in the selection of suitable parents and screening of his breeding material in early generations. The diallel cross technique as advocated by Hayman (1954, 1958) and Jinks (1954, 1955) offers a method especially in self fertilized crops like wheat to assess the crosses right in the F_1 generation and provides the necessary genetic information on the plant characters to determine the right breeding approach.

Hussain *et al.* (1986) crossed six wheat varieties and showed that additive type of gene action was operative with partial dominance for number of spikelets per spike while for number of grains per spike and grain yield per plant over dominance type of gene action was present. Khan *et al.* (1992) analysed 6 x 6 complete diallel cross of spring wheat varieties and found additive gene action with some degree of partial dominance for spike length. Chowdhry *et al.* (1993) reported that the, genetic interactions were apparently of over dominance type for number of spikes per plant and number of grains per spike while additive type of gene action with partial dominance and absence of non allelic interaction was found for 1000-grain weight. Bhutta *et al.* (1994) investigated from a 4 x 4 diallel cross in wheat that the grain yield per plant was controlled by non -additive type of gene action with over dominance.

The present study was conducted to ascertain the type of genetic mechanisms involved in the expression of certain spike characteristics and grain yield of wheat in a five parental complete diallel cross. Such information would be helpful to keep up the tempo of our wheat improvement.

Materials and Methods

The present research work was carried out in th experimental area of the Department of Plant Breeding a Genetics, University of Agriculture, Faisalabad. The mate comprised five different varieties/lines of wheat nam HABA-4, HABA-12, Pitic-62, Pak-81 and LU26S and wo crossed in a complete diallel fashion during March, 199 The F_1s including the reciprocals and parents were spa planted in the field following triplicated randomiz complete block design during the year 1997-98. Fi meters long single rows for each genotype in ea replication served as an experimental unit with plant plant and row to row distance of 15cm and 30c respectively. Sowing was done by dibbling method. T seeds per hole were sown and later after germinati thinned to one seedling per site. Ten guarded plants w randomly selected at maturity from each genotype in ea replication. The data were recorded on individual plant ba on number of spikes per plant, spike length, number spikelets per spike, number of grains per spike, 1000-gr weight and grain yield per plant. The analysis of varia technique developed by Steel and Torrie (1980) was app to estimate the significance of mean differences and wh the differences were significant, the data were fur subjected to diallel analysis technique advocated Hayman (1954, 1958) and Jinks (1954, 1955).

Results and Discussion

Analysis of variance for important spike characteristics grain yield exhibited highly significant differences am genotypes (Table 1) from which it was evident diversity for these traits existed among the parents wh could be utilized for wheat improvement programmes.

Number of spikes per plant: The Vr/Wr gra representation revealed that regression line intercepted Wr-axis below the origin indicating over dominance typ gene action (Fig.1). Similar results were reported Chowdhry *et al.* (1993). Epistasis was absent as regression line did not deviate significantly from unit sl The distribution of varietal array points on regression

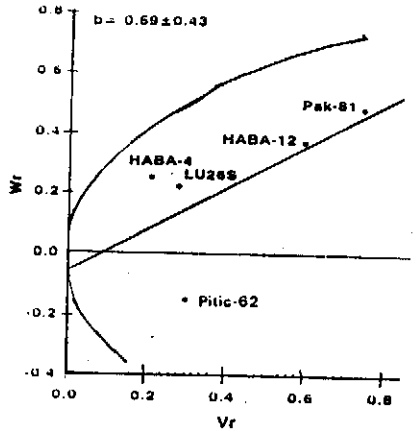

Figure 1: Vr/Wr graph for number of spikes per plant.

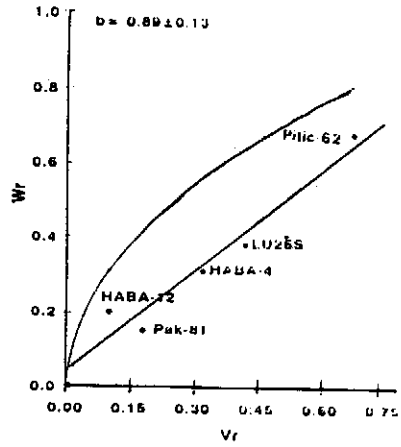

Figure 2: Vr/Wr graph for spike length.

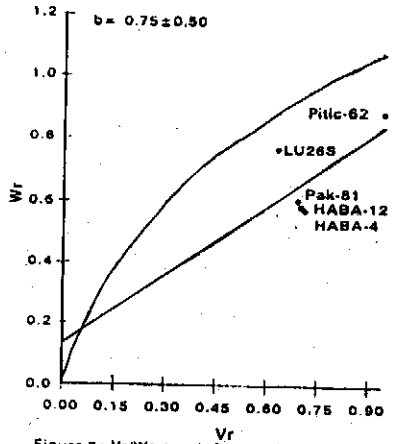

Figure 3: Vr/Wr graph for number of spikelets per spike.

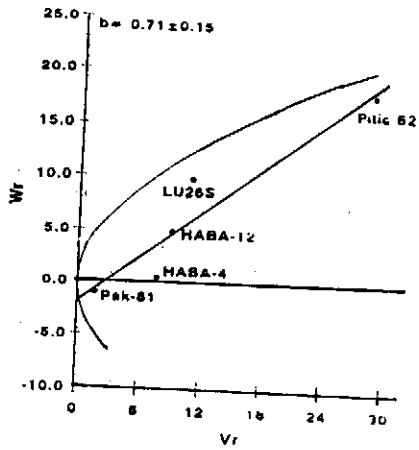

Figure 4: Vr/Wr graph for grains per spike

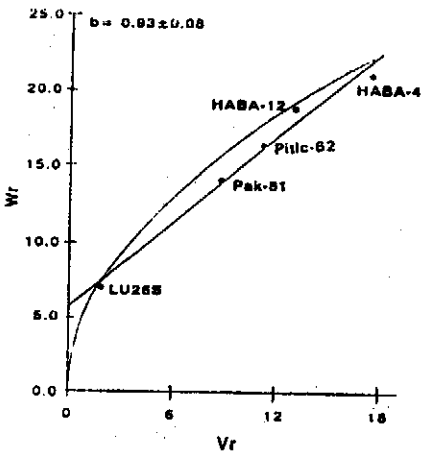

Figure 5: Vr/Wr graph for 1000-grain weight.

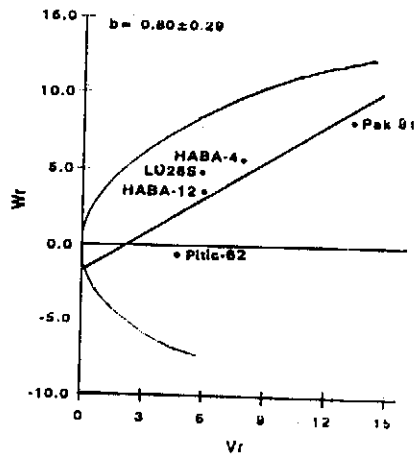

Figure 6: Vr/Wr graph for grain yield per plant.

Table 1. Analysis of variance for spike characteristics and grain yield per plant in a 5 x 5 diallel cross of wheat.

S.O.V.	df	Mean squares					
		Number of spikes per plant	spike length	Number of spikelets per spike	Number of grains per spike	1000-grain weight	Grain yield per plant
Replications	2	4.79	0.45	1.38	0.03	3.20	5.94
Genotypes	24	3.19**	1.46**	3.14**	46.19**	53.22**	31.52**
Error	48	0.61	0.24	0.48	1.21	1.31	1.10

** = Highly significant

dominant genes being closest to the origin whereas the revealed that the line HABA-4 possessed maximum variety Pak-81 had maximum recessive genes being farthest from the origin. The selection in early generations would be difficult because of the over-dominance type of gene action.

Spike length (cm).: From the Fig. 2 it is evident that this trait exhibited partial dominance as the regression line cut wr-axis just above the point of origin. Khan *et al.* (1992) reported partial dominance with additive type of gene action for this trait. The distribution of array points on regression line indicated that the line HABA-12 being closer to the origin carried maximum dominant genes while the variety Pitic-62 being farthest from the origin carried maximum recessive genes. As the regression line was of unit slope, it confirmed the absence of epistasis. The selection would be effective in later generation for spike length which was controlled by partial dominance with non additive type of gene action in the absence of epistasis.

Number of spikelets per spike: Fig. 3 showed that inheritance pattern for number of spikelets per spike appeared to be additive with partial dominance, as the regression line intercepted the Wr-axis above the point of origin. These results were in agreement with the findings of Hussain *et al.* (1986). The estimated regression line deviated non significantly from unit slope, suggesting the absence of non allelic interactions. The distribution of varietal array points on the regression line suggested that the line HABA-12 possessed maximum dominant genes being closest to the origin while the variety Pitic-62 being farthest from the origin obtained maximum recessive genes. As this character exhibited additive type of gene action with partial dominance in the absence of epistasis, the selection in early generation would be beneficial.

Number of grains per spike: The graphical illustration of Vr/Wr indicated the over dominance type of gene action for number of grains per spike, as the regression line cut the Wr-axis below the point of origin (Fig. 4). Similar results were reported by Hussain *et al.* (1986) and Chowdhry *et al.* (1993). The regression line did not deviate significantly from unit slope the variety Pak-81 being closest to the origin had maximum dominant genes while the variety Pitic-62 carried the maximum recessive genes being farthes from the point of origin. Selection would be difficult in ear generations for number of grains per spike due to the ov dominance type of gene action.

1000-grain weight (g): The graphic representation of Vr/W indicated that additive with partial dominance type of ge action governed the expression of 1000-grain weight, the regression line cut the Wr-axis above the point of orig (Fig. 5). Similar results were found by Chowdhry *et a* (1993). There was no non-allelic interaction because t regression line did not deviate from the unit slope. T distribution of varietal array points on the regression li indicated that the variety LU26S possessed the maximu dominant genes being closest to the point of origin wh the line HABA-4 being farthest from the origin carri maximum recessive genes. Additive type of gene acti with partial dominance in the absence of epistasis for 100 grain weight suggested that selection in early generati would be very effective for this trait.

Grain yield per plant (g): The values of Vr/Wr graph for gr yield per plant illustrated the over dominance type of ge action as the regression line intercepted the Wr-axis bel the origin (Fig 6). These results were in agreement w those of obtained by Hussain *et al.* (1986) and Bhutta *et* (1994). Since the estimated regression line deviated n significantly from unit slope, so the epistasis was abs The distribution of varietal array points on the regres line indicated that the variety Pitic-62 being closest to origin had maximum dominant genes while the variety P 81 carried maximum recessive genes being farthest f the origin. Due to the over dominance type of gene ac for grain yield per plant, the effective selection in e generations would be some what difficult.

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