http://www.pjbs.org

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 4 (8): 977-979, 2001
© Asian Network for Scientific Information 2001

Gene System Governing Plant Height and Some Drought Related Leaf Characteristics in Spring Wheat

Mohsin Ali Chaudhry, Muhammad Aslam Chowdhry, Muhammad Ahsan and Ihsan Khaliq
Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad, Pakistan

Abstract: A 5 x 5 diallel cross experiment on spring wheat varieties namely Shahkar-95, Chakwal-86, Faisalabad-85, Rawal-87 and Pasban-90 was conducted to ascertain the type of gene action involved in the control and expression of some important morpho-physiological traits. Plant height, flag leaf area, leaf venation and epidermal cell size were controlled by additive type of gene action with partial dominance. While the parameters like stomatal frequency and stomata size were controlled by over dominance type of gene action. Epistasis was absent in all the traits.

Key words: Wheat, drought, leaf traits, gene action.

Introduction

Wheat (*Triticum aestivum* L.) production can be enhanced through the development of new cultivars having wider genetic base capable of producing better under various agro-climatic situation. An estimate of gene action is important in launching a successful breeding programme. The diallel analysis developed by Hayman (1954) and Jinks (1955) provides a fairly reliable mechanism to properly understand the nature of gene action involved in the development of complex genetic characters having economic values. Chowdhry *et al.* (1995) and Chowdhry *et al.* (1997) reported that plant height was governed by partial dominance with additive type of gene action. Similar findings were observed by Alam *et al.* (1990) for flag leaf area, Subhani (1997) for leaf venation and Tahir (1999) for epidermal cell size while over dominance type of gene action was observed by Munir (1997) for stomatal frequency and stomata size.

Materials and Methods

The research was carried out at Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad. Five varieties/lines viz., Shahkar 95, Chakwal 86, Faisalabad 85, Rawal 87 and Pasban 90 were crossed in all possible combinations during 1998-99. Seed of F_0's along with their parents were sown in the field during November 1999 in a randomized complete block design. The seeds were dibbled with plant-to-plant and row-to-row distance of 15 and 30 cm, respectively. Single row of 5 meter length served as an experimental unit. At maturity ten guarded plants from each row of each replication were randomly selected. The data were recorded on the plant height (cm), flag leaf area (cm^2), leaf venation, stomatal frequency, stomata size (μ) and epidermal cell size (μ) on individual plant basis. The data were analyzed statistically using analysis of variance technique (Steel and Torrie, 1980) and significant differences among the genotypes were further analyzed using diallel analysis technique.

Results and Discussion

The analysis of variance showed highly significant differences among genotypes for all the characters (Table 1).

Plant height: Regression line in Fig. 1 cut the Wr-axis above the origin indicating the additive type of gene. The regression line did not deviate significantly from unit slope indicating absence of epistasis. The results seem to be compatible with those of Chowdhry *et al.* (1995, 1997) and Munir (1997). The distribution of varietal array points on regression line revealed that variety Rawal 87 contained maximum dominant genes, as it is being closest to the origin while Shahkar-95 possessed most recessive gene, being farthest from the origin for plant height. In view of partial dominance with additive gene action effective selection is possible for plant height in early generation.

Flag leaf area: The Vr/Wr graph reveals that flag leaf area is governed by partial dominance as the regression line intercepted the Wr-axis above the origin. The results derived from present study were also in agreement with earlier findings of Alam *et al.* (1990), Adnan and Bhutta (1994) and Chowdhry *et al.* (1995) who reported additive effects for flag leaf area. The regression line did not deviate significantly from unit slop suggesting the absence of epistasis.
The genotype Faisalabad 85 was nearest to origin indicating that most of the dominant genes present in it, while Chakwal 86 being away from the origin carried most of the recessive genes (Fig. 2) . Additive and partial type of gene action is very helpful for selection in early generation

Leaf venation: The regression line cut Wr-axis above the point of origin (Fig. 3) indicating additive type of gene action with partial dominance. The results corroborated the findings of Subhani (1997). The regression line did not deviate significantly from unit slope suggesting the absence of epistasis. The relative position of array points on regression line depicted that variety Faisalabad 85 contained maximum dominant gene as it is being closest to the origin and variety Shahkar-95 contained most recessive gene being farthest from the origin. Additive gene action with partial dominance in the absence of epistasis suggest that selection will be effective in early generation.

Stomatal frequency: The graphical representation of Vr/Wr indicated the non additive type of gene action with over dominance as regression line intercepted Wr-axis below the origin (Fig. 4). The results are in agreement with the findings of Munir (1997). The deviation of regression line was not significant from unity, this indicates the absence of epistasis. The array points showed that Faisalabad 85 being nearest to the origin had most of the dominant genes while Rawal 87 was the farthest from the origin so it carried most of the recessive genes. Due to the presence of non-additive gene action selection would be difficult in early generation for this trait.

Table 1: Analysis of variance of 5 x 5 diallel cross.

S.O.V.	Df	Mean squares					
		Plant height	Flag leaf area	Leaf venation	Stomatal frequency	Stomata size	Epidermal cell size
Replication	2	14.309	0.140	0.6594572	2.7255	129905	4815.71
Genotypes	24	1021.892**	70.955*	9.955*	32.9436**	502971*	2098844.9**
Error	48	114.194	72.831	3.667935	29.0156	4719707	46832.28

*,** = Significant at 5 and 1 percent probability level respectively.

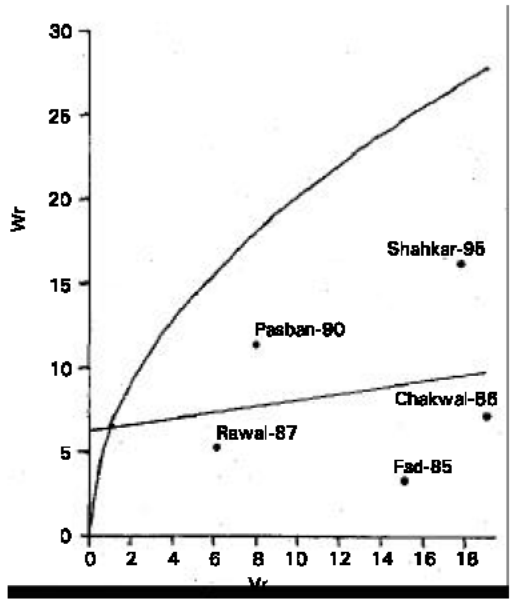

Fig. 1: Wr/Vr graph for plant height

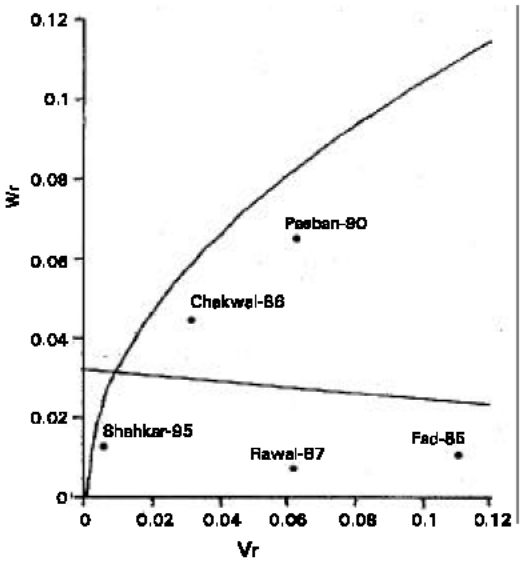

Fig. 3: Wr/Vr graph for leaf venation

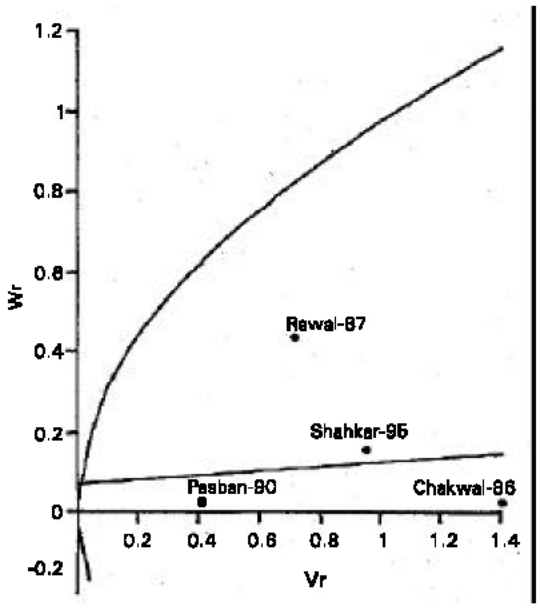

Fig. 2: Wr/Vr graph for flag leaf area

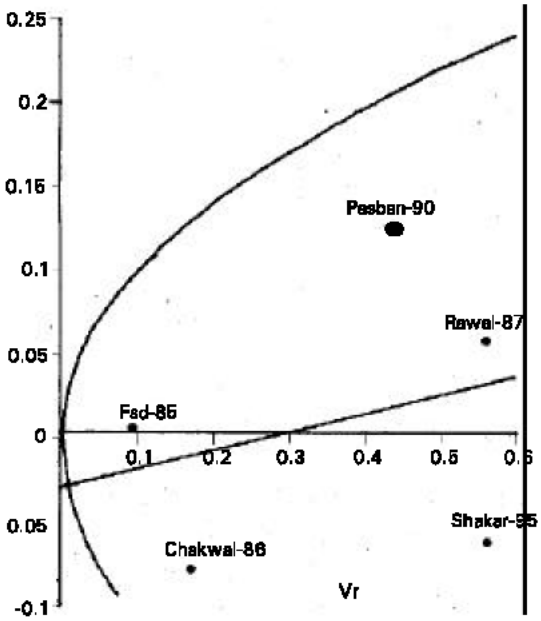

Fig. 4: Wr/Vr graph for stomatal frequency

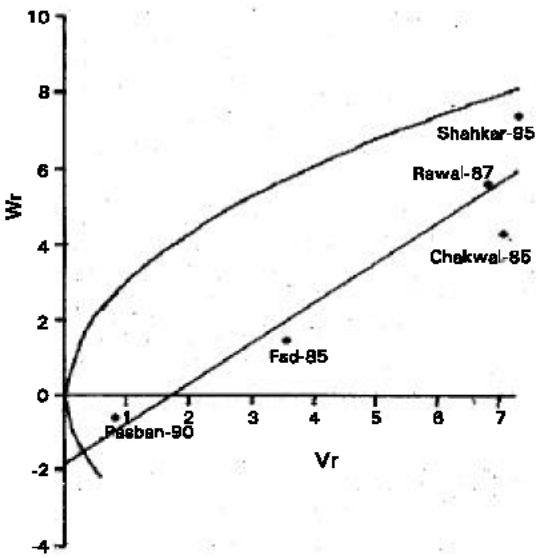

Fig. 5: Wr/Vr graph for stomata size

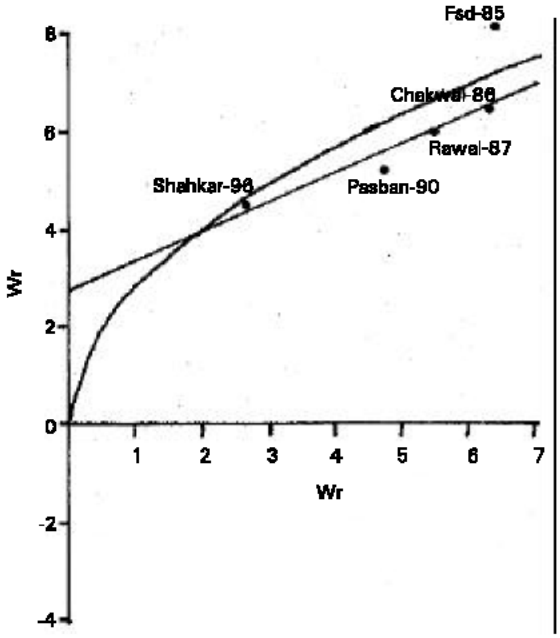

Fig. 6: Wr/Vr graph for epidermal cell size

Stomata size: The regression line intercepted the Wr-axis below the origin indicating non-additive type of gene action with over dominance (Fig. 5). However, Munir (1997) reported partial dominance type of gene action for stomata size. The deviation of regression line was not significant from unity. This indicates that there was no allelic interaction. The array points on regression line revealed that variety Pasban 90 being nearest to the origin had most of the dominant genes while Shahkar 95 being away from the origin contained maximum recessive genes. The selection in early generation would be difficult due to over dominance type of gene action.

Epidermal cell size: From Vr/Wr graph for epidermal cell size (Fig. 6) it is evident that regression line cut Wr-axis above the origin indicating partial dominance with additive type of gene action. The results are in agreement with the findings of Tahir (1999). The estimated regression line did not deviate significantly from unit slope. The position of array points on regression line indicated that genotypes Shahkar 95 owing to proximity to the origin possessed maximum dominant genes while variety Faisalabad 85 being away from the origin contained maximum recessive genes. Due to additive type of inheritance selection in early generation would be effective.

References

Adnan, M. and M.A. Bhutta, 1994. Genetic study of some quantitative characters in spring wheat (*T. aestivum* L.) Pak. J. Agric. Sci., 31: 422-425.

Alam, K., M.Q. Khan and M.A. Chowdhry, 1990. Genetic studies for yield and components in wheat (*Triticum aestivum* L. em. Thell) J. Agric. Res., 28: 18.

Chowdhry, M.A., M.T. Arshad, G.M. Subhani and I. Khaliq, 1997. Inheritance of polygenic traits in hexaploid spring wheat. JAPS., 7: 77-79.

Chowdhry, M.A., S.Z.A. Shah, S.S. Mehdi and M. Adnan, 1995. Biometrical analysis of some metric traits in a 4 x 4 diallel cross of spring wheat. Gomal Univ. J. Res., 15: 107-114.

Hayman, B.I., 1954. The theory and analysis of diallel crosses. Genetics, 39: 789-809.

Jinks, J.I., 1955. A survey of genetical basis of heterosis in a variety of diallel crosses. Heredity, 9: 233-237.

Munir, F., 1997. Genetic control of some metric traits determining grain yield in bread wheat. M.Sc. Agric. Thesis, Dept. Pl. Br. Genet. Univ. Agric., Fsd. Pakistan.

Steel, R.G.D. and J.H. Torrie, 1980. Principles and Procedures of Statistics. 2nd ed, McGraw Hill Book Co., New York, USA.

Subhani, G.M., 1997. Genetic architecture of some morpho-physiological traits in hexaploid wheat under stress and normal condition. Ph.D. Thesis, Dept.. Pl. Br. Genet. Univ. Agric. Fsd. Pakistan.

Tahir, A., 1999. Biometrical analysis of some metric traits in a 5 x 5 diallel cross of bread wheat. M.Sc. Agric. Thesis, Dept.. Pl. Br. Genet. Univ. Agric., Faisalabad.