INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/2002/04–3–379–382
http://www.ijab.org

Genetic Analysis for Various Quantitative Traits in Maize (*Zea mays* L.) Inbred Lines

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ABSTRACT

Gene action was determined for various quantitative traits in a complete diallel set involving six maize inbred lines. Variance/covariance graphs revealed that number of days taken to tasseling, number of days taken to silking, number of kernel rows per ear, number of kernels per row, 100- grain weight and grain yield per plant were controlled by over dominance type of gene action, while number of days taken to silking showed partial dominance. From the distribution of the array points it appeared that inbred line B-46 possessed maximum dominant genes for 100- grain weight and line EX-285 for grain yield per plant. For number of days taken to tasseling, number of days taken to silking and number of kernel rows per ear, inbred line SYP-24 had maximum dominant genes.

Key Words: Gene action; Quantitative traits; Over dominance; Tasseling; Silking; *Zea mays* L.; Inbred lines

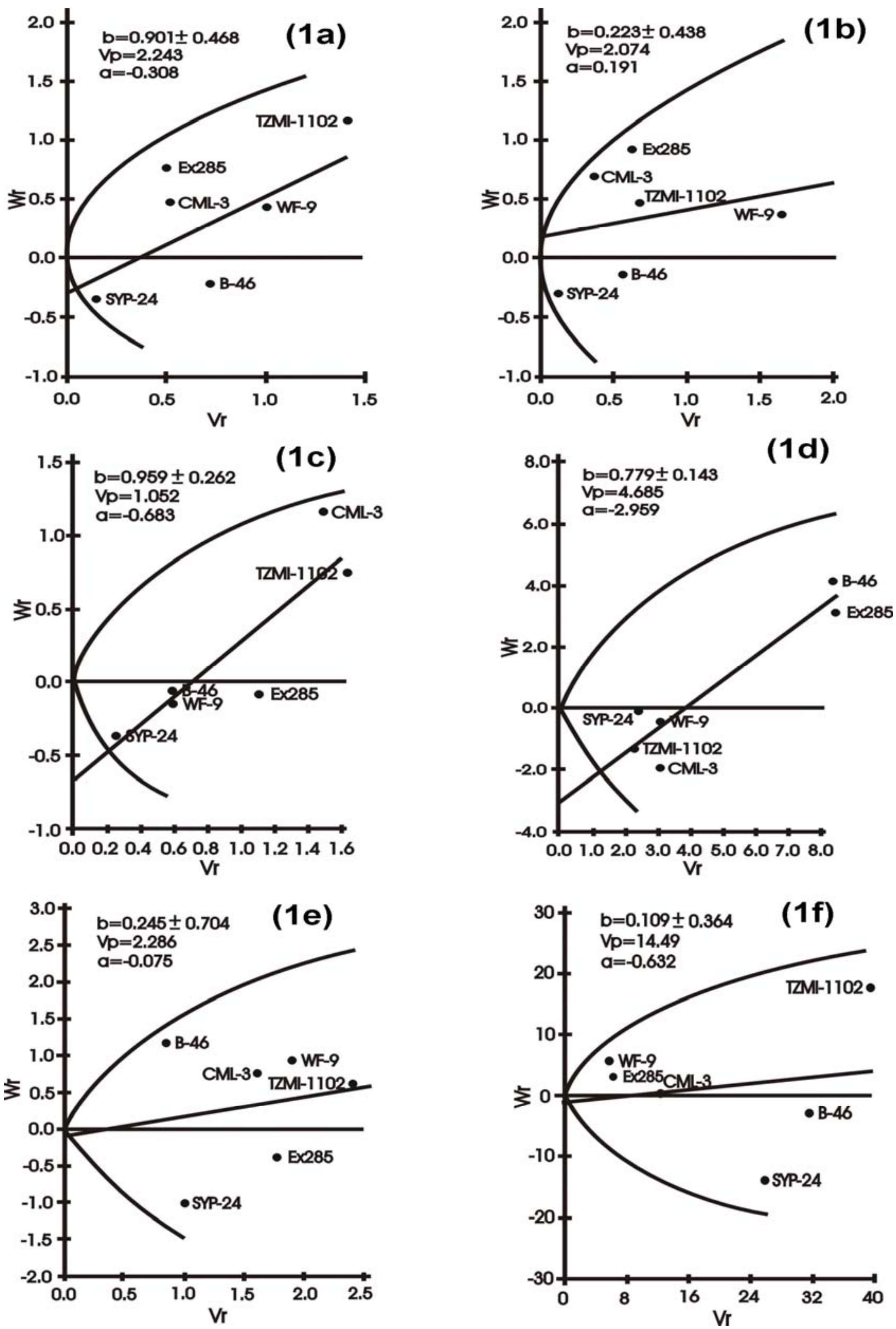
INTRODUCTION

Maize is world's important food crop after wheat and rice. Being a short- duration cereal crop it has top priority in hilly areas especially the northern parts of the country, where chilling conditions and snow fall limit growing period for other cereals. The importance of maize as an industrial raw material is rapidly increasing. The primary objective of most maize breeding programs is the evolution of high yielding and well adapted cultivars. Breeding for improved varieties is a continuous process and requires primarily a thorough knowledge of the genetic mechanism governing yield and yield components. Diallel cross technique developed by Hayman (1954) and Jinks (1954) provides information on the inheritance mechanism in the early filial generations and helps the breeder to make effective selection. Dhillon and Singh (1976) observed the importance of over dominance and presence of complementary epistasis in the inheritance of grain yield and days to silking. Kanaka (1982) performed 7x7 diallel cross analysis in maize and reported that over dominance was present for number of kernels per row, kernel rows per ear, 100-grain weight and grain yield per plant. Giridharan *et al.* (1996) provided information on combining ability, gene action and grain yield in maize inbreds. Mean phenotypic expression for grain yield per plant was higher in single cross hybrids. Yield was controlled by additive and non- additive gene action in diallel crosses. Ismail (1996) provided information on genetic variance and combining ability from data on number of days taken to tasseling, number of days taken to silking and grain yield per plant from 7 maize inbred lines. The results revealed highly significant differences between genotypes. The inbred lines possessed excess dominant genes for grain yield per plant. Perez-Velasquez *et al.* (1996) performed diallel analysis on five elite maize inbred and concluded that number of kernels per row was controlled by additive type of gene action, while number of kernel rows per ear, 100- grain weight and grain yield per plant were conditioned by over dominance gene action. Joshi *et al.* (1998) studied combining ability in maize inbred lines for yield attributes and reported additive and non-additive gene effects. There was preponderance of non-additive gene action in the expression of yield per plant and additive gene action for 100-grain weight. Kumar *et al.* (1998) provided information on genetic variance derived from 8 yield related traits. Generation mean analysis revealed that both additive and non-additive gene action were important for number of kernels per row and grain yield per plant. Non additive effects were predominant for number of kernel rows per ear. Dutu (1999) provided information on genotypic and phenotypic variances from diallel crosses of maize inbred lines. From the analysis of data, it was revealed that additive gene action was predominant in the inheritance of grain yield. Kumar *et al.* (1999) gave information on combining ability from yield related traits in maize. The results revealed a preponderance of non-additive gene action for grain yield and yield component characters. Paul and Debanth (1999) performed combing ability analysis in maize inbreds in a 7x7 diallel fashion. Both general and specific combining ability effects were significant for days taken to silking. The results indicated that additive gene action was more important than non-additive gene action. The objective of the present study is to ascertain the best cross combination for important trait pertaining to grain yield and its components amongst some elite inbred lines of maize.

MATERIALS AND METHODS

The studies were conducted in the research area of the Department of Plant Breeding & Genetics, University of Agriculture, and Faisalabad. The experimental material

Fig. 1. Vr/Wr graph for number of days taken to tasseling (a), number of days taken to silking (b), number of kernel rows per ear (c), number of kernels per row (d),100-grain weight (e) and grain yield per plant (f).



comprised six inbred lines of maize i.e., B-46, CML-3, EX-285, SYP-24, TZMi-1102, WF-9, crossed in a diallel fashion to obtain seed of all possible single and reciprocal crosses. The F1 seeds along with the parents were dibbled in rows keeping 60cm row to row and 30cm plant to plant distances in a randomized complete block design with three replications. Data pertaining to days taken to tasseling, days taken to silking, number of kernel rows per ear, number of kernels per row, 100-grain weight (g) and grain yield per plant (g) were statistically analyzed (Steel & Torrie, 1980).Gene action was determined by the diallel cross method as described by Hayman (1954), Jinks (1954) and Whitehouse *et al.* (1958).

RESULTS AND DISCUSSION

Number of days taken to tasseling. The differences among the genotypes were highly significant. (Table I) The regression line cut the Wr axis below the origin which showed over dominance type of gene action (Fig Ia). Inbred line SYP-24 being nearer to the origin possessed maximum dominant genes while inbred line TZMi-1102 had most recessive alleles. The results are in line with Kanaka (1982) who found over dominance type of gene action conditioning this character.

Number of days taken to silking. Analysis of variance (Table 1) revealed highly significant differences among the genotypes. From the Vr/Wr graphic pattern (Fig Ib) it is seen that the regression line intercepted the covariance axis above the origin which revealed partial dominance. From the relative position of the array points on the regression line, it is obvious that inbred line SYP-24 obtained maximum dominant genes while inbred line WF-9 possessed maximum recessive genes. The present results corroborate the findings of Dhillon and Singh (1976) who reported that days taken to silking were under non-additive genetic control.

Number of kernel rows per ear. Analysis of variance for number of kernel rows per ear indicated that the differences among the genotypes were highly significant (Table1). Regression line (Fig Ic) passed below the graphic origin showing the preponderance of over dominance for the loci controlling the character. As the regression line had unit slope, it indicated the absence of non-allelic gene interaction. Inbred line SYP-24 possessed most of the dominant genes while inbred line CML-3 carried maximum recessive genes. The results are in agreement with Kumar (1998) and Perez-Velasquez (1996) who reported that number of kernel rows per ear was under the control of non-additive gene effect.

Number of kernels per row. Analysis of variance for number of kernels per row indicated that the differences among genotypes were highly significant (Table I). Regression line (Fig Id) passed below the graphic origin, which accounted for over dominance type of gene action. From the relative position of the array points on regression line, it appeared that inbred line SYP-24 possessed maximum dominant genes while inbred line B-46 most of the recessive genes. Kumar (1998) reported both additive and non additive type of gene action for number of kernels per row.

100-Grain weight. Analysis of variance (Table I) indicated that the differences among the genotypes were highly significant. The graphical presentation (Fig Ie) depicted that the regression line passed just below the point of origin which revealed a degree of over dominance for this character. From the relative position of array points on regression line it is seen that inbred line B-46 possessed maximum dominant genes while inbred line TZMi-1102 had maximum recessive genes. Similar results have been reported by Kanaka (1982) and Perez-Velasquez (1996) who demonstrated that grain weight was under the control of over dominance type of gene action.

Grain yield per plant. Analysis of variance indicated that differences among genotypes were highly significant (Table1). Graphical representation (Fig If) revealed that the regression line intercepted the Wr axis just below the point of origin which indicated the presence of over dominance type of gene action. From the regression line it is evident that inbred line EX-285 possessed maximum dominant genes whereas inbred line TZMi-1102 carried most recessive genes. The results are in line with Kumar (1998), Joshi (1998) and Perez-Velasquez (1996) who reported that grain yield per plant was under the control of non-additive type of gene action.

CONCLUSION

From the foregoing it may be inferred and concluded that since most of the characters exhibited over –dominance type of gene action the material can be exploited for heterotic effects.

Table I. Analysis of variance for grain yield and its components in 6x6 diallel crosses

		Mean Squares					
Source of Variation	**Degree of Freedom**	**Days taken to tasseling**	**Days taken to silking**	**Number of kernel rows per ear**	**Number of kernels per row**	**100-grain weight**	**Grain yield per plant**
Replications	2	2.79	1.08	0.36	3.69	0.20	31.18
Genotypes	35	3.89**	2.24**	2.81**	18.124**	4.62**	96.06**
Error	70	1.42	1.16	0.48	2.73	0.41	20.73

* * Highly significant

REFERENCES

Dhillon, B.S. and J. Singh, 1976. Inheritance of grain yield and other quantitative traits in maize. *Exp. Agri.,* 13: 253–6.

Dutu, H., 1999. Results concerning the genetic determination of maize productivity. *Cercetari Agron.(Moldova),* 32: 29–33.

Giridharn, S., M.N. Prasad and S. R. Rangaswamy, 1996. Diallel, triallel and quadriallel analysis for grain yield in maize. *Mad. Agri. J.,* 83: 230–6.

Hayman, B.I., 1954. The theory and analysis of diallel cross-1. *Genetics,* 32: 789–809.

Ismail, A.A., 1996. Gene action and combining ability for flowering and yield in maize under two different sowing dates. *Assiut J. Agric. Sci.,* 27: 91–105

Jinks, J.L., 1954. The analysis of continuous variation in a diallel cross of *Nicotiana rustica* varieties. *Genetics,* 39: 767–88

Joshi V.N., N. K. Pandiya and R.B.Dubey, 1998. Heterosis and combining ability for quality and yield in early maturing single cross hybrids of maize. *Indian J. Gen. Pl. Br.,* 58: 519–24.

Kanaka, S.K., 1982. Genetic analysis of ten quantitative characters in grain sorghum. *Indian Thesis Absts.,* 8: 72–3 [*Pl. Br. Abst.,* 53: 408; 1983].

Kumar. A., M.G. Gangashetti and A. Kumar, 1998. Gene effects in some metric traits of maize. *Ann. Agri. Biol. Res.,* 3: 139–43.

Kumar. M.V.N., S.S. Kumar and M. Ganesh, 1999. Combining ability studies for oil improvement in maize. *Crop Res. Hisar,* 18: 93–9.

Paul, K.K. and S.C. Debanth, 1999. Combining ability analysis in maize. *Pakistan J. Sci. Ind. Res.,* 42: 141–4.

Perez-Velasquez, J.C., H.Celallos, S. Pandey and C.D. Amaris, 1996. A diallel cross analysis of some quantitative characters in maize. *Crop Sci.,* 36: 572–8.

(Received 01 May 2002; Accepted 28 May 2002)