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INHERTANCE OF FOUR QUANTITATIVE TRAITS IN TOMATO *(LYCOPERSICON ESCULENTUM Mill.).*

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Abstract

The inheritance of days to flowering, plant height, number of fruits per plant and fruit yield per plant were studied in the parental, F_1, F_2, BC_1 and BC_2 generations of two crosses involving three parents. A six-parameter model was used to explain the various genetic effects. In Jap x CT1, the dominance effects were pronounced for days to flowering, plant height and number of fruits per plant. The additive x dominance gene effects were predominant for number of fruit per plant, The dominance x dominance type of interaction was relatively predominant in most of the cases. Heterosis were detected for all the characters studied.

Key words: Lycopersicon esculentum, Inheritance, Quantitative traits.

Tomato (*Lycopersicon esculentum* Mill.) is one of the most important vegetable crops in the world. A few number of studies have been carried out to study the inheritance of quantitative traits using diallel crosses and generation means in tomato (Dhaliwal and Nandpuri, 1986; Lopez and Cuartero, 1985; Omara *et al.*, 1988; Younis *et al.*, 1987). In Bangladesh, very few work have been reported on the inheritance of quantitative traits using generation means in tomato. The six-paramenter using generation means provides information about the components of epistasis along with the dominance and additive components (Anderson and Kempthorne, 1954).

The present investigation was undertaken to study the inheritance of days to flowering, plant height, number of fruits per plant and fruit yield per plant partitioning the genetic variance into additive (d), dominanec (h) and digenic epistatic i.e. additive x additve (i), additive (j) and dominance (l).

The experimental material was Japanese (Jap), K7 and CT1 and F_1, F_2 and backcross generations of two crosses viz. Jap x K7 and Jap x CT1, were used in the study. The seedlings were raised in the seed bed. Forty five day old seedlings of the parents, F_1, F_2 and backcross generations of each cross were grown in winter 1986-87 in a randomized block design in three replications at the Institute of Postgraduate Studies in Agricultere (IPSA), Salna, Gazipur, Research Farm. Parents, F_1s and backcrosses were grown in two rows while

the F_2s were grown in four rows. Ten plants were planted in each row. Row to row distance was 75 cm and plant to plant distance was 60 cm. Data were collected on individual plants for days to flowering, plant height (cm), number of fruits per plant and fruit yield per plant (kg). Data were analysed following Hayman's (1958) and Gamble's (1962) six-parameter model for estimation of genetic components.

The F_1 means in both crosses approached the late parental value indicating the dominance of lateness over earliness (Table 1). Estimates of the six-parameter for various gene effects considered show that dominance x dominance (l) interaction was positive and significant for Jap x K7. In Jap x CT1, the dominance (h) gene effect was positive and highly significant and the dominance x dominance (l) interaction was positive and significant. The additive (d), additive x additive (i), and additive x dominance (l) interactions were negative in both the crosses. Dhaliwal and Nandpuri (1986) reported both additive and non-additive gene effects for early fruit yield in tomato while Lopez and Cuartero (1985) reported partial dominance for early fruit yield from an eight variety diallel cross in tomato.

In Jap x K7, the plant height approached the mid-parental value showing incomplete dominance while Jap x CT1 indicated the over dominance for this character. The Jap x K7 showed negative and highly significant effects for additive (d), dominance (h), additive x additive (i) and additive x dominance (j) but positive and highly significant for dominance x dominance (i) type of interaction. In Jap x CT1, the estimates of (h) and (i) were positive. Younis *et al.* (1987) reported that the additive gene action was more inportant for final plant height in tomato.

In both crosses the mean value of F_1 was close to the higher parent indicating the dominance of higher number of fruit over the lower number of fruits. Estimates of six-parameter model show that in Jap x K7, the additive (d) gene effect was negative and highly significant but the additive x dominance (j) was positive and highly significant but the dominance x dominance (l) type of interaction was positive and highly significant. Omara *et al.* (1988) reported that additive components of genetic variance was predominant for number of fruit per plant.

Table 1. Mean values of selected characters of tomato in two crosses over six generations.

Crosses	Generation					
	P_1	P_2	F_1	F_2	BC_1	BC_2
			Days to flowering			
Jap x K7	74.93±0.29	76.53±1.33	77.60±3.38	78.54±1.54	72.00±1.15	76.07±2.16
Jap x CT1	74.93±0.29	71.80±0.52	75.13±0.75	79.10±1.67	71.10±1.16	77.00±1.15
			Plant height (cm)			
Jap x K7	85.55±4.80	70.00±2.41	75.36±1.37	75.03±3.83	44.50±3.17	73.73±2.29
Jap x CT1	85.55±4.80	102.93±4.50	113.86±4.95	99.75±1.40	92.16±4.96	113.00±9.22
			Number of fruit per plant			
Jap x K7	13.86±0.87	28.33±1.09	26.91±2.80	25.68±2.94	5.00±0.57	31.93±5.39
Jap x CT1	13.86±0.87	62.86±4.49	63.93±11.55	27.90±2.00	17.88±2.56	29.93±5.20
			Fruit yield (kg) per plant			
Jap x K7	1.41±0.12	1.85±0.08	1.77±0.17	1.62±0.19	0.36±0.07	2.28±0.42
Jap x CT1	1.41±0.12	1.67±0.14	2.05±0.29	2.03±0.24	1.75±0.50	1.95±0.39

Table 2. Estimates of gene effects of selected characters of tomato in two crosses

Crosses	Gene effects					
	m	d	h	i	j	l
			Days to flowering			
Jap x K7	78.54 **	-4.07	-16.15	-18.02 *	-3.27	28.54 *
Jap x CT1	79.10 **	-5.90 **	56.50 **	-20.02 *	-7.46 **	20.99 *
			Plant height			
Jap x K7	75.03 **	-29.23 **	-66.08 **	-63.68 **	-37.00 **	133.49 **
Jap x CT1	99.75 **	-20.83	30.95	11.33	-12.14	-5.45
			Number of fruits per plant			
Jap x K7	25.68 **	-26.93 **	-22.98	-22.86	15.83 **	51.01
Jap x CT1	27.90 **	-12.05 *	9.59	-15.98	12.45	124.94 **
			Fruit yield per plant			
Jap x K7	1.62 **	-1.92 **	-1.05	-1.19	-1.0 **	2.71
Jap x CT1	2.03 **	-0.19	-0.19	-0.70	-0.70	0.46

* Significant at 5% level of probability
** Significant at 1% level of probability

In Jap x K7, the mean value of F_1 was close to the higher parental value indicating the dominance of higher number of fruit over lower number but in Jap x CT1, the mean value of the F_1 was higher than the higher parent indicating the presence of overdominance. The estimates of six-parameter model reveals that in both the crosses only the dominance x dominance (l) gene interaction was positive. The additive genetic effects for fruit yield was also reported by Dhaliwal and Nandpuri (1986) and Omara *et al.* (1988) while partial dominance was reported by Lopez and Cuartero (1985).

The estimates of six genetic parameters indicate a test for different types of gene actions and their importance in the breeding programme. The magnitude of additive and dominance effects for the characters studied in each of the crosses varied leading to the variation in the inheritance.

References

Anderson, V. I. and O. Kempthorne. 1954. A model for the study of quantitative inheritance. Genetics 39: 883-898.

Dhaliwal, M.S. and K.S. Nandpuri. 1986. Genetics of earliness in tomato. Annals of Botany 2(1): 72-76.

Gamble, E.E. 1962. Gene effects in corn (*Zea mays*) I. Separation and relative importance of gene effects for yield. Can. J. Plant Sci. 42: 339-348.

Hayman B.I. 1958. The separation of epistatic from additive and dominance variation in generation means. Heredity 12 : 371-390.

Lopez-Rivares, P. and J. Cuartero. 1985. Genetics of the components of early yield in tomato. Genetica Iberica 37: 25-38

Omara, M.K.; S.E. Younis.; T.H.I. Sherif, M.Y. Hussein and H.M. E1-Aref. 1988. A genetic analysis of yield and yield components in the tomato (*Lycopersicon esculentum Mill.*). Assiut Jour of Agril. Sc. 19: 227-238.

Younis, S.E,A.; M.K. Omara; T.H.I. Sherif and H.M. El-Aref. 1987. A diallel analysis of earliness and some other vegetative characters in tomato (*Lycopersicon esculentum Mill.*). Assiut Jour. of Agril. Sc. 18: 279-290.