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Genetics of Yield and Components in Tomato (*Lycopersicon esculentum* Mill.)

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ABSTRACT

A Study of 30 F_1 hybrids of tomato in a diallel set involving six diverse genotypes showed that non-additive genetic component contributed to the genetic expression of days to 50 per cent flowering, number of laterals plant $^{-1}$, number of clusters plant $^{-1}$, number of fruits plant $^{-1}$, fruit weight, yield plant $^{-1}$ and total soluble solids. Both additive and non-additive gene action were present with predominance of additive gene action for plant height and number of locules fruit $^{-1}$. The results also indicated over dominance for days to 50 per cent flowering, number of laterals plant $^{-1}$, number of clusters plant $^{-1}$, number of fruits plant $^{-1}$, fruit weight, yield plant $^{-1}$ and total soluble solids. Majority of the characters were controlled by atleast one group of dominant genes.

Key words : Diallel, Dominance, Gene Action, Heterosis, *Lycopersicon esculentum*

Information on gene action controlling characters related to productivity would aid in the choice of effective and efficient breeding methods and thus would accelerate the pace of genetic improvement for fruit yield. The present investigation, employing diallel crosses among six genetically diverse genotypes of tomato (L*ycopersicon esculentum* Mill.) was conducted to obtain information on gene action responsible for the inheritance of yield and other related attributes.

MATERIAL AND METHODS

Six diverse tomato genotypes were crossed in a diallel fashion. Thirty F_1 hybrids and six parental genotypes were grown under field condition. The experiment was laid in randomized block design with three replications adapting all the agronomic practices. The observations were recorded for nine characters *viz.,* days to 50 per cent flowering, plant height, number of laterals plant^{-1}, number of clusters plant^{-1}, number of fruits plant^{-1}, fruit weight, yield plant^{-1}, number of locules fruit^{-1} and total soluble solids on ten randomly selected plants or on plot basis in each replication. Estimates of variability and genetic parameters were obtained according to the method given by Hayman (1954).

RESULTS AND DISCUSSION

The mean squares due to genotypes were highly significant for all the characters under study which indicated that the population possessed a great deal of genetic variation. The t^2 value was non-significant for all the traits except fruit weight, indicating that basic assumptions of model were fulfilled for the characters (Table 1). Hayman (1954) and Verhalen and Murrey (1957) suggested that the analysis can be carried out even with the partial failure of assumptions, hence, the analysis for fruit weight was also done.

The estimation of genetic parameters revealed significance of additive and non-additive components for all the characters except days to 50% flowering. However, predominance of additive gene action was observed for plant height and number of laterals plant^{-1}, number of clusters plant^{-1}, number of fruits plant^{-1}, yield plant^{-1} and total soluble solids. The overall genetic evaluation of characters (Table 1) revealed that the mean degree of dominance $(H_1 / D)^{1/2}$ was partial for plant height and number of locules plant^{-1}. Over dominance was exhibited for days to 50 per cent flowering, number of laterals plant^{-1}, number of clusters plant^{-1}, number of fruits plant^{-1}, fruit weight, yield plant^{-1} and total soluble solids which is likely to be confounded with the complementary type of gene action to be asymmetrical for all characters except number of clusters plant^{-1} and yield plant^{-1}. The parents having preponderance for dominance alleles for number of laterals plant^{-1}, number of fruits plant^{-1}, fruit weight, number of locules fruit^{-1} and total soluble solids was evinced by KD/KR values of more than unity. While reverse indications were noted for other characters *viz.,* days to 50%

Table . Estimates of genetic paramters D,F,H_1,H_2,h^2 and their related statistics for nine characters in 6 x 6 diallel cross of tomato.

Genetic parameters and related statistics	Days to 50% flowering	Plant height	No. of laterals plant^{-1}	No. of clusters plant^{-1}	No. of fruits plant^{-1}	Fruit weight	Yield plant^{-1}	No.of locules plant^{-1}	Total soluble solids
D	4.63	90.77**	0.25	1.32**	16.60*	31.42**	0.03*	1.51**	0.23*
F	-0.68	-0.68	0.16	-0.14	12.51	31.96	-0.01	0.78	0.16
H_1	8.29	39.23**	1.16**	1.51**	39.71**	97.78	0.13	0.95*	0.60*
H_2	7.86	37.01**	1.13**	1.51**	28.61	80.87**	0.13**	0.79	0.51*
h^2	-0.45	82.59**	4.17**	3.96**	22.70*	146.88**	0.43**	0.63**	-0.01
E	1.96	5.11**	0.04	0.17**	3.01	4.66	0.01	0.12	0.02
$(H_1/D)^{1/2}$	1.34	0.66	2.17	1.07	1.55	1.76	2.18	0.79	1.61
$H^2/4H_1$	0.24	0.24	0.24	0.25	0.18	0.21	0.25	0.21	0.21
KD/KR	0.85	0.98	1.35	0.90	1.64	1.81	0.98	1.98	1.24
h^2/H_2	-0.06	2.23	3.7	2.61	0.79	1.82	3.22	0.80	-0.01
r	0.90*	-0.97*	-0.90	-0.67	-0.61	-0.46	-0.74	-0.75	0.15
t^2	1.12	5.64	1.02	1.01	0.12	7.46*	0.02	0.08	0.06

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

flowering, plant height, number of clusters plant^{-1} and yield plant^{-1}.

The direction of dominance (h^2) was positive for plant height, number of laterals plant^{-1}, number of clusters plant^{-1}, number of fruits plant^{-1}, fruit weight, yield plant^{-1} and number of locules fruit^{-1} suggesting that using parents dominant for these characters would result in improvement of this character in positive direction. The direction was negative for days to 50% flowering and total soluble solids.

The ratio h^2/H_2 suggested that number of groups of dominant genes appeared to be more than one for plant height, number of laterals plant^{-1}, number of clusters plant^{-1}, fruit weight and yield plant^{-1} while rest of the traits showed lower value. This would not necessarily suggest the absence of dominant genes, may be due to the fact that the negative and positive dominant genes nullify the effect of one another. Similar observations for various characters were also reported by several workers (Singh and Mital, 1978; Alice Kurian, 1990; Gibrel *et al*., 1982; Rai *et al*., 1996; Sekar 1996 and Rao *et al*., 2007).

Both additive and non-additive effects were involved in the inheritance of tomato fruit yield and its major component factors. For overall improvement, multiple crossing among several elite lines may be enforced to incorporate desirable genes from several parents at a time using diallel selective mating system as proposed by Jenson (1970) to exploit both types of gene action.

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