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Research Note

GENE EFFECTS FOR QUALITATIVE TRAIT USING THREE TESTERS IN TOMATO (*Lycopersicon esculentum* Mill.)

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ABSTRACT : Three testers, BT-17 and PS-1 and there hybrid (BT-17 × PS-1) were crossed to 15 inbred lines to develop the experimental material The modified triple test-cross analysis was applied to estimate additive (D), dominance (H) and epistatic component of genetic variance for ten quantitative traits of tomato.. Overall epistasis was important for number of seeds/fruit and number of locules/fruit for both the season except number of seeds/fruit in spring-summer season Significant estimate of both additive and dominance component were observed for all the characters except total soluble solids in both the season for additive and total soluble solids in autumn-winter season for dominant component. The F value was positive and significant for total soluble solids in autumn-winter season showing isodirectional nature of dominance. Significant of additive components and F parameter showing increasing effect on the characters, indicates that pedidree selection would be effective for improvement of such traits.

Keywords : *Quality, modified triple test cross, epistatis, additive, dominant, tomato.*

Tomato (*Lycopersicon esculentum* Miller) is one of the most important vegetables crops grown through out in world. Besides fresh consumption, tomato rank first among processed vegetable in the world. More number of seed in tomato in an undesirable character for the point of view its table value as well as its quality. Hence less number of seeds per fruit is preferred for both table and processing purposes. Number of locules in the fruit is of paramount important for selection of verities for processing. High total soluble solid (TSS) is the main constituent for preparing of processed products like puree, sauce, ketch-up etc. Besides soluble solid alcohol insoluble solids (AIS) which constitute 20% of TSS and consist of pectin, polysaccharides including cellulose and structural protein determine the viscosity of fruit juice and thick consistency of processed products. Very little information is available on the inheritance of number of seeds, number of locules and total soluble solids in tomato. Therefore, the present investigation was initiated to study the genetics of these important traits in tomato.

Two tomato inbred lines , BT-17 (L_1) and PS-1 (L_2) and there hybrid (BT-17 × PS-1) referred as (L_3) were crossed as a tester with 15 pure breeding line of tomato, namely H-24, TC-1, S-12, Pant T-4 , BT-3, NDT-11, Sel-7, Anand T-1, Pusa Ruby, Angoor Lata, H-36, NDT-4, Azad T-2, EC-31515 and EC-1154 develop a set of 45 crosses. The experimental material consisting of 3 testers, 15 lines, 30 single crosses and 15 three-way crosses was evaluated in randomized blocks design with three replications during spring-summer seasons of 1995-96 at Banaras Hindu University, Varanasi. The progenies were grown in row of 3 m width at inter row and intra row spacing of 60 and 50 cm, respectively. Observations were recorded on 5 randomly selected plants per plot for 3 qualitative traits *e.g.* number of seeds/fruit, number of locules/fruit and total soluble solids (Table 1) and data were used for modified triple test-cross analysis (Ketata *et al*. 4, and 5) following Jinks *et al.* (2) and Kearsey and Jinks (6).

Analysis of variance of modified triple test-cross to deduct the epistasis revealed that significant epistasi was present for number of seeds/fruit and number of locules/fruit for both the season except number of seeds/fruit in spring-summer season. The epistasis × block and within family was non-significant for all the character (Table 1). The analysis of variance for Sums ($L_{1i} + L_{2i}$) showed that variance due to sums are important for all the character in both the season except total soluble solids in autumn-winter. However,

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Table 1 : Analysis of variance for the test of epistasis in the 2nd Modified Triple Test Cross model for qualitative characters in tomato.

Source	Seasons	d. f.	Number of seeds/ fruit	Number of locules/ fruit	Total Soluble Solids
Epistasis	AW	14	616.60**	0.81**	0.32
$(L_{1i} + L_{2i} - P_i)$	SS	14	213.98	1.40**	0.33
Epistasis × Block	AW	28	68.36	0.03	0.05
	SS	28	26.29	0.01	0.05
Within families	AW	540	173.43	0.06	0.23
	SS	540	103.82	0.06	0.20

*, ** Significant at P = 0.05 and P = 0.01 respectively

Table 2 : Analysis of variance for sums $(L_{2i} + L_{2i})$ and differences $(L_{2i} + L_{2i})$ the test of epistasis in 2nd Modified Triple Test Cross model for different characters in tomato.

Source	Seasons	d.f.	Number of seed/ fruit	Number of locules/ fruit	Total Soluble Solids
(a) Analysis of additive variance					
Sums $(L_{1i}. + L_{2i})$	AW	14	1131.58**	0.71**	0.58
	SS	14	687.51**	1.73**	0.71**
Sums × Block	AW	28	70.82	0.04	0.05
	SS	28	48.90	0.03	0.06
(b) Analysis of dominance variances					
Differences	AW	14	799.45**	0.29**	0.29
$(L_{1i}.+L_{2i})$	SS	14	742.45**	1.52**	0.51*
Differences ×	AW	28	48.04	0.03	0.05
Blocks	SS	28	47.52	0.04	0.05
Within families	AW	360	173.33	0.07	0.27
	SS	360	95.16	0.10	0.28

*, ** Significant at P= 0.05 and P= 0.01 respectively. AW – Autumn-winter, SS – Spring-summer

Table 3 : Estimates of additive (D), dominance (H) genetic component of genetic variance and other estimates in 2nd modified Triple Test Cross model in tomato.

Genetic component & other estimates	Season	Number of seeds/ fruit	Number of locules/ fruit	Total Soluble Solids	
TTC families	D	AW	1277.67**	0.85**	0.41
		SS	789.80**	2.17**	0.57
	H	AW	835.09**	0.29**	0.03
		SS	863.05**	1.89**	0.31*
	F	AW	35.71	-0.08*	0.19**
		SS	-111.03*	0.06	0.08
	r (RF)	AW	-0.06	0.31*	-0.81**
		SS	0.26*	-0.06	-0.23
	$(H/D)^{½}$	AW	0.81	0.58	0.27
		SS	1.04	0.93	0.74

Note:- RF = ‘r’ value to show the significance of ‘F’ parameter
*, ** Significant at P= 0.05 and P= 0.01, respectively, AW – Autumn-winter, SS – Spring-summer

The test of significant of differences ($L_{1i} - L_{2i}$) item was also important for all the traits except total soluble solids in autumn-winter. Interaction component was not important for any traits. When these interaction items were used as determinate for testing the significance of difference variance, the significance of difference item was not found in any traits (Table 2).

The variance due to sums ($L_{1i} + L_{2i}$) were used for estimating additive (D) component of genetic variation, whereas the variance due to differences ($L_{1i} - L_{2i}$) item were used for estimation of dominance (H) component (Table 3). The estimate of both additive and .dominance components were significant for all the characters, except total soluble solids in both the season for additive and total soluble solids in autumn-winter season for dominant component. In general, the estimate of additive component were grater in magnitude than the dominant component for most of the traits. The presence of common alleles in the tester increases the magnitude of additive component.

The directional element F was estimated from the covariance of the sums and differences and its significance was tested in directly as the correlation r (RF) of sums and differences. When the value of r (RF) and F were considered together it was found that the estimate of directional element (F) was important and significant number of locules/fruit and total soluble solids in autumn-winter season and for number of seeds/fruit in spring-summer season. The related isodirectional nature of dominance, suggesting that gens with increasing effects were most predominant for these traits.

The positive and non-significance value of F for number of seeds/fruit in autumn-winter season, number of loculs and soluble solids in spring-summer season suggested an bidirectional nature of dominance. It may be argued that epistasis or dominance do not have much of the directional element. Nanda *et al.* (8) also did not observed the confounding effects of F with dominance for most of the traits in triple test cross analysis in wheat. However, the possibility of confounding of directional element with epistasis and dominance cannot be underrated as the component F was presented along with high coefficient of dominance and epistasis assessed for number of seeds/fruit in both the seasons.

The overall picture of dgree of dominance dominance $(H/D)^{½}$ was in the range of partial dominance for most of the traits. The number of seeds/fruit in both the seasons appears to be dominant in this investigation confirming to reports of Kalloo *et al.* (3). Similar result was also reported in pea (Singh *et al*. 9 & 10). The overall degree of dominance suggested that most of the character studied are controlled predominanantly by additive gene effects, however, dominance and epistatic components played a major role in controlling the expression of different traits which was also reported in pea (Singh *et al.,* 9 & 10). The findings of Bhutani and Kalloo (3) for locule number and Mittal *et al.* (7) for number of seeds in tomato support the present findings. The greater role played by non-additive genetic components suggest that heterosis breeding would be desirable to improve the quality of tomato fruits.

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