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Association and path coefficient studies in bacterial wilt resistant F_4 progenies of tomato *(Lycopersicon esculentum* Mill.)

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Abstract

Seventeen bacterial wilt resistant F_4 progenies of tomato *(Lycopersicon esculentum* Mill.) were planted in randomized block design with three replications during summer-rainy season of 2006. Observations were recorded on the traits *viz.*, days to 50 per cent flowering, days to first harvest, total fruits per plant, marketable fruits per plant, average fruit weight, gross yield per plant and marketable yield per plant. The data were analyzed as per standard statistical procedure. Analysis of variance revealed significant differences among the progenies for all the traits. Marketable yield per plant was positively correlated with marketable fruits per plant. This was again confirmed through path coefficient analysis that marketable fruits per plant had the maximum direct contribution towards marketable yield per plant. However, the indirect contribution of marketable fruits per plant towards marketable yield per plant via average fruit weight was negative.

Key words: Tomato, *Lycopersicon esculentum* Mill., correlation, path coefficient, F4 progenies.

Introduction

Tomato *(Lycopersicon esculentum* Mill.), a member of family *Solanaceae* is one of the most important protective foods both because of its special nutritive value and also because of its widespread production. It is the world's largest vegetable crop after potato and sweet potato, but it tops the list of canned vegetables. In India, tomato occupies an area of 5,40,000 hectares with a production of 76,00,000 metric tonnes (Anonymous, 2005), whereas in Himachal Pradesh it is grown in about 9,211 hectares of area with a production of about 3,10,183 metric tonnes (Anonymous, 2005-06), bulk of which is exported as an off-season produce to the markets located in the north Indian plains. Bacterial wilt caused by *Ralstonia solanacearum* is one of the most important diseases in some specific pockets of Zone I and Zone II (Kangra Valley and surrounding areas of Mandi and Chamba districts) of Himachal Pradesh. Gupta *et al.* (1998) confirmed the pathogenicity of *Ralstonia solanacearum* in tomato growing areas of Solan district. Gradually, the disease is further spreading to other districts like Kullu, Bilaspur and Hamirpur (Sood *et al.* 2002). Crop loss in fields ranged from 70 to 100 per cent in bacterial wilt prone areas. To tackle this serious biotic constraint in tomato, resistance breeding work is being carried out at various research centers located in the country and abroad and resistant genotypes have also been developed. Efficiency of selection in any breeding programme mainly depends upon the knowledge of association of characters. Although correlation coefficients indicate the nature of association among the traits, path coefficient analysis splits the correlation values into direct and indirect effects so as to measure the relative importance of causal factors involve. Hence the present study was undertaken on 17 bacterial wilt resistant F_4 progenies developed in the Department of Vegetable Science and Floriculture, CSK HPKV, Palampur to find out the inter-relationships among component traits and marketable fruit yield, and to estimate the direct and indirect contribution of component traits on marketable fruit yield through path analysis in the bacterial wilt resistant progenies of tomato.

Material and Methods

The present investigation was undertaken at the Experimental Farm of the Department of Vegetable Science and Floriculture, Himachal Pradesh Krishi Vishvavidyalaya, Palampur from February to August, 2006. Nursery sowing was done in raised nursery beds and the seedlings of 17 bacterial wilt resistant F_4 progenies were transplanted in Randomized Block Design (RBD) with three replications in bacterial wilt sick plots. Each entry/progeny was accommodated in three rows (21 plants) spaced 75cm apart with an intra-row spacing of 45cm. One row each of susceptible varieties as checks (Solan Gola and Roma) were included as every 10^{th} row alternately to ensure the presence of uniform distribution of bacterial wilt disease inoculum in the experimental field. Observations on the parameters *viz.*, days to 50 per

10th row alternately to ensure the presence of uniform distribution of bacterial wilt disease inoculum in the experimental field. Observations on the parameters *viz.*, days to 50 per cent flowering, days to first harvest, total fruits per plant, marketable fruits per plant, average fruit weight, gross yield per plant and marketable yield per plant were recorded. The phenotypic and genotypic coefficients of correlation were computed using the formulae given by Al-Jibouri *et al.* (1958) and path coefficient analysis by Dewey and Lu (1959).

Results and Discussion

In the present study, in general, the genotypic correlation coefficients were high than the corresponding phenotypic ones indicating the inherent association among the various traits studied (Table 1). Correlation coefficients (phenotypic and genotypic) for marketable yield per plant were found to be significantly and positively correlated with total and marketable fruits per plant and gross yield per plant.

Thus, selection on the basis of more number of fruits per plant definitely leads to the high yield. The results are line with Kumar *et al.* (2003) and Kumar (2005) for total fruits per plant, Upadhyay (2000) and Kumar (2005) for marketable fruits per plant and Upadhyay (2000), Singh *et al.* (2002) and Kumar (2005) for gross yield per plant. There was negative and significant association of marketable yield per plant with average fruit weight at genotypic level only. This finding was in broad conformity with Mohanty (2003) and Kumar (2005). Positive and significant correlations at phenotypic and genotypic level were observed between days to 50 per cent flowering and days to first harvest, total fruits per plant and marketable fruits per plant, total fruits per plant and marketable yield per plant, total fruits per plant and gross yield per plant, marketable fruits per plant and marketable yield per plant, marketable fruits per plant and gross yield per plant and gross yield and marketable yield per plant. The results are in broad conformity with Kumar and Lal (1989), Upadhyay (2000) and Singh *et al.* (2004) for days to 50 per cent flowering and days to first harvest, Upadhyay (2000) and Kumar (2005) for total fruits per plant and marketable fruits per plant, Nandpuri *et al.* (1973), Sidhu and Singh (1989) for total fruits per plant and marketable yield and gross yield per plant, Upadhyay (2000) and Kumar (2005) for marketable fruits per plant and marketable yield and gross yield per plant and Singh *et al.* (2002), Upadhyay (2000) and Kumar (2005) for gross yield and marketable yield per plant. Total fruits per plant and average fruit weight, and marketable fruits per plant and average fruit weight exhibited negative and significant association at phenotypic and genotypic levels whereas average fruit weight

Table 1. Estimates of correlation coefficient at phenotypic (P) and genotypic (G) level among different traits of tomato

Traits		Days to first harvest	Total fruits/ plant	Marketable Fruits/plant	Average fruit weight (g)	Gross yield/ plant (g)	Marketable yield / plant (g)
Days to 50% flowering	P	0.597*	-0.114	-0.095	0.021	-0.272	-0.199
	G	0.730*	-0.051	-0.050	0.119	-0.182	-0.141
Days to first harvest	P		0.008	0.022	0.094	-0.134	-0.074
	G		0.036	0.015	0.167	-0.069	-0.111
Total fruits/plant	P			0.994*	-0.718*	0.550*	0.707*
	G			1.000*	-0.835*	0.593*	0.748*
Marketable fruits/plant	P				-0.717*	0.529*	0.716*
	G				-0.828*	0.597*	0.753*
Average fruit weight (g)	P					-0.146	-0.345
	G					-0.303	-0.521*
Gross yield/plant (g)	P						0.929*
	G						0.966*

*Significant at 5% level of significance

and marketable yield per plant showed significant and negative correlation at genotypic level only.

Marketable fruits per plant and fruit weight exhibited the direct positive effect on marketable fruit yield at phenotypic and genotypic level, respectively. However the average fruit weight had negative indirect contribution via marketable fruits per plant. This suggested that fruit size can be improved only upto a certain extent and thereafter it shall prove counter productive by reducing the proportion of marketable fruits per plant. The foregoing discussion suggested that marketable fruits per plant, gross yield per plant and average fruit weight are the primary component traits on which selection shall prove to be effective. The present findings are in agreement with those of Dudi and Kalloo (1982) and Singh *et al.* (1988) for fruit number and fruit weight.

Table 2. Direct and Indirect effect of component traits on marketable yield of tomato at phenotypic and genotypic level

Traits		Days to 50% flowering	Days to first harvest	Marketable fruits /plant	Average fruit weight (g)	Correlation with Marketable yield
Days to 50% flowering	P	**-0.002**	-0.001	0.000	0.000	-0.199
	G	**-0.085**	-0.062	0.004	-0.010	-0.141
Days to first harvest	P	0.010	**0.017**	0.000	0.002	-0.074
	G	0.007	**0.010**	0.000	0.002	-0.111
Marketable fruits/plant	P	-0.195	0.044	**2.039**	-1.462	0.716*
	G	-0.057	0.018	**1.155**	-0.957	0.753*
Average fruit weight (g)	P	0.000	0.001	-0.007	**0.010**	-0.345
	G	0.022	0.030	-0.150	**0.181**	-0.521*

Residual effect P – 0.120 G – 0.114

*Significant at 5% level of significance
Underlined values indicate direct effects

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