Correlation and Path Coefficient Analysis in Tomato (*Solanum lycopersicon* L. Karst) under Fruit Worm (*Heliothis zea* Buddie) Infestation in a Line × Tester

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ABSTRACT

Experiments were conducted during the dry seasons of 2010 to 2011 in north eastern Nigeria to evaluate F_1 hybrids in tomato for yield and resistant to fruit worm insect. The study was among other things to estimate the association between fruit yield and yield traits in tomato and to estimate the path coefficients. The result revealed that flower clusters/plant, leaves/plant and plant height exhibited significant positive genotypic correlations with fruits/plant. The results also revealed a strong and positive phenotypic correlations between fruits/plant with trichome count, flower clusters, leaves/plant and plant height. There were negative and significant genotypic and phenotypic correlation coefficients between % damaged fruits and trichome count. Trichome count, flower clusters/plant, leaves/plant and plant height are traits therefore to be considered when selecting for fruit yield improvement. The path analysis revealed that % damaged fruit, flower clusters/plant, days to final harvest and leaves/plant had a direct effect on fruit yield.

OBJECTIVES

The degree of association between yield and yield components of tomatoes and the degree of interrelationship between the direct and the indirect effects to fruit yield has not been studied in this environment and as a result there is paucity of information. An attempt was therefore, made to determine the correlation coefficients between various quantitative traits of tomato and to also estimate their path coefficients.

MATERIALS AND METHODS

Experiments were conducted during dry season of 2010 to 2011 on eight parents of tomato and 12 hybrids derived through line × tester. The experiments were at two locations, *viz*: Lake Alau near Maiduguri, Borno State (11° 6′ N; 13° 17′ E) and Hong in Adamawa State (10° 15′ N; 13° 20′ E), all in north eastern Nigeria.

The land was prepared manually and the treatments were laid out in RCBD with 3 replications . Irrigation water was applied into the beds at 2 to 4 days intervals as required from transplanting to final harvest. NPK (15:15:15) fertilizer at the rate of 80 kg/ha was applied into the field 15 days after transplanting. Weeding was done as required according to the Nigerian crop production guide. The field was artificially infested by tomato fruit worm to see the reactions of the parental lines and hybrids to this insect.

Data were collected on five randomly selected plants per plot on the following yield and yield traits: trichome count, flower clusters/plant, leaves/plant, plant height and number of fruits/plant. Other traits on which data were recorded included, fruit yield, % damaged fruits and days to final harvest. All data collected were subjected to correlation and path coefficient analysis and the correlation coefficient among all the traits at phenotypic (r_p) and genotypic (r_g) level were estimated employing the formulae of (Al-Jibourie *et al.*, 1958). While the estimates of direct and indirect effect of component traits on fruit yield were computed using the formula suggested by Wright (1921 and elaborated by Dewey and Lu (1959).

RESULTS

Table 1: Genotypic and phenotypic correlation coefficients between yield and yield traits

TRAITS	Trich Count	Fl. Cluster	Leaves /Plant	Plant Ht	Fruits /Plant	Yield /Plant	% Dam. Fruits	Days to Harv
Trich. Count	**1.00**	0.90**	0.90**	0.69	0.04	0.16	0.92**	0.02
Fl. Clusters	0.90**	**1.00**	0.92**	0.91**	0.99**	-0.91**	-0.92**	0.92**
Leaves/Plant	0.90**	0.90**	**1.00**	0.91**	0.99**	-0.91**	-0.92**	-0.91**
Plant Ht.	0.71**	0.81**	0.99**	**1.00**	0.95**	0.56	0.91**	0.91**
Fruits/Plant	0.91**	0.91**	0.91**	0.90**	**1.00**	0.92**	0.97**	0.99**
% Dam. Fruit	0.22	0.22	0.29	-0.10	0.91**	**1.00**	-0.91**	-0.90**
Days to Harv	-0.90**	-0.90**	-0.90**	0.66	0.92**	-0.32	**1.00**	-0.92**
	0.90**	-0.81**	-0.91**	0.57	0.92**	-0.07	-0.77**	**1.00**

**Significant at 1% level of probability
Genotypic correlation values: upper right diagonal
Phenotypic correlation values: lower left diagonal

Table 2: Path coefficients of component traits on fruit yield of tomato.

TRAITS	Trich. Count	Fl. Cluster	Leaves /Plant	Plant Ht.	Fruits /Plant	% Dam. Fruits	Days to Harv	Corr. Coef.
Trich. Count	**0.092**	0.631	0.239	-0.001	0.047	0.991	0.010	0.22
Fl. Cluster	0.087	**0.651**	0.315	-0.030	0.267	-0.991	0.440	0.22
Leaves/Plant	0.087	0.586	**0.346**	-0.027	-0.290	-0.991	-0.435	0.29
Plant Ht.	0.069	0.527	-0.030	**-0.030**	-0.279	-0.980	0.435	-0.10
Fruits/ Plant	0.088	0.592	0.315	0.027	**-0.293**	-0.945	0.473	0.91**
% Dam. Fruit	-0.087	-0.586	-0.311	0.020	0.270	**0.977**	0.440	-0.32
Days to Harv.	0.087	-0.527	-0.315	-0.017	0.270	0.829	**0.478**	-0.07

DISCUSSIONS

Study of association between traits helps in selection of genotypes and proffers a way for simultaneous selection scheme in more than one trait. This explain the fact that improvement in a particular trait could result into the improvement of all the positively related traits .

Significant and positive genotypic correlations between fruits/plant with flower clusters, leaves/plant, plant height and days to final harvest implies that the traits could be improved simultaneously. Similar findings were reported by Kumar *et al.* (1979). It also means that a high level of heritability existed between these traits. Hannan *et al* (2007) and Hayder *et al* (2007) also reported significant positive association between fruit yield and flower clusters/plant, leaves/plant and plant height. Hayder *et al* (2007) affirmed that these traits were synonymous to yield increase in tomato.

Significant and positive correlation between yield and trichome count tells the importance of trichome as a resistance strategy in control of fruit worm. Kennedy and Sorenson (1985) had reported a direct relationship between the preponderant levels of trichome with resistance to fruit worm.

The path analysis partitions the correlation coefficient into direct and indirect effects through alternate pathways towards yield. Highest direct contribution towards fruit yield was evident through % damaged fruits followed by flower clusters and days to final harvest. It therefore, means that yield is dependant on the % of damaged fruits, flower clusters and days to final harvest.

The indirect effect of % damaged fruits to yield via trichome count and days to final harvest were high. The indirect effect of flower clusters via trichome count, leaves/plant, plant height and number of fruits was also high. Hayder *et al* (2007) and Bhardwaj and Sharma (2005) reported similar results and found a significant contributions to yield through plant height, flower clusters, leaves/plant and number of fruits/plant.

The important yield contributing traits could therefore be circumvented for fruit yield. This result is in agreement with that of Golani *et al*. (2007) and Indu Rani *et al*. (2008). This finding confirms the reliability of these traits in selecting a superior tomato type for yield in tomato.

CONCLUSIONS

Yield contributing traits such as flower clusters/plant, leaves/plant and plant height were found to have positive and significant genotypic and phenotypic correlations with number of fruits/plant. The resistance trait i.e. trichome count was genotypically correlated with flower clusters/plant, leaves/plant and % damaged fruits. Number of fruits/plant were phenotypically and positively correlated with flower clusters, leaves/plant, plant height and days to final harvest. Trichome count was significantly and negatively phenotypically correlated with number of fruits/plant.

The % damaged fruit exhibited the highest positive direct effect on fruit yield. The direct effects of flower clusters/plant, days to final harvest, and leaves/plant were positive on fruit yield. These traits could be exploited concurrently when selecting for high yielding genotypes in tomato.

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