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Character association study on tomato advance lines in Odisha

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Abstract
Field experiment were carried out in RRTTS, Semiliguda, Koraput during 2017-18 and in AICRP on vegetable research in OUAT, Bhubaneswar in 2017-18 and 2018-19 respectively. The present study was undertaken with the objective to determine the degree of association between yield and it`s component characters over three environment. Forty tomato advance lines along with 7 check varieties were evaluated for identifying their efficiency with respect to 15 yield and yield attributing traits. The result from the pooled analysis of correlation study revealed that highest positive correlation both at genotypic and phenotypic level was between yield and numbers of truss per plant (r_p-0.738, r_g-0.802) followed by number of fruits per plant (r_p-0.679, r_g-0.695), number fruit per truss (r_p-0.554, r_g-0.592). Among the other component traits number of fruits per plant shows positive correlation with number of fruits per cluster (r_p-0.804, r_g-0.840), average fruit weight with number of flower per cluster (r_p-0.732, r_g-0.794).

Keywords: Genotypic Correlation Coefficient (r_p), phenotypic correlation coefficient (r_g), tomato advance lines

1. Introduction
Tomato (*Solanum lycopersicum* L., 2n=2x=24) is one of the most important and popular vegetables in the world because of its wider adaptability, high yielding potential and suitability for variety of uses in fresh as well as processed food industries (He *et al*., 2003; Nwosu *et al*., 2014) [10]. It belongs to the family Solanaceae and is native of Peru Equador region (Jenkins, 1948; Rick, 1969) and is normally a selfpollinated crop. In India, tomato occupies an area of 809000 ha. and 19697000MT of production (Horticulture Statistics 2017) [14]. In odisha the area under production is 91.03 thousand ha. with production of 1319.11 thousand MT and productivity of 14.41MT/ha. (Horticulture Statistics 2017) [14]. As a cash crop, it has great demand in the international market (Hannan *et al*., 2007a; Solieman *et al*., 2013) [2]. Tomatoes are an excellent source of minerals and vitamins (Akinfasoy *et al*., 2011). Its vitamin C content is particularly high (Kanyomeka & Shivute, 2005) [6]. Tomato's fruit is consumed in providing salads and cookies. In addition, it is used to can, paste, ketchup, sauce, puree and fruit juice (Maitidevi & Kathmandu, 2008). Tomato soup is good remedy for patients suffering from constipation and very good appetizer (Kalloo *et al*., 2001) [5]. It is herbaceous, annual to perennial, prostrate and sexually propagated crop plant with bisexual flowers. There are four to eight flowers in each compound inflorescence. Tomato is a typical day neutral plant and is mainly self-pollinated, but a certain per cent of cross-pollination also occurs. It is a warm season crop, reasonably resistant to heat and drought and grows under wide range of soil and climatic conditions. All the species of tomato are native to Western South America (Rick, 1976) [12]. Selection of yield *per se* is not reliable as it is much influenced by the environment. Therefore, indirect selections through component characters became important in breeding for yield improvement. Hence, studies on character associations not only help to understand physical linkage but also provide information on nature and direct of selection.

Material methods
Field experiment were carried out in forty advance lines including seven check i.e. five state released varieties and two national released varieties in RRTTS, Semiliguda, Koraput during 2017-18 and in AICRP on vegetable research in OUAT, Bhubaneswar in 2017-18 and 2018-19 respectively. The experiment was carried out in randomized block design with two replication with a spacing of 60cm x 40cm. The plot size was 2m x 1.80m. The observation of fifteen morpho-physiological characters were taken viz., days to 50% flowering, plant height, number of branches per plant, number of flower truss per plant, number of flowers per truss, number of fruit per truss, number of fruit per plant, length of fruit, girth of fruit, Pericarp thickness, average fruit weight, root volume, leaf area index, total chlorophyll content, total yield per plot. Data is collected from five randomly selected plants from each block. The pooled analysis of genotypic and phenotypic correlation was calculated for three environments under study. The details of advance lines are given in table 1. Total fifteen characters and their abbreviation is given in table 2

Result
The highest estimate of correlation at genotypic and phenotypic level was between yield and number of flower per cluster (r_p-0.738, r_g-0.802) followed by number of fruits per plant (r_p-0.679, r_g-0.695), number fruit per truss(r_p-0.554, r_g-0.592), number of fruit per truss(r_p-0.519, r_g-0.548), girth of fruit(r_p-0.515, r_g-0.537), average fruit weight(r_p-0.514, r_g-0.544). The rest of the characters non-significant correlation was found with yield (Table 3).
Among other component traits other than yield positive

significant correlation was found between number of branches per plant and plant height (r_p-0.385, r_g-0.638), number of fruit per truss and number of truss per plant (r_p-0.710, r_g-0.719), number of fruit per truss and number of truss per plant (r_p-0.702, r_g-0.728), number of fruit per truss and number of flower per truss (r_p-0.804, r_g-0.840), number of fruit per plant and number of truss per plant (r_p-0.732, r_g-0.794), number of fruit per plant and number of flower per truss (r_p-0.728, r_g-0.775), number of fruit per plant and number of fruit per truss (r_p-0.750, r_g-0.798), girth of fruit (r_p-0.345, r_g-0.419), Pericarp thickness and length of fruit (r_p-0.410, r_g-0.445), average fruit weight and girth of fruit (r_p-0.603, r_g-0.666). for the rest of character non-significant correlation is found(Table 3).

Discussion

Genetic studies on association of yield components convey evolutionary trend and the direction of divergence among a group of characters. Very often, selection for yield *per se* is not reliable and therefore, indirect selection through component traits becomes important for ultimate output, the grain yield. Hence studies on character association not only help to understand physical linkage, but also provide information on nature and direction of selection. Therefore, in the present study an attempt has been made to estimate the nature and magnitude of correlation of character pairs, which would facilitate selection of genotypes where a balanced combination of characters is associated with increased productivity.

The correlation coefficients among different characters were worked out at phenotypic and genotypic levels and have been presented in table 2. In general, the genotypic correlation coefficients were high in magnitude than phenotypic correlation coefficients. The highest estimate of correlation at genotypic and phenotypic level was between yield and number of flower per cluster followed by number of fruits per plant, number fruit per truss, number of fruit per truss, girth of fruit, average fruit weight and the similar type of result was found by Khan and Samadia (2012) [7] Meitei *et al*. (2014) [9], Prashanth *et al*. (2007) [11] Nwosu *et al*. (2014) [10] Meena and Bahadur (2015) [8] Ahiwar *et al.* (2013) and Sharma and Jaipaul (2014) [13].

Table 1: details of 40 advance lines

SL NO	Name Of Germplasm	Plant Type
1.	11/TOBN-3	Medium Long, indeterminate
2.	BT-3	Long, determinate
3.	BT-17	short, indeterminate
4.	BT-18	Short, indeterminate
5.	BT-21	Short, determinate
6.	BT-101	Medium long, determinate
7.	BT-106	Short, determinate
8.	BT-136	Long, determinate
9.	BT-218	Medium Long, determinate
10.	BT-317	Medium long, semi determinate
11.	IIVR SEL-2	Medium Long, determinate
12.	BT-12-2	Long, determinate
13.	BT-17-2	Short, indeterminate
14.	BT-112-1	Long, determinate
15.	BT-207-2	Medium long, indeterminate
16.	BT-428-3	Medium long, indeterminate
17.	BT-442-2	Long, semi determinate
18.	BT-506-1	Short, determinate
19.	BT-12-3-2	Short. Indeterminate
20.	BT-305-2-4-2	Long, indeterminate
21.	BT-22-4-1	Medium long, indeterminate
22.	BT-306-1-2	Medium long, indeterminate
23.	BT-224-3-1	Medium long, indeterminate
24.	BT-413-1-2	Long, determinate
25.	BT-429-1-1	Long, determinate
26.	BT-429-2-2	Long, determinate
27.	BT-433-2-1	Short, determinate
28.	BT-433-2-3	Short, determinate
29.	BT-433-1-2	Medium long, semi determinate
30.	BT-507-2-2	Short, indeterminate
31.	BT-508-1-1	Long, semi determinate
32.	BT-19-1-1-1	Short, determinate
33.	BT-215-3-3-1	Long, semi determinate
State released varieties		
34.	BT-1	Short, Determinate
35.	BT-2	Short, determinate
36.	BT-10	Short, determinate
37.	BT-12	short, determinate
38.	UTKAL RAJA	Short, determinate
National release varieties		
39.	ARKA VIKASH	Medium Long, indeterminate
40.	MEGHA TOMATO	Long, determinate

Table 2: 15 characters studied and there abbreviation

Characters	Abbreviation
Days to 50% flowering	DF
Height of plant(cm)	PH
Number of branches per plant	NBP
Number of truss per plant	NTP
Number of flower per truss	NFT
Number of fruit per truss	NFrT
Number of fruit per plant	NFrP
Length of fruit (mm)	LF
Girth of fruit (mm)	GF
Pericarp thickness of fruit (mm)	PT
Average fruit weight (gm)	AFW
Root volume (cc)	RV
Leaf area index	LAI
Total chlorophyll content	TC
Total yield per plot (kg)	TYP

Table 3: Estimates of phenotypic and genotypic correlation co-efficient among various characters for 40 tomato genotypes

Characters		DF	PH	NBP	NTP	NFT	NFrT	NFrP	LF	GF	PT	AFW	RV	LAI	TC
PH	r_p	-0.014													
	r_g	-0.031													
NBP	r_p	-0.087	0.385												
	r_g	-0.257	0.638												
NTP	r_p	-0.041	-0.007	-0.013											
	r_g	-0.007	-0.004	-0.141											
NFT	r_p	-0.059	0.001	-0.044	0.710										
	r_g	-0.073	0.002	-0.083	0.719										
NFrT	r_p	-0.003	0.092	-0.047	0.702	0.804									
	r_g	0.002	0.112	-0.130	0.728	0.840									
NFrP	r_p	-0.007	0.070	0.080	0.732	0.728	0.750								
	r_g	0.012	0.077	0.065	0.794	0.775	0.798								
LF	r_p	0.127	0.180	0.070	0.062	-0.001	0.110	-0.026							
	r_g	0.241	0.194	0.116	0.064	-0.005	0.123	-0.028							
GF	r_p	0.027	0.028	-0.007	0.345	0.143	0.119	0.132	0.199						
	r_g	0.024	0.030	0.083	0.419	0.163	0.162	0.151	0.212						
PT	r_p	0.101	0.298	0.250	0.096	-0.076	-0.075	0.006	0.410	0.073					
	r_g	0.185	0.310	0.595	0.136	-0.075	-0.069	0.011	0.445	0.065					
AFW	r_p	0.075	0.015	0.057	0.256	-0.048	-0.048	-0.182	0.183	0.603	0.188				
	r_g	0.070	0.010	0.043	0.294	-0.042	-0.046	-0.159	0.199	0.666	0.220				
RV	r_p	0.060	0.285	0.195	0.225	0.125	0.124	0.185	0.176	0.222	0.189	0.201			
	r_g	0.112	0.300	0.323	0.250	0.139	0.141	0.190	0.191	0.225	0.204	0.217			
LAI	r_p	0.135	0.189	0.119	0.023	-0.117	-0.064	-0.045	0.218	-0.071	0.292	0.103	-0.072		
	r_g	0.261	0.241	0.172	0.007	-0.186	-0.096	-0.074	0.258	-0.095	0.341	0.165	-0.087		
TC	r_p	0.078	0.013	-0.062	0.272	0.242	0.253	0.167	0.194	0.115	0.238	0.108	0.117	0.193	
	r_g	0.116	0.014	-0.099	0.299	0.262	0.280	0.173	0.201	0.122	0.254	0.114	0.120	0.240	
TYP	r_p	0.017	0.099	0.132	0.738	0.519	0.554	0.679	0.098	0.515	0.133	0.514	0.288	-0.011	0.153
	r_g	0.017	0.100	0.223	0.802	0.548	0.592	0.695	0.102	0.537	0.143	0.544	0.292	-0.018	0.155

Discussion

Genetic studies on association of yield components convey evolutionary trend and the direction of divergence among a group of characters. Very often, selection for yield *per se* is not reliable and therefore, indirect selection through component traits becomes important for ultimate output, the grain yield. Hence studies on character association not only help to understand physical linkage, but also provide information on nature and direction of selection. Therefore, in the present study an attempt has been made to estimate the nature and magnitude of correlation of character pairs, which would facilitate selection of genotypes where a balanced combination of characters is associated with increased productivity.

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Conclusion

Selection of yield *per se* is not reliable as it is much influenced by the environment. Therefore, indirect selections through component characters became important in breeding for yield improvement. In general, the estimates of genotypic correlation were higher than that of phenotypic

correlation, indicating that the environmental causes of correlation had affected the genetic cause, thereby reducing the reliability of phenotypic correlation for use in crop improvement programme.

In the present study number of flower per cluster, number of fruits per plant, number fruit per truss, number of fruit per truss, girth of fruit, average fruit weight shows positive correlation with yield per plot which reveals that selection on the basis of these characters bears relevance to fruit yield in tomato.

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