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COMBINING ABILITY OF QUALITY AND YIELD IN TOMATO (*LYCOPERSICON ESCULENTUM* MILL.)

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Summary

Eight diverse genotypes were crossed in all possible combination excluding reciprocals to identify the best parental combination. The analysis variance postulated highly significant variances for general and specific combining ability to all the characters. The magnitude of general combining ability variances was higher than the specific combining ability variances indicating importance of additive component for all characters except fruit breadth. The parents EC-368860, BT-17, BT-18, EC-164336-A-1 and EC-369060-A were observed good general combination for one or more of the character contributing yield. The crosses EC-339074 x EC369060-A and EC-164336A x BT-18 was most promising combination for quality and yield, respectively. The additive gene action in present study suggested that most of the crosses can be utilized for developing desired segregants.

सारांश

टमाटर की ८ विभिन्न प्रभेदों का सभी संभव संकरण व्युत्क्रम को छोड़कर उत्तम पितृ संयोजन प्राप्त करने के लिए किया गया। सभी गुणों के लिए सामान्य एवं विशिष्ट संयोजन क्षमता में उच्च सार्थक विभिन्नता पाई गयी। साधारण संयोजन क्षमता स्तर विशिष्ट संयोजन क्षमता से अधिक था जो स्पष्ट करता है कि फल की मोटाई के अतिरिक्त सभी गुणों के लिए योज्य घटक सार्थक है। पितृ ई०सी० ३६८८६०, बी टी-१७, बी टी-१८, ई०सी० १६४३३६-ए-१ और ई०सी० ३६९०६० एक या अधिक गुण जो उपज से संबंधित था के लिए अच्छे संयोजी साबित हुए। संकर ई०सी० ३३९०७४ X ई०सी० ३६९०६० और ई०सी० १६४ ३३६ – ए-१ X बीटा-१८ उपज एवं गुणवत्ता के लिए अच्छे थे। योज्य जीन प्रक्रिया अच्छे पृथक्करण संतति को विकसित करने के लिए प्रयोग में लाई जा सकती है।

Introduction

Tomato (*Lycopersicon esculentum* Mill.) is one of the major crops among vegetables, grown widely both for fresh and processing. Being a self pollinated it has a tremendous potential for heterosis breeding. Several commercial hybrids have been developed coupled with excellent quality and yield. With increasing popularity of F_1 hybrids it is imperative to obtain new hybrids with excellent performance. The knowledge of general combining ability (gca) and specific combining ability (sca) helps to select the parents as well as crosses and find out gene action to formulate and effective brooding methodology. Therefore the present investigation was undertaken to identify best parental combination having good quality coupled with high yield.

Materials and Methods

Eight diverse genotype/cultivar of tomato, namely EC-164336-A-1 (P_1), EC-368860 (P_2), EC-339074 (P_3), EC-369060-A (P_4), EC-386021 (P_5), Sonali (P_6), BT-17 (P_7) and BT-18 (P_8) were crossed in all possible combination excluding reciprocals. The 28 F_1 hybrids along with their eight parents were evaluated during Kharif 2002, in RBD with three replications at Research Farm, HARP, Ranchi. Twenty plants in each treatment were transplanted at row and plant spacing at 60 and 40 cm, respectively. Observation were recorded on 10 randomly selected plants from each treatment for quality and yield attributing traits viz; plant height(cm), number of branches per plant, average fruit weight (g), fruit length (cm), fruit breadth (cm), fruit firmness(lb/inch^2), TSS (%), number of locules per fruit, pulp thick-

Table 1: Best parents, crosses, relationship between *sca* and *gca* effects of crosses for quality and yield in tomato

Characters	High gca effects	*Perse* performance	Common parents on the basis of gca effects and *per se* performance	Best crosses on the basis of *per se* performance	Best crosses on the basis of sca effects	Common crosses in the basis of *sca* effect and *per se* performance	gca effects of parents
Plant height	EC-339074	EC-369060-A	EC-339074	EC-368860x BT-17	EC-368860x BT-17	EC-368860x BT-17	M X L
	EC-368860	EC-339074	EC-369060-A	EC-339074x EC-386021	EC-339074x EC-386021	EC-339074x EC-386021	H X L
	EC-369060-A	BT-17		EC-339074x BT-18	EC-339074x BT-18	EC-339074x BT-18	M X L
Number of branches per plant	EC-368860	EC-339074	EC-164336-A-1	EC-368860x Sonali	EC-368860x Sonali	EC-368860x Sonali	H X M
	EC-164336-A-1	EC-164336-A-1	EC-339074	EC-369060-Ax BT-18	EC-369060-Ax BT-18	EC-369060-Ax BT-18	L X M
	EC-339074	Sonali		EC-164336-A-1x BT-18	EC-164336x EC-386021		
Average fruit weight	BT-17	Sonali	EC-339074	BT-17x BT-18	EC-339074x EC-369060-A	BT-17x BT-18	H X L
	EC-339074	EC-339074		EC-164336-A-1x EC-368860	BT-17x BT-18	EC-164336-A-1x EC-368860	L X H
	EC-368860	EC-164336-A-1		EC-368860x Sonali	EC-164336-A-1x EC-368860		
Fruit length	EC-368860	EC-368868	EC-368860	EC-368860x Sonali	EC-368860x Sonali	EC-368860x Sonali	H X M
	Sonali	Sonali	Sonali	EC-368860x BT-18	EC-368860x EC-369060-A	EC-368860x EC-369060-A	H X L
	BT-18	BT-18	BT-18	EC-368860x EC-369060-A	EC-386021x BT-17		
Fruit breadth	EC-339074	EC-339074	EC-339074	EC-339074x EC-386021	EC-339074x EC-386021	EC-339074x EC-386021	H X M
	BT-17	BT-17	BT-17	EC-339074x BT-17			
	Sonali	Sonali	Sonali	EC-339074x Sonali			
Fruit firmness	EC-386021	EC-164336-A-1	EC-386021	EC-368860x BT-18	EC-368860x BT-18	EC-368860x BT-18	H X M
	EC-368860	EC-386021	BT-17	EC-368860x BT-17	EC-339074x EC-369060-A		
	BT-17	BT-17		EC-164336-A-1x BT-18	EC-339074x EC-386021		
TSS	EC-368860	EC-368860	EC-368860	EC-368860x BT-17	EC-339074x EC-369060-A	EC-369060-Ax BT-17	L X M
	EC-164336-A-1	EC-164336-A-1	EC-164336-A-1	EC-386021x Sonali	EC-369060-Ax BT-17		
	EC-386021	EC-386021	EC-386021	EC-369060-Ax BT-17	EC-369060-Ax BT-18		
Number of locules per fruit	EC-386021	EC-369060-A	EC-386021	EC-368860x EC-386021	EC-164336-A-1x EC-339074	EC-368860x EC-386021	L X H
	EC-369060-A	EC-386021	EC-369060-A	EC-368860x EC-369060-A	EC-368860x Sonali	EC-368860x Sonali	L X L
	Sonali	Sonali	Sonali	EC-368860x Sonali	EC-368860x EC-386021		
Pulp thickness	EC-164336-A-1	EC-339074	Sonali	EC-368860x EC-369060-A	EC-368860x EC-369060-A	EC-368860x EC-369060-A	H X L
	Sonali	Sonali	EC-339074	EC-368860x Sonali	EC-386021x BT-17	EC-368860x Sonali	H X H
	EC-339074	EC-386021		EC-368860x EC-339074	EC-368860x Sonali		
Yield	BT-18	EC-339074	EC-339074	EC-164336-A-1x BT-18	EC-164336-A-1x BT-18	EC-164336-A-1x BT-18	M X H
	EC-339074	EC-369060-A	BT-17	EC-164336-A-1x BT-17	EC-369060-Ax EC-386021		
	BT-17	BT-17		EC-164336-A-1x EC-339074	Sonali x BT-17		

ness (cm) and yield (q/ha). Data were pooled and subjected to statistical analysis. The combining ability estimates were calculated according to the Method 2 and Model I of Griffing (1956b).

Results and Discussion

Significant variances were observed for general and specific combining ability for all the characters(Kaur *et al.*,2002). However the relative magnitude of general combining ability variances was higher than the specific combining ability variances indicating thereby that the additive component was of major importance in the expression of all the characters, except fruit breadth was found to be under the control of both additive and non additive gene action. These finds are in agreement with those of other Mittal and Singh (1977), Lonkar and Borikar(1988), Srivastva *et al.*(1998) and Sanjay *et al.*(2002). Under such situation where both additive and non-additive component of genetic variance are important, it is evident that maximum production may be attain with a breeding system that can exploit both additive and non-additive genetic effect simultaneously.

General combining ability studies have successfully led to making choice of suitable parent. This information on quality, yield and its components would greatly help in proper classification of parental lines in the present study. Parent EC-339074 exhibited significant and high general combining ability effects for plant height, number of branches per plant, average fruit weight, fruit breadth, pulp thickness and yield per plant. General combining ability effect includes both additive and additive x additive type of gene action (Griffing, 1956a, b), which represent fixable genetic variance. Some scientist (Srivastva et *al.*,1998) have also reported that additive parental effect as measured by general combining ability effects are of critical importance and value, whereas non-allelic interaction are impracticable and can not be manipulated. On the basis of *per se* performance and general combining ability effect, parent EC-339074 and EC 369060A for plant height, EC 164336A-1 and EC339074 for number of branches per plant, EC-339074 for average fruit weight, EC368860 and Sonali for fruit length EC-339074 and BT-17 for fruit breadth, EC-164336-A-1 for TSS, EC-386021 and EC369060-A for number of locules per fruit, Sonali and EC-339074 for pulp thickness and EC-339074 and BT-17 for yield were found best general combiner.

Specific combining ability effects represent
and epistatis as potential parameters for hete
ing, which is non fixable and utilized in to
commercial exploitation of heterosis is fe
three best performing hybrids on the bas
performance and *sca* effects are presented
To confirm whether the crosses indicated
of specific combining ability effects wer
best performer ones, the best five crosses
of per se performance and specific combi
effects were selected.The best performing h
EC-368860xBT-18, EC-339074xEC-3860
368860xBT-18 for plant height, EC-368860
369060AxBT-18 for number of branches p
17xBT-18 and EC-164336A-1xEC-368860
fruit weight, EC-368860xSonali and EC-3
369060 for fruit length, EC-339074xEC386
breadth, EC369060AxBT-17 for TSS, EC-3
386021 and EC-368860xSonali for numbe
per fruit, EC-368860xEC-369060-A-1 and
x sonali for pulp thickness and EC164336
for yield. It is clear from the result obtai
majority of the crosses which showed the
fects, the parental lines involved were at
the five most out standing parental lines,
368860, BT-17, BT-18, EC164336-A-1 and
A, which had high *gca* effects for one or
characters contributing yield. This indica
superior performance of the F_1 showing
fects was largely due to epistatic interacti

In the parent study, best cross combinatio
high x high, high x low, high x moderate,
low and low x low general combiner for cha
study (Table 1).This has suggested that goo
binations are not always obtained betwee
eral combiners. If the crosses showing th
cific combining ability involved both t
which are good general combiners, they
ploited in practical heterosis breeding.
crosses showing the high specific combi
involve one good combiner and one mo
biner may be utilized as desirable transgr
regants, if the additive gene action pres
combiner and complementary epistatic
moderate combiner, act in the same direct
mize the desirable plant attributes. The a
non-additive gene action in present stud
that a breeding procedure such as populati

ment (selection) and heterosis might prove most beneficial for improving the quality and yield in tomato.

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