ESTIMATION OF HETEROSIS AND COMPONENTS IN EXPERIMENTAL CROSSES DEVOLOPED AMONG ELITE LINES OF TOMATO *(Solanum lycopersicum L.)*

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By

M.BUJJI NASARAIAH (1119013)

DEPARTMENT OF GENETICS AND PLANT BREEDING

SCHOOL OFAGRICULTURE

LOVELY PROFESSIONAL UNIVERSITY

PHAGWARA-144401

PUNJAB

Title: ESTIMATION OF HETEROSIS AND COMPONENTS IN EXPERIMENTAL CROSSES DEVOLOPED AMONG ELITE LINES OF TOMATO ***(Solanum lycopersicum L.)***

Name of student	: M.BUJJI NASARAIAH
Father's Name	: M.NASARAIAH
Mother's Name	: M.PADMA
Major Subject	: GENETICS AND PLANT BREEDING
Name of Supervisor	: Dr. HARMEET SINGH JANEJA
Place/Station of Research	: LPU, Phagwara, India
University Regd .No	: 11719013
Year of Passing B.Sc.(Agri)	: May 2017
Year of Admission in M.Sc. Agri (G&P)	: August 2017
Period of Research	: 2017-2019

CERTIFICATE

This is to certified that this synopsis entitled-"Estimation of Heterosis and components in experimental crosses developed among elite lines of tomato (*Solanum lycopersicum* L.)" submitted in partial fulfillment of requirements for degree–Master of Science in Genetics and Plant Breeding by Bujji Nasaraiah, Registration no.11719013 to Department of Genetics and Plant Breeding, School of Agriculture, Lovely Professional University, has been formulated and finalized by the student himself on the subject.

(Signature of Student)

M.Bujji Nasaraiah

11719013

(Signature of Supervisor)

Dr. Harmeet Singh Janeja

UID: 12964

DECLARATION

I here by declare that the project work entitled—"**Estimation of heterosis and components in experimental crosses developed among elite lines of Tomato** *(Solanum lycopersicum L.)***"** is an authentic record of my work carried at Lovely Professional University as requirements of Project work for the award of degree Master of Science in Genetics and Plant Breeding, under the guidance of Dr. Harmeet Singh Janeja, Associate Professor, School of Agriculture, Lovely Professional University, Phagwara, Punjab.

M.Bujji Nasaraiah

(RegistrationNo.11719013)

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1. Introduction

Tomato (**solanum lycopersicum**) belongs to the genus Lycopersicon under Solanaceae family. Tomato is a herbaceous sprawling plant growing to 1-3 m in height with weak woody stem. The flowers are yellow in colour and the fruits in size from cherry tomatoes, about 1–2 cm in size to beefsteak tomatoes, about 10 cm or more in diameter

Tomato is one of the most versatile vegetable with wide usage. Tomatoes are used for soup, salad, pickles, ketchup, puree, sauces and in many other ways.

Tomato crop is grown in almost all kinds of ecological conditions. In India, tomato is cultivated over an area of 777.5 thousands hectares with a total production of 18286.4 thousands metric tonnes with productivity of 23.51 MT /ha in 2013-14. Bihar, Karnataka, Odissa, Maharashtra, Himachal Pradesh, West Bengal, Tamil Nadu, Uttar Pradesh and Gujarat are major tomato growing states, among them Karnataka is the largest producer state in India..

Tomato, a tropical day neutral plant and is mainly self pollinated (but a certain percentage of cross-pollination also occurs). It is warm season crop reasonably resistant to heat and drought and grows under wide range of soil and climatic conditions. Tomato a self pollinated crop has a tremendous potential for heterosis.

Heterosis breeding is a tool for genetic improvement in tomato which has been advocated by several workers ever since the phenomenon of hybrid vigour was noticed by Hedrick and Booth (1907). Further, comparative ease in emasculation, high percentage of fruit setting and good number of seeds per fruit also facilitate the exploitation of heterosis in tomato. It is an established fact that for successful hybrid breeding (development) selection of parents has a vital role. The studies on combining ability of parents is essential in choosing parents. Combining ability analysis is an important technique to understand the genetic potential of parents and their hybrids. It also provides the information on gene effects to help us in formulating an effective breeding strategy. Many biometrical procedures have been developed to obtain information on combining ability. Diallel crossing technique is one among them which is widely used to work out combining ability of the parents and crosses to be involved in hybrid production.

Objectives

1. To identify best performing experimental hybrids
2. To estimate the heterosis and its components in experimental crosses developed among elite lines of tomato.
3. To study gene effects for important fruit, quality and agronomic traits

REVIEW OF LITERATURE

Heterosis is defined as the superiority of the hybrids over their parents in terms of vegetative growth, adaptation and productivity of plants (Shull 1908, East 1936, Gustafsson 1946 and Hayes 1952). The phenomenon of hybrid vigour in tomato was first observed by Hedrick and Booth (1907). Later on, Wellington (1912) and Stucky (1916) reported that tomato hybrids were superior to their respective better parents for yield and its component traits. A tremendous progress has been made in the development of potential hybrids in tomato, since the discovery of hybrid vigor by Shull (1914). Extensive work on different aspects of heterosis in tomato has been carried out over the past several years. Brief review of information available on the present studies has been collected and brought out.

HETEROSIS

Bhatt et al. (2001) conducted a study on tomato to find out the extent of heterosis for yield with two important quality traits, ascorbic acid and total soluble solids. Significant differences among genotypes ware obtained for all the three traits. Positive highly significant heterosis was found over the better parent for yield (41.97), ascorbic acid (16.68) and total soluble solids (25.97).

Kurian and **Peter** (2001) experimented with tomato hybridization and achieved the Fl hybrids which showed highest significant hetero beltiosis for TSS and lycopene. The Fl hybrids generally performed better in fruit quality, i.e. uniform ripening, high lycopene and total solids.

Premalakshme et al. (2005) presented study for development of F1 hybrids with high yield and quality in tomato through diallel crossing involving six parents. The studies revealed remarkable heterosis over the better parent for earliness, plant height, and laterals per plant. In order of merit, the three best performing F1 hybrids exhibited heterosis percentage of 14.43 and 13.90 for marketable fruit weight and fruit yield over the standard check, respectively.

Sharma (2003) observed desirable heterosis over the best parent and better standard check for days to 50 per cent flowering, number of fruit per plant, fruits per cluster, fruit weight, total fruit yield per plant, marketable yield per plant, pericarp thickness and plant height while less desirable heterosis for number of locule per plant. Tiwari and Lal (2004)

reported heterobeltiosis and standard heterosis for the traits viz., marketable yield, number of fruits, fruit weight, pericarp thickness, TSS and plant height.

Anita et al. (2005) studied eight F1 hybrids and their 16 parents and observed heterosis to the extent of 63.30 per cent for fruit weight, 25 per cent for number of locules per fruit, 23.33 per cent for number of fruits per plant, 109.11 per cent for yield per plant, 29.03 per cent for TSS and 32.25 per cent for ascorbic acid content over better parent. The cross NDT-15 × Pant T-5 manifested maximum heterosis for fruit number and total yield.

Dharmatti et al. (2006) in a line (5) × tester (10) analysis reported negative heterosis over check for bacterial wilt incidence. The crosses Arka Alok × SP-2-2, Arka Alok × L-101, Sonali × SP-2-2 and Arka × W-9430 were the most outstanding. Harer et al. (2006) studied heterosis for yield components, TSS and ascorbic acid contents in 8 parental half diallel and reported 71.3 per cent heterobeltiosis for fruit yield per plant.

Kumari and **Sharma** (2011) in a line (15) × tester (3) analysis observed significant heterosis in favourable direction for yield, fruit number and plant height. The crosses Sioux × FT-5, S-1001 × Solan Vajr, EC-521041 × FT-5 and S-1001 × EC-15998 were the most outstanding.

Kapur (2011) evaluated bacterial wilt resistant lines of tomato and observed that all the cross-combinations in pooled environment revealed heterobeltiosis for marketable yield per plant, whereas 25 out of 28 cross combinations showed significant positive heterosis over standard check. On the basis of standard heterosis in pooled environment, the top ranking cross-combinations for marketable fruit yield per plant were BWR-5 × 16-B (112.50%), 7-2 × CLN1314G (82.69%), BL333-3 × CLN1314G and 17-2 × CLN1314G (78.85% each) and BWR-5 × 12-1 and CLN2116B × 16-B (75% each). These cross combinations had the maximum per se performance to the extent of 2.21, 1.90, 1.86, 1.86, 1.82 and 1.82 kg per plant, respectively in comparison to 1.04 kg per plant in the standard check Avtar (7711).

2.Material and method

a) Plant material

The present field experiment on Tomato [*Solanum lycopersicum*] was conducted during summer-2018 at experimental fields of breeding department, school of Agriculture, LPU, Phagwara, Punjab. The experimental material comprised of 17 varieties.

b) Experimental detail

Crop	:	Tomato
Design	:	RBD (Randomized block design)
Genotypes	:	17
Experimental year	:	2018-19
No. of replications	:	3
Spacing	:	45x60cm
Season	:	Summer

VARIETIES

1) Pusa rubi
2) PB Reitta
3) KS-16
4) Pusa khagni
5) so-lalima
6) barka bahar
7) PBC
8) BT 120
9) pant 5
10) NDTV r73
11) B72
12) arka saurab
13) m-local
14) arka rakshak
15) arka vikas
16) pusa rohini
17) pusa gaurav

REFERENCES

International Journal of Agronomy and Agricultural Research (IJAAR) BY Sujeet Kumar , P. H. Ramanjini Gowda. Article published on September 2016.

Premalakshmi, V, Thangaraj, T, Veeraraghathatham, D and Arumugam, T. 2003. Hybrid vigour for yield and shelf life in tomato (Lycopersicon esculentum Mill.). South Indian Horticulture. 50(4-6): 360-369.

Premalakshmi, V, Thangaraj, T, Veeraraghavathatham, D and Arumugam, T. 2005. Heterosis and combining ability ability in tomato (Solanum lycopersicum L.). Vegetable 32(1): 47-50.

Ahmed S, Quamruzzaman A K M and Uddin M N.2011.Estimate of heterosis in tomato (Solanum lycopersicum L.). Bangladesh Journal Agricultural Research. 36 (3): 521-527.

Ali M S, Bhowmik A and Khan S H. 1989. Combining ability and heterosis in tomato. Bangladesh Journal of Agriculture 14(3):225-231.