Plant Archives Vol. 14 No. 1, 2014 pp. 101-104 *ISSN 0972-5210*

HETEROSIS FOR SOME QUALITY TRAITS IN TOMATO (*LYCOPERSICON ESCULENTUM* MILL.)

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Abstract

An experiment was conducted to evaluate the extent of heterosis in tomato for carotene content, vitamin C, pericarp thickness and shelf life in a Line × Tester analysis between six high yielding genotypes and three fruit borer resistant genotypes. Heterotic hybrids were identified for carotene content of fruits (EC-461070 × MTM Local, EC-461070 × EC-461057), vitamin C content (EC-461018 × EC-461035, PKM-1 × EC-461057), pericarp thickness (EC-461018 × EC-461057) and shelf life (PKM-1 × EC461057).

Key wards : Heterosis, quality traits, tomato.

Introduction

The phenomenon of heterosis in tomato was first observed by Hedrick and Booth in 1908. Since then, heterosis for yield, its components and quality traits were extensively studied by many workers. Recently heterosis breeding is considered as an important method of crop improvement for improving the productivity and quality of vegetables. The extent of heterosis for ascorbic acid (vitamin, C), carotene (vitamin, A) and other quality traits of tomato were estimated in cross combinations involving high yielding along with good fruit quality accessions (Lines) and fruit borer resistance accessions (Testers) is reported in this paper.

Materials and Methods

Three tomato accessions (Marthandam Local, EC-461035, EC-461057) showing varying degrees of resistance to fruit borer (*Helicoverpa armigera*) were selected as male parents and six female lines were selected based on higher yield and good fruit quality were EC-461070, EC-461018, Ec-461078, Arka Alok, PKM-1 and Muthi. Six lines were selected using selection index method. Selfed seeds were obtained from the parents to rise the crop and the six lines and three testers were crossed. The exotic genotypes were introduced from AVRDC (Asian Vegetable Research and Development Centre), Taiwan. The hybrids along with parents were raised in randomized block design with three replications. The study was carried out at Research Farm, College of Agriculture, Vellayani, Thiruvananthapuram, Kerala Agricultural University. Well developed good quality seeds of nine parents and eighteen hybrids were sown in nursery. Twenty five days after sowing the seedlings were transplanted to the main field. The plot size is 1.8 × 3m. The seedlings were planted at a spacing of 60cm × 60cm. The cultural and management practices were done as per package of practices, recommendations (KAU, 1996) were followed. Heterosis was calculated as the percent deviation of the mean performance of the F's from its mid parent (MP), better parent (BP) and standard parent (SP) for each cross combination were worked out as suggested by Briggle (1963) and Hayes *et al*. (1965). MTM Local was chosen as the standard parent which is a high yielder and highly resistant to fruit borer.

Results and Discussion

Percentage of relative heterosis (RH) and Heterobeltiosis (HB) and standard heterosis (SH) were estimated from the mean value of parents and hybrids for the quality related characters are presented in tables 1 and 2. Significant positive heterosis was recorded in the hybrids for carotene content in tomato fruits. Positive heterosis for carotene content in tomato fruit is a desirable character, which is the most important quality contributing trait in tomato. Out of eighteen hybrids four expressed significant positive relative heterosis. They were EC-461070 × MTM Local (33.17), EC-461070 × EC- 461057

Table 1 : Mean performance of parents F_1 hybrids and extent of heterosis in tomato for carotene and vitamin C content of fruits.

S. no.	Parents/hybrids	Carotene (µg/100mg)				Vitamin C (mg/100g)			
		Mean	RH	HB	SH	Mean	RH	HB	SH
1.	EC-461070 (L_1)	2126.67	-	-	-	21.02	-	-	-
2.	EC-461018 (L_2)	1806.67	-	-	-	18.46	-	-	-
3.	EC-461078 (L_3)	2230.00	-	-	-	19.49	-	-	-
4.	Arka Alok (L_4)	2230.00	-	-	-	19.48	-	-	-
5.	PKM-1 (L_5)	1643.33	-	-	-	21.02	-	-	-
6.	Mukthi (L_6)	1846.67	-	-	-	22.57	-	-	-
7.	MTM Local (T_1)	1963.33	-	-	-	24.10	-	-	-
8.	EC-461035 (T_2)	1786.67	-	-	-	27.69	-	-	-
9.	EC-461057 (T_3)	1586.67	-	-	-	27.69	-	-	-
10.	$L_1 \times T_1$	2723.33	33.17**	28.06**	38.71**	22.57	0.02	-6.38	-6.38
11.	$L_1 \times T_2$	2056.67	5.11	-3.29	4.75	25.64	5.26	-7.42	6.36
12.	$L_1 \times T_3$	2593.33	39.68**	21.94*	32.09**	25.13	3.17	-9.26	4.25
13.	$L_2 \times T_1$	2016.67	6.98	2.72	2.72	21.02	-1.21	-12.78*	-12.78*
14.	$L_2 \times T_2$	1973.33	9.83	9.23	0.51	27.69	20.01**	0.00	14.88**
15.	$L_2 \times T_3$	1860.00	9.63	2.95	-5.26	24.10	4.45	-12.96*	-0.01
16.	$L_3 \times T_1$	2060.00	-1.75	-7.62	4.92	23.07	5.87	-4.27	-4.27
17.	$L_3 \times T_2$	1923.33	-4.23	-13.75	-2.04	23.59	0.01	-14.81**	-2.13
18.	$L_3 \times T_3$	2296.67	20.35*	2.99	16.98	23.07	-2.18	-16.67**	-4.27
19.	$L_4 \times T_1$	2633.33	22.67**	13.02	34.43**	22.05	1.18	-8.52	-8.52
20.	$L_4 \times T_2$	1880.00	-8.66	-19.31	-4.24	24.61	4.35	-11.11*	2.12
21.	$L_4 \times T_3$	1980.00	1.11	-15.02	0.85	24.10	2.18	-12.96**	-0.014
22.	$L_5 \times T_1$	2013.33	11.65	2.55	2.55	21.02	-6.85	-12.81**	-12.81*
23.	$L_5 \times T_2$	1963.33	14.48	9.89	0.00	24.61	1.05	-11.11*	2.12
24.	$L_5 \times T_3$	1750.00	8.36	6.49	-10.87	27.18	11.58*	-1.85	12.75*
25.	$L_6 \times T_1$	2073.33	8.84	5.60	5.60	24.10	3.28	-0.01	-0.01
26.	$L_6 \times T_2$	1836.67	1.10	-0.54	-6.45	23.59	-6.12	-14.81**	-2.13
27.	$L_6 \times T_3$	1646.67	-4.08	-10.83	-16.13	27.18	8.15	-1.85	12.75*
	CD 5%		352.18	406.66	406.66		2.19	2.53	2.53

L- Lines, T- Testers, RH- Relative Heterosis, HB- Heterobeltiosis, SH- Standard Heterosis.
**Significant at 1% level, * Significant at 5% level.

(39.68), EC-461070 × EC-461057 (20.35) and Arka Alok × MTM Local (22.67). Two hybrids *viz*., EC-461070 × MTM Local and EC-461070 × EC-461057 recorded significant positive relative heterosis, heterobeltiosis and standard heterosis for this trait.

The hybrids exhibited significant relative heterosis, heterobeltiosis and standard heterosis for vitamin C content in tomato fruits. Only two hybrids EC-461018 × EC-461035 (20.01) and PKM-1 × EC-461057 (11.58) recorded significant positive relative heterosis. Three hybrids exhibited significant positive standard heterosis *viz*., EC-461018 × EC-461035 (14.88), PKM-1E × EC-461057 (12.75) and Mukthi × EC-461057 (12.75). Similar results were reported by Devi (1984), Kanthaswamy and Balakrishnan (1989) and Hassan *et al*. (2000).

The hybrids exhibited significant heterosis for pericarp thickness. Pericarp thickness is major character controlling firmness and keeping quality of tomato fruits. Relative heterosis ranged from 14.71 to 16.22 and four hybrids recorded significant positive relative heterosis *viz*., EC-461070 × EC-461035 (6.67), EC-461018 × EC-461057 (16.22), EC-461078 × EC-461057 (9.35) and Mukthi × EC-461057 (8.29). Significant positive heterosis was earlier reported by Nandapuri & Tyagi (1974) and Varghese (1998). Shelf-life is the most important character in tomato breeding, which is responsible for keeping quality and calculated in days. Heterobeltiosis was significant and positive in only one hybrid PKM-1 × EC-461057 (24.37). All the other hybrids exhibited negative heterosis.

Table 2 : Mean performance of parents, F_1 hybrids and extent of heterosis in tomato for pericarp thickness and shelf life.

S. no.	Parents/hybrids	Pericarp thickness (mm)				Shelf life (days)			
		Mean	RH	HB	SH	Mean	RH	HB	SH
1.	EC-461070 (L_1)	4.46	-	-	-	10.63	-	-	-
2.	EC-461018 (L_2)	3.47	-	-	-	9.47	-	-	-
3.	EC-461078 (L_3)	4.21	-	-	-	8.27	-	-	-
4.	Arka Alok (L_4)	4.81	-	-	-	12.40	-	-	-
5.	PKM-1 (L_5)	4.94	-	-	-	6.63	-	-	-
6.	Mukthi (L_6)	5.22	-	-	-	10.77	-	-	-
7.	MTM Local (T_1)	6.46	-	-	-	20.10	-	-	-
8.	EC-461035 (T_2)	6.09	-	-	-	11.70	-	-	-
9.	EC-461057 (T_3)	4.71	-	-	-	6.50	-	-	-
10.	$L_1 \times T_1$	5.80	6.10	-10.31**	-10.32**	14.60	-4.99	-27.36**	-27.36**
11.	$L_1 \times T_2$	5.63	6.67*	-7.56*	-12.95**	10.60	-5.07	-9.40	-47.26**
12.	$L_1 \times T_3$	4.54	-0.98	-3.54	-29.76**	9.60	12.06	-9.72	-52.24**
13.	$L_2 \times T_1$	5.12	3.05	-20.78**	-20.78**	13.57	-8.23	-32.50**	-32.50**
14.	$L_2 \times T_2$	5.00	4.67	-17.80**	-22.59**	9.93	-6.14	-15.10*	-50.58**
15.	$L_2 \times T_3$	4.75	16.22**	0.99	-26.46**	7.97	-0.21	-15.85*	-60.37**
16.	$L_3 \times T_1$	4.55	-14.71**	-29.60**	-29.60**	11.73	-17.27**	-41.63**	-41.63**
17.	$L_3 \times T_2$	5.32	3.30	-12.65**	-17.74**	9.87	-1.17	-15.67*	-50.91**
18.	$L_3 \times T_3$	4.87	9.35*	3.54	-24.60**	7.93	7.45	4.03	-60.53**
19.	$L_4 \times T_1$	5.63	-0.08	-12.84**	-12.84**	15.97	-7.28	-25.04**	-25.04**
20.	$L_4 \times T_2$	5.45	0.06	-10.41**	-15.63**	11.20	-7.05	-9.68	-44.28**
21.	$L_4 \times T_3$	4.77	0.14	-0.97	-26.25**	8.70	-7.94	-29.84**	-56.72**
22.	$L_5 \times T_1$	5.68	-0.47	-12.17**	-12.17**	10.63	-20.45**	-47.10**	-47.10**
23.	$L_5 \times T_2$	5.74	4.08	-5.70	-11.19**	9.03	-1.46	-22.79**	-55.06**
24.	$L_5 \times T_3$	4.96	2.80	0.337	-23.26**	8.17	24.37**	23.12**	-59.37**
25.	$L_6 \times T_1$	5.48	-6.27	-15.27**	-15.27**	12.93	-16.20**	-35.66**	-35.66**
26.	$L_6 \times T_2$	5.79	2.45	-4.82	-10.37**	10.60	-5.64	-9.40	-47.26**
27.	$L_6 \times T_3$	5.38	8.29*	2.94	-16.81**	8.17	-5.41	-24.15**	-59.37**
	C.D. 5%		0.36	0.41	0.41		1.34	1.54	1.54**

L- Lines, T- Testers, RH- Relative Heterosis, HB- Heterobeltiosis, SH- Standard Heterosis.
** Significant at 1% level, * Significant at 5% level.

Acknowledgements

I express my sincere thanks to Dr. D. Chandramony, Former Professor and Head, Department of Plant Breeding and Genetics, College of Agriculture, Kerala Agricultural University, Vellayani, Thiruvananthapuram for her expert guidance, valuable suggestions and constructive criticisms. I am grateful to Dr. L. M. Engle, Genetist and Head (GRSU), Asian Vegetable Research and Development Centre (AVRDC), Taiwan and Dr. R. V. Singh, Head, Germplasm Exchange Division, ICAR, New Delhi for providing seeds of tomato genotypes for conducting this study.

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