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HETEROSIS FOR YIELD COMPONENTS AND FRUIT CHARACTERS IN TOMATO

Alice Kurian, K. V. Peter and S. Rajan
College of Horticulture, Vellanikkara 680 656, Trichur, India

Abstract: Heterosis for yield components and fruit characters was studied using line x tester analysis between bacterial wilt resistant / tolerant accessions and processing varieties. Heterotic hybrids were identified for average fruit weight (Sakthi x Fresh Market 9, Sakthi x HW 208F), yield / plant (Sakthi x TH 318, Sakthi x Fresh Market 9), locule number (LE 206 x Ohio 8129, LE 214 x St 64) and pericarp thickness (Sakthi x St 64, LE 206 x 64, LE 214 x St 64). All the hybrids were late to harvest and they produced fruits with round shape.

Key words: Fruit characters, heterobeltiosis, relative heterosis, yield components.

INTRODUCTION

Heterosis in tomato was first observed by Hedrick and Booth (1908) for higher yield and more number of fruits. Since then, heterosis for yield, its components and quality traits were extensively studied. Choudhary *et al.* (1965) emphasized the extensive utilization of heterosis to step up tomato production. The extent of heterosis for yield components and fruit characters of tomato in cross combinations involving wilt resistant / tolerant accessions and processing varieties is reported in this paper.

MATERIALS AND METHODS

Three tomato accessions (Sakthi, LE 214, LE 206) showing varying degrees of resistance / tolerance to bacterial wilt were selected as female parents from the germplasm collections maintained at the Department of Olericulture, College of Horticulture, Vellanikkara, Trichur. The five male testers selected from exotic varieties, based on processing quality were HW 208F, St 64, Ohio 8129, Fresh Market 9 and TH 318. Selfed seeds were obtained from the parents to raise the crop and the three lines and five testers were crossed. The 15 hybrids along with eight parents were raised in pots and evaluated in a completely randomized block design. Twelve pots were maintained for each entry. The crop was maintained as per the package of practices recommendations of the Kerala Agricultural University (KAU, 1986). The fruit shape index was derived by dividing polar diameter / equatorial diameter. Magnitude of heterosis was calculated in terms of two parameters. Heterosis over better parent (heterobeltiosis) and mid parent (relative heterosis) were worked out as suggested by Briggle (1963) and Hayes *et al.* (1965).

RESULTS AND DISCUSSION

Heterobeltiosis (HB) and relative heterosis (RH) were estimated and presented along with the mean performance of parents and hybrids (Tables 1 and 2). All the hybrids were late to harvest as indicated by the positive estimates of heterosis. The heterobeltiosis ranged from 5.95 to 21.37%, whereas relative heterosis ranged from 2.14 to 14.37%. Kurganskya and Agentova (1974) found that heterosis for earliness occurred most often when both the parents were early. Therefore, the observed lateness can be attributed to the strong influence of male parents which were late. In concurrence with the observed lateness, Hewitt and Stevens (1979) also reported delayed maturity in hybrids.

Significant relative heterosis for average fruit weight was observed in Sakthi x Fresh Market 9 and Sakthi x HW 208F (18.73 and 10.90% respectively). The increased fruit weight observed in the hybrids was in agreement with Larson and Currence (1944) who reported larger fruit size from those inbred lines having larger fruits. Also agreed with the intermediate fruit size between parents reported by Tesi *et al.* (1970) and Conti (1974). Sakthi x Fresh Market 9 was the best hybrid, which showed the highest *per se* performance.

The hybrids Sakthi x TH 318 (180.34 g) and Sakthi x Fresh Market 9 (1155.47 g) yielded more than the better parents but their heterobeltiosis effects were not significant (8.48 and 7.04% respectively). Significant relative heterosis was observed in these hybrids (9.20 and 13.24%). The increased yield in these two hybrids may be due to the high yielding parents selected for hybridization as suggested by Courtney and Peirce (1979). The lateness of

Table 1. Mean performance of parents and F_1 hybrids and extent of heterosis in tomato for days to harvest, average fruit weight and fruit yield / plant

Parents / Fj hybrids	Days to harvest			Fruit yield / plant, g			Average fruit wt., g		
	Mean	HB, %	RH, %	Mean	HB, %	RH, %	Mean	HB, %	RH, %
Parents									
Sakthi	93.6	-	-	1065.18	-	-	31.17	-	-
LE 206	93.2	-	-	880.66	-	-	21.40	-	-
LE 214	97.4	-	-	691.20	-	-	25.86	-	-
St 64	100.8	-	-	887.75	-	-	37.78	-	-
Ohio 8129	108.6	-	-	835.89	-	-	34.16	-	-
HW 208F	110.6	-	-	1045.40	-	-	69.14	-	-
TH 318	105.4	-	-	1196.18	-	-	48.81	-	-
Fresh Market 9	105.8	-	-	1051.08	-	-	88.38	-	-
F_1 hybrids									
Sakthi x St 64	100.8	7.69	3.70	813.90	-23.59**	-16.65**	32.91	-12.89	-4.54
Sakthi x Ohio 8121	106.4	13.68	5.24	705.48	-33.77**	-26.78**	28.70	-15.98	-12.14
Sakthi x HW 208F	107.6	14.96	5.39	1022.05	-4.05	-3.15	55.62	-19.55	10.90*
Sakthi xTH 3 18	104.0	11.11	4.52	1280.34	7.04	13.24**	39.53	-19.01	-1.15
Sakthi x Fresh Market 9	113.6	21.37	13.94	1155.47	8.48	9.20*	70.97	-19.70	18.73**
LE 206 x St 64	100.0	7.30	3.09	721.43	-18.74**	-18.41**	30.64	-18.90	3.55
LE 206 x Ohio 8129	105.8	13.52	4.86	654.56	-25.67**	-23.74**	26.96	-21.08	-2.95
LE 206 x HW 208F	109.4	17.38	7.36	726.25	-30.53**	-24.59**	36.35	-47.43	-19.70
LE 206 x TH 318	105.0	12.66	5.74	576.17	-51.83**	-44.51**	32.06	-34.32	-8.67
LE 206 x Fresh Market 9	109.0	16.95	9.55	775.00	-26.27**	-19.76**	35.30	-60.06	-35.69
LE 214 x St 64	103.2	5.95	4.14	559.61	-36.96**	-29.12**	29.07	-23.05	-8.64
LE 214 x Ohio 8129	105.2	8.01	2.14	523.00	-37.43**	-31.50**	25.00	-26.81	-16.69
LE 214 x HW 208F	115.0	18.07	10.58	758.58	-27.44**	-12.64**	41.70	-39.69	-12.21
LE 214 x TH 318	113.4	16.43	11.83	821.35	-31.34**	-12.96**	36.37	-25.49	-2.58
LE 214 x Fresh Market 9	116.2	19.30	14.37	693.60	-34.01**	-20.38**	42.01	-52.47	-26.45
SEm	1.05	-	-	32.44	-	-	1.83	-	-
CD (0.05)	-	2.96	2.56	-	91.07	78.91	-	5.15	4.46
CD (0.01)	-	3.92	3.39	-	120.66	104.53	-	6.82	5.91

HB = Heterobeltiosis; RH = Relative heterosis; *Significant at 5% level; "Significant at 1% level

parents, Fresh Market 9 and TH 318 can also be a reason for heterosis as observed by Popova (1979).

The female parents involved in the cross had round fruits (shape index 0.79 to 0.89) and male parents had ovate fruits (shape index 1.03 to 1.22). The hybrids produced fruits with round shape as indicated by index value less than one (0.86 to 0.92). Consequently, the estimates over better parent (-27.05 to -13.46%) and mid parent (-15.64 to -2.73%) were negative. The results are in agreement with Rao and Choudhary (1981) who observed the F_1s to be intermediate in fruit shape when round and pear shaped varieties were crossed.

The hybrids LE 206 x Ohio 8129 (58.56%) and LE 214 x St 64 (6.67%) showed significant positive heterobeltiosis for locules / fruit. All other hybrids had fewer locules compared to the better parent as indicated by the negative estimate of heterobeltiosis (-33.33 to -8.00%). Five hybrids showed significant relative heterosis. Heterobeltiosis and relative heterosis for locules / fruit were reported earlier (Anbu *et al.*, 1976). From the quality point of view, reduction of locule number is desirable and negative estimate of heterosis is valuable.

All the hybrids had increased pericarp thickness (4.46 to 6.29 mm) than the female parents

Table 2. Mean performance of parents and F_1 hybrids and extent of heterosis in tomato for fruit shape index, locules per fruit and pericarp thickness

Parents / F_1 hybrids	Fruit shape index			Locules / fruit			Pericarp thickness, mm		
	Mean	HB, %	RH, %	Mean	HB, %	RH, %	Mean	HB, %	RH, %
Parents									
Sakthi	0.89	-	-	4.0	-	-	3.92	-	-
LE 206	0.79	-	-	3.6	-	-	4.89	-	-
LE 214	0.88	-	-	3.0	-	-	4.55	-	-
St 64	1.05	-	-	2.6	-	-	6.50	-	-
Ohio 8129	1.22	-	-	2.0	-	-	6.26	-	-
HW 208F	1.03	-	-	5.0	-	-	5.50	-	-
TH 318	1.10	-	-	4.2	-	-	6.40	-	-
Fresh Market 9	1.04	-	-	5.0	-	-	6.13	-	-
F_1 hybrids									
Sakthi x St 64	0.87	-17.14**	-10.31**	3.6	-10.00**	9.09**	6.08	-6.46	16.70**
Sakthi x Ohio 8129	0.89	-27.05**	-15.64**	3.2	-20.00**	6.67	4.46	-28.75	-12.38
Sakthi x HW 208F	0.89	-13.59**	-7.29**	4.4	-12.00**	-2.22	4.72	-14.18	0.21
Sakthix TH 318	0.92	-16.36**	-7.54**	3.6	13.64**	-12.20**	5.33	-16.72	3.29
Sakthi x Fresh Market 9	0.90	-13.46**	-6.74**	4.4	-12.00**	-2.22	5.11	-16.64	1.70
LE 206 x St 64	0.89	-15.24**	-3.26**	2.4	-33.33**	-22.58**	6.29	-3.23	10.45**
LE 206 x Ohio 8129	0.89	-27.05**	-11.44**	5.0	55.56**	78.57**	5.02	-19.81	-9.96
LE 206 x HW 208F	0.87	-15.53**	-4.40**	4.6	-8.00**	6.98**	5.03	-8.55	-3.18
LE 206 x TH 318	0.91	-17.27**	-3.70*	3.6	-14.29**	-7.69**	5.46	-14.69	-3.28
LE 206 x Fresh Market 9	0.89	-14.42**	-2.73	4.2	-16.00**	-2.33	5.82	-5.06	5.63
LE 214 x St 64	0.88	-16.19**	-8.81**	3.2	6.67*	14.29**	6.12	-5.85	10.76**
LE 214 x Ohio 8129	0.90	-26.23**	-14.29**	2.6	-13.33**	4.00	4.68	-25.24	-13.41
LE 214 x HW 208F	0.89	-13.59**	-6.81**	4.6	-8.00	15.00	4.85	-11.82	-3.48
LE 214 x TH 318	0.91	-17.27**	-8.08**	3.6	-14.29**	-	5.29	-17.34	-3.38
LE 214 x Fresh Market 9	0.86	-17.31**	-10.42**	4.2	-16.00**	5.00*	4.80	-21.70	-10.11
SEm	0.01			0.07			0.16		
CD (P = 0.05)		0.04	0.03		0.19	0.16		0.45	0.39
CD (P = 0.01)		0.05	0.05		0.25	0.22		0.60	0.52

HB = Heterobeltiosis; RH = Relative heterosis; *Significant at 5 % level: "Significant at 1 % level

(3.92 to 4.89 mm). Hybrids of Sakthi, LE 206 and LE 214 with St 64 showed significant relative heterosis. This observation corresponded to Rao and Choudhary (1981) who reported appreciable increase in flesh thickness when the male parent was firm fruited.

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