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Identification of heterotic hybrids for yield and yield traits in brinjal

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Abstract

Diallel method of analysis was followed involving eight parents IBH-2, Utkal Keshari, IBH-3, SBJH-631, Sep-034, Sep-034, A. Nerkanth and BH-2. to study of heterosis for yield characters. The F₁ were evaluated during late kharif/rabi 2018-19 for the present study in randomized block design for two replications. Significant and positive heterosis was observed for most of the characters. The percentage of heterotic crosses showing heterosis over better parent were total yield of fruits per plant (71.06), fruit length (8.29), fruit weight (85.60), fruit diameter (43.27), plant height (27.45), days to 50% flowering (-19.72) and shoot borer infestation (-81.70%). High heterosis was observed in the cross 4 x 5 (SBJH-631 x Sep-034) for total yield of fruits per plant (kg/plant).

Keywords: Heterosis, standard check and Brinjal

Introduction

It is important vegetable crop cultivated throughout the warmer region of the world and has its centre of origin as India Thomposon *et al.* (1957). It is one of the major vegetable crops grown in Maharashtra after onion occupying an area of 26000 ha and has production of 548000 MT (Hort. Glance 2017) [4]. In Maharashtra, the crop is grown during all season *viz.*, Kharif, Rabi and Summer, usually under irrigated condition except at higher altitudes.

Brinjal is an important year round widely consumed vegetable in tropical and subtropical regions of globe. It is grown extensively in India, Bangladesh, Pakistan, China and Philippines. In India, it is one of the most common, popular and principal vegetable crop grown in the country. It is a versatile crop adapted to different agro climatic regions and can be grown throughout the year. It is a perennial but grown commercially as an annual crop. A number of cultivars are grown in India based on consumer preference for fruit colour, size, shape and taste.

The productivity of brinjal crop is low in some areas. The reasons for low yield are, growing of low yielding cultivars and the problems of diseases like phomopsis blight, little leaf, leaf spot and bacterial wilt and insect pests like fruit and shoot borer, jassids and epilachna beetles. Therefore, identification of good combiner and specific cross combinations and exploitation of heterosis is in need.

Materials and Methods

The present investigation entitled "Heterosis and Combining Ability Studies in Brinjal (*Solanum melongena* L.)" was conducted at Experimental farm of Department of Agricultural Botany, College of Agriculture, and V.N.M.K.V. Parbhani during *kharif* 2018. Twenty eight crosses were made during late Kharif /rabi 2017-18 using genetically diverse parents. Thus, eight parents, two check and 28 hybrids were evaluated during late kharif /rabi 2018-19 for the present study.

A set of 38 genotypes comprising of 8 parents and their 28 F₁ and standard checks Manjarigota and Panchaganga were sown in Randomized Block Design with two replications. Fertilizers were applied at the rate of 100 kg N/ha, 50 kg P₂O₅/ha and 50 kg K₂O/ha. P₂O₅ and K₂O were applied as basal dose with 50 kg of nitrogen before one week of transplanting, while, remaining 50 kg of nitrogen was top dressed at the time of flowering.

Result and Discussion

The analysis of variance showed significant differences among treatments for the characters studied (Table 1).

Heterosis (%) over mid parent (MP), better parent (BP) and standard checks (SC1, SC2) was calculated for yield. The results obtained are presented in Table 2, which are discussed below.

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a) Plant height: Among the cross combinations, minimum plant height was observed in IBH-2 x BH-2. For plant height three and fifteen hybrids exhibited the significant negative heterosis over mid parent, better parent respectively. Whereas two each of hybrids showed significant negative heterosis over standard check first and standard check second, respectively. Positive heterosis for this trait has also been reported by Chezhan *et al.* (2000)^[2], Kumar and Pathania (2003)^[5].

b) Days to 50 per cent flowering: The cross combination Utkal Keshari x IBH3 was observed earliest in flowering with respect to mean performance of crosses. For this trait, six, nine, one and one hybrids exhibited the significant positive heterosis over mid parent, better parent and standard check one and standard check two, respectively. Early flowering in hybrids has also been reported by Rai *et al.* (2005)^[6].

c) Fruit length (cm): maximum fruit length was observed in cross SBJH-631 x Sep-034. For fruit length one, nine and twelve hybrids showed significant positive heterosis over mid parent, better parent and standard check one and standard check two respectively.

d) Fruit diameter (cm): Among the cross combinations, maximum fruit diameter was observed in cross IBH-3 x BH-

2. For fruit diameter eight, four, six and eight hybrids exhibited the significant positive heterosis over mid parent, better parent and standard check one and standard check two, respectively. Positive heterosis for this trait has also been reported by Shafeeq *et al.* (2007)^[7].

e) Fruit weight (gm): maximum fruit weight was observed in cross Kavya x BH-2. For fruit weight eighteen, thirteen, twenty seven and twenty seven hybrids exhibited the significant positive heterosis over mid parent, better parent and standard check one and standard check two respectively. The studies also corroborate with the findings of Chiezhan *et al.* (2000).

f) Fruit yield (kg): Among the cross combinations, maximum fruit yield was observed in cross SBJH-631 x Sep-034. With respect to mean performance it revealed that, twenty, eleven, twenty eight and twenty eight hybrids showed significant positive heterosis over mid parent, better parent and standard check

g) Shoot Borer Infestation: Twenty one hybrid expressed significant negative heterosis over both the standard checks. Standard heterosis ranged from -81.70% (SBJH 631X Sep034) to 22.75% (SBJH 631 X BH-2). The result is in conformity with Pranee tha *et al.* (2011).

Table 1: Analysis of variance (mean square) for experimental design for different characters in Brinjal

Source of variation	D.F.	Plant height	Days to 50% flowering	Fruit length	Fruit weight	Fruit diameter	Fruit yield per plant	Shoot borer infestation
Replication	1	0.238	1.798	0.732	0.090	0.924	0.028	4.243
Genotype	35	106.093**	46.635**	8.014**	724.187**	17.086**	1.147**	27.070**
Parents	7	282.779**	68.338**	10.445**	664.098**	26.328**	1.099**	8.485**
Hybrids	27	62.868**	42.405**	7.193**	657.893**	15.322**	0.785**	30.026**
Parents vs Hybrids Error	1	36.343	8.938	13.168**	2934.74**	0.0006	11.279**	77.350**
SE±		4.64	2.92	0.59	3.47	0.67	0.28	0.92

*Significant at 5% and 1% level

Table 2: Heterosis in percentage over mid parent (MP), better parent (BP) and standard checks (SC1, SC2) for various characters in Brinjal

S. No.	Hybrids	Plant height (cm)				Days to 50% flowering				Fruit length (cm)			
		MP	BP	SC1	SC2	MP	BP	SC1	SC2	MP	BP	SC1	SC2
1.	IBH-2 x Utkal Keshari	-8.39	-10.98*	16.32*	14.31*	11.73**	1.84	20.37**	18.57**	8.94	3.12	16.00	21.41*
2.	IBH-2 x IBH-3	-1.34	-12.70*	14.06*	12.09	-4.02	-11.45**	4.67	3.09	-19.58**	-23.35**	-13.77	-9.75
3.	IBH-2 x SBJH-631	-2.17	-2.66	28.48**	26.26**	-8.98**	-9.92*	8.71	7.08	-5.89	-18.15**	24.51**	30.32**
4.	IBH-2 x Sep-034	-12.38*	-19.32**	5.41	3.59	-3.32	-4.08	13.37**	11.67*	-40.21**	-51.90**	-11.14	-7.00
5.	IBH-2 x Kavya	-7.70	-20.67**	3.66	1.87	-10.24**	-11.51**	4.59	3.02	-32.34**	-34.57**	26.40**	-22.97*
6.	IBH-2 x A. Nerkanth	-4.21	-9.69	18.00**	15.96*	-14.34**	-17.57**	-2.57	-4.03	-2.34	-9.65	19.51*	25.09**
7.	IBH-2 x BH-2	-13.03	-27.45**	-5.20*	-6.84*	-8.11*	-14.54**	1.01	-0.51	-18.74**	-23.35**	-13.77	-9.75
8.	Utkal Keshari x IBH-3	-4.87	-11.19*	6.47	4.63	-6.85	-8.07	-8.16*	-9.54*	-3.60	-4.30	-2.43	2.12
9.	Utkal Keshari x SBJH-631	-8.15	-13.23*	17.23**	15.20*	-11.10**	-19.72**	-3.13	-4.56	14.35*	-5.06	44.43**	51.17**
10.	Utkal Keshari x Sep-034	-8.27	-17.06**	6.96	5.11	7.46	-1.34	14.77**	13.05*	-9.56	-30.19**	28.97**	34.98**
11.	Utkal Keshari x Kavya	-5.86	-14.83**	2.25	0.48	11.69**	3.14	18.46**	16.68**	-12.55	-14.46	-10.13	-5.94
12.	Utkal Keshari x A. Nerkanth	-12.14*	-4.51	4.99	3.18	1.93	-3.67	5.29	3.71	-13.55*	-23.94**	0.61	5.30
13.	Utkal Keshari x BH-2	11.79*	-18.49**	17.72*	15.69*	8.67*	6.33	8.09	6.46	-12.51	-12.84	-12.42	-8.34
14.	IBH-3 x SBJH-631	-7.47	-5.72	7.59	5.74	-6.65	-14.69**	2.95	1.41	-13.58*	-27.83**	9.79	14.91
15.	IBH-3 x Sep-034	-1.52	6.71	3.66	1.87	-2.25	-9.16*	5.68	4.09	-8.95	-29.35**	30.52**	36.61**
16.	IBH-3 x Kavya	10.34	-0.10	7.31	5.46	2.62	-4.06	10.19**	8.53	9.92	8.29	13.77	19.08*
17.	IBH-3 x A. Nerkanth	6.91	-5.66	15.61*	13.61*	5.86	1.31	10.73**	9.07	-18.71**	-28.02**	-4.79	-0.35
18.	IBH-3 x BH-2	0.98	-11.69*	-5.13*	-6.77*	-2.55	-3.39	-1.79	-3.26	-23.07**	-23.91**	-22.42**	-18.80*
19.	SBJH-631 x Sep-034	-3.64	-9.43	16.56*	14.55*	-4.86	-6.57	12.75**	11.06*	1.90	-7.09	71.64**	79.65**
20.	SBJH-631 x Kavya	5.82	-19.93**	19.55**	17.48*	-9.01*	-11.21	7.15	5.55	-5.80	-20.37**	21.13**	26.78**
21.	SBJH-631 x A. Nerkanth	-14.67**	-19.93**	5.70	3.87	-4.92	-9.41*	9.33*	7.69	9.35	2.22	55.50**	62.76**
22.	SBJH-631 x BH-2	-2.33	-18.86*	7.10	5.25	8.03*	5.42	27.01**	19.26**	-13.62*	-28.50**	8.78	13.85
23.	Sep-034 x Kavya	2.30	-5.14	4.29	2.49	-5.44	-6.04	9.30*	7.66	-24.	-40.94**	9.12	14.20
24.	Sep-034 x A. Nerkanth	2.82	0.26	16.02*	14.02*	-1.92	-4.88	10.65*	8.99	-18.4070**	14.04**	58.81**	66.22**
25.	Sep-034 x BH-2	8.13	-2.99	6.65	4.81	4.45	-2.14	13.86**	12.13*	0.19**	-37.17**	16.07	21.48*
26.	Kavya x A. Nerkanth	-5.76	-14.62*	-1.20	-2.90	2.47	-5.61	13.92**	12.21**	-26.71**	-34.25**	-13.03	-8.98

27.	Kavya x BH-2	26.12**	21.68**	14.32*	12.34	1.28	-4.54	9.64*	8.00	-11.64	-13.88	-9.52	-5.30
28.	A. Nerkanth x BH-2	3.78	-8.95	5.37	3.55	9.85*	6.00	15.86**	14.12**	-28.70**	-37.47**	-17.29	-13.43
SE ±C.D at 5%		4.02382	4.64631	4.64631		2.52900	2.92024	2.92024		0.51671	0.59665	0.59665	
C.D at 1%		8.16873	9.43244	9.43244		5.13411	5.92836	5.92836		1.04897	1.21125	1.21125	
		10.9601	12.6557	12.6557		6.88855	7.95421	7.95421		1.40743	1.62516	1.62516	

Table 2: Continued

S.No.	Hybrids	Fruit weight (gm)				Fruit Diameter (cm)				Fruit yield per plant (kg)			
		MP	BP	SC1	SC2	MP	BP	SC1	SC2	MP	BP	SC1	SC2
1.	IBH-2 x Utkal Keshari	7.45	-10.47**	71.85**	67.11**	-19.31**	-33.14**	2.18	2.99	10.13	5.73	60.69**	52.25**
2.	IBH-2 x IBH-3	10.35**	-0.96	90.12**	84.88**	-18.67**	-35.17**	-0.92	-0.13	54.45**	29.51**	96.83**	86.50**
3.	IBH-2 x SBJH-631	-5.36	-17.57**	58.23**	53.87**	-40.74**	-58.86**	-37.12**	-36.62**	38.19**	16.59**	157.78**	144.25**
4.	IBH-2 x Sep-034	43.83**	8.22*	107.75**	102.02**	-3.28	-32.57**	3.06	3.87	-20.24**	-29.41**	39.31**	32.00**
5.	IBH-2 x Kavya	12.42**	-9.01*	74.66**	69.85**	-4.93	-22.86**	17.90**	18.84**	2.22	-0.17	51.72**	43.75**
6.	IBH-2 x A. Nerkanth	0.65	-1.28	89.50**	84.28**	-1.13	-25.14**	14.41*	15.32*	-23.25**	13.82	104.22**	93.50**
7.	IBH-2 x BH-2	-14.22**	-15.86**	67.92**	63.29**	-28.30**	-34.86**	-0.44	0.35	51.05**	37.15**	89.77**	97.50**
8.	Utkal Keshari x IBH-3	47.08**	35.18**	106.28**	100.60**	6.85	1.74	2.18	2.99	56.52**	35.85**	138.26**	80.00**
9.	Utkal Keshari x SBJH-631	25.63**	19.23**	69.92**	65.12**	-20.22**	-36.52**	-36.24**	-35.74**	32.02**	7.76	84.70**	125.75**
10.	Utkal Keshari x Sep-034	71.00**	50.29**	92.22**	86.93**	41.30**	13.04*	13.54*	14.44**	9.55	-6.42	104.49**	75.00**
11.	Utkal Keshari x Kavya	92.47**	85.60**	137.39**	130.85**	6.25	3.48	3.93	4.75	43.65**	41.17	78.89**	93.75**
12.	Utkal Keshari x A.Nerkanth	17.22**	-0.79	83.16**	78.11**	24.39**	10.87	11.35	12.24*	12.07	-0.29	120.58*	69.50**
13.	Utkal Keshari x BH-2	39.98**	14.84**	129.20**	122.89**	-3.10	-12.59*	9.17	10.04	67.20**	57.74**	120.70**	109.00**
14.	IBH-3 x SBJH-631	1.29	-2.09	49.41**	45.29**	5.81	-12.50	-20.52**	19.89**	40.55**	2.98	127.70**	115.75**
15.	IBH-3 x Sep-034	53.20**	25.25**	91.14**	85.87**	-13.29	-27.88**	-34.50**	-33.98**	46.22**	11.23	119.53**	108.00**
16.	IBH-3 x Kavya	54.96**	37.78**	110.26**	104.47**	17.37**	14.68*	9.17	10.04	42.92**	22.22*	77.04**	67.75**
17.	IBH-3 x A. Nerkanth	-27.64**	-33.91**	22.01**	18.65*	53.61**	43.27**	30.13**	31.16**	15.33	-9.26	62.80**	54.25**
18.	IBH-3 x BH-2	34.66**	18.82**	137.13**	130.60**	31.17**	13.29**	41.48**	42.61**	33.67**	24.49**	112.14**	101.00**
19.	SBJH-631 x Sep-034	10.91*	-6.80	32.72**	29.06**	-9.49	-10.14	-45.85**	-45.42**	86.98**	71.06**	179.68**	165.00**
20.	SBJH-631 x Kavya	31.40**	20.50**	71.61**	66.88**	-18.87**	-34.13**	-37.29**	-36.80**	16.80*	-3.34	113.72**	102.50**
21.	SBJH-631 x A. Nerkanth	-10.18*	-20.44**	46.87**	42.83**	-16.46*	-26.67**	-42.36**	-41.90**	34.12	21.48**	168.60**	154.50**
22.	SBJH-631 x BH-2	31.17**	12.38**	124.29**	118.11**	-1.42	-27.27**	-9.17	-8.45	31.19**	2.39	126.39**	114.50**
23.	Sep-034 x Kavya	97.68**	79.49**	13.19**	107.31**	24.49**	1.65	-3.23	-2.46	33.08**	15.37	127.70**	115.75**
24.	Sep-034 x A. Nerkanth	-27.89**	-45.02**	1.50	-1.29	-22.01**	-31.11**	-45.85**	-45.42**	17.65*	12.30	121.64**	110.00**
25.	Sep-034 x BH-2	17.76**	-12.53**	74.57**	69.76**	17.92**	-12.59*	9.17	10.04	36.62**	11.23	119.53**	108.00**
26.	Kavya x A. Nerkanth	-15.08**	-30.22**	28.81**	25.26**	5.53	-3.67	-8.30	-7.57	38.32**	25.00**	124.27**	112.50**
27.	Kavya x BH-2	56.87**	25.11**	149.70**	142.82**	15.87**	2.10	27.51**	28.52**	58.59**	47.18**	113.19**	102.00**
28.	A. Nerkanth x BH-2	4.27	0.36	100.31**	94.79**	-4.7	-22.41**	-3.10	-2.33	26.61**	7.06	92.08**	82.00**
SE ±		3.01224	3.47824	3.47824		0.58556	0.67615	0.67615		0.24905	0.28758	0.28758	
C.D at 5%		6.11514	7.06115	7.06115		1.18874	1.37264	1.37264		0.50559	0.58381	0.58381	
C.D at 1%		8.20482	9.47410	9.47410		1.59496	1.84170	1.84170		0.67836	0.78330	0.78330	

Table 2: Continued

S. No.	Hybrids	Shoot Borer Infestation (%)			
		MP	BP	SC1	SC2
1.	IBH-2 x Utkal Keshari	-32.24	-35.90**	-32.17**	-13.20
2.	IBH-2 x IBH-3	-20.62	-28.46**	-23.18**	-3.12
3.	IBH-2 x SBJH-631	39.77	-51.69**	-48.12	-34.57**
4.	IBH-2 x Sep-034	26.28	-33.21**	-28.28**	-9.55
5.	IBH-2 x Kavya	34.77	-39.52**	-35.06**	-18.10*
6.	IBH-2 x A. Nerkanth	0.47	-13.81**	-7.45	16.72*
7.	IBH-2 x BH-2	18.02	-21.35**	-15.54*	6.52
8.	Utkal Keshari x IBH-3	0.19	-5.20**	-9.21	14.49
9.	Utkal Keshari x SBJH631	30.70	-41.87**	-44.33	-29.80**
10.	Utkal Keshari x Sep-034	37.60	-40.40**	-42.92**	-28.02**
11.	Utkal Keshari x Kavya	34.36	-35.74**	-38.46**	-22.39**
12.	Utkal Keshari A. Nerkanth	21.17	-28.86**	-31.88	-14.09
13.	Utkal Keshari x BH-2	39.31	-40.21**	-41.00	-25.59**
14.	IBH-3 x SBJH-631	52.18	33.38**	14.93**	44.94**
15.	IBH-3 x Sep-034	6.19	-6.74	-18.68**	2.55
16.	IBH-3 x Kavya	36.45	-38.38**	-43.47	-28.70**
17.	IBH-3 x A. Nerkanth	27.88	-31.78**	-41.22**	-25.87**
18.	IBH-3 x BH-2	27.86	-32.43**	-33.32**	-15.91**
19.	SBJH-631 x Sep-034	75.93	-79.01**	-81.70**	-76.92**
20.	SBJH-631 x Kavya	11.91	-4.48	-12.36*	10.53
21.	SBJH-631 x A. Nerkanth	57.06	-60.40**	-69.57**	-61.62**
22.	SBJH-631 x BH-2	50.34	24.59**	22.95**	55.06**
23.	Sep-034 x Kavya	38.79	-40.31**	-45.23**	-30.93**
24.	Sep-034 x A. Nerkanth	27.91	-32.18**	-40.87**	-25.43**
25.	Sep-034 x BH-2	38.00	-41.61**	-42.38**	-27.33**
26.	Kavya x A. Nerkanth	45.77	33.94**	22.89**	54.98**
27.	Kavya x BH-2	1.55	-5.01	-6.26	18.22**
28.	A. Nerkanth x BH-2	17.37	4.39	3.02	29.92**
SE ±			0.92332		0.92332
C.D at 5%			1.87443		1.87443
C.D at 1%			2.51496		2.51496

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