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Development of heterotic hybrid in bitter melon (*Momordica charantia* L.) for earliness and high fruit yield

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Abstract

The present investigation was undertaken to study the magnitude of heterosis in 45 hybrids (F₁s) developed by following the Line × Tester mating design using fifteen lines and three testers for earliness and high fruit yield. Among the parents, OBGCBR-2 and IC-085611 have performed as superior genotypes for heterosis. Highest degree of heterosis for most of the traits *i.e.*, earliness and fruit yield traits were registered in desired direction in the hybrid OBGCBR-2 × Jaunpuri Green. Estimation of standard heterosis in cross OBGCBR-1 × IC-085611 recorded desired relative heterosis for days to 50% pistillate flowering. Heterosis for node at which 1st pistillate flower appears was in the desired direction in cross OBGCBR-2 × Jaunpuri Green for standard check and; hybrid Meghna × Jaunpuri Green for relative heterosis and heterobeltiosis. Hybrids Katehi × IC-085612 exhibited negative and significant relative heterosis and heterobeltiosis for internodal length. In case of sex ratio and fruit length cross OBGCV-2 × IC-085612 showed heterosis in desired direction for relative parent and heterobeltiosis. The positive and significant, relative parent and heterobeltiosis was in the hybrid Green Jhalari × Jaunpuri Green for fruit diameter. For average fruit weight positive and significant heterosis observed in cross OBGCBR-2 × IC-085611 over standard parent. Estimation of standard heterosis for number of fruit plant⁻¹ indicated that the hybrids OBGCBR-2 × IC-085611 found to be desirable superior cross combinations over standard heterosis followed by Meghna × Jaunpuri Green for relative parent and heterobeltiosis.

Keywords: Heterosis, earliness, line × tester, hybrids, superior lines and crosses.

Introduction

Bitter melon (*Momordica charantia* L.) having a diploid somatic chromosome number of $2n = 2x = 22$ (Bharathi *et al.*, 2011); is a dicot climbing vegetable species belongs to the family cucurbitaceae and originates in tropical Asia. Although, some gynoecious lines have been also reported, which also provide valuable genetic resources (as maternal plants) in breeding programs for the production of F₁ hybrids (Behera *et al.*, 2010) [3]. It is an extremely cross-pollinated crop species and its monoecious nature has resulted in a wide range of genetic diversity in terms of shape, size and colour of fruits available in the country.

Heterosis signifies the increased or decreased vigour of the F₁ hybrids and can be defined as the hybrid vigour or the superiority of the hybrids over the parents. It has been recognized as a practical tool in which the breeder provides a means of increasing yield and earliness. It may be manifested in terms of high productivity, uniformity, built-in resistance, environmental adaptations, earliness, etc. However, it never happens that each hybridization is accompanied by a manifestation of hybrid vigour and only a certain pair of parents gives heterotic progeny. Therefore, for the development of effective heterosis breeding programme in bitter melon, there is a need to elucidate the genetic nature and magnitude of quantitatively inherited traits and estimated prepotency of parents in hybrid combinations.

Materials and Methods

The present study was conducted to examine the genetic architecture of economic traits by following the L × T mating design. The 45 F₁ hybrids and 18 parents (15 lines × 3 testers) along with a standard check (Pusa Do Mausami) were raised at the Vegetable Research Farm, Department of Horticulture, Banaras Hindu University, Varanasi (UP) during *Kharif*-2016, *Kharif*-2017 and *Kharif*-2018 in a randomized complete block design with three replications. Eighteen promising diverse inbred lines of bitter melon, *viz.*, OBGCBR-2, OBGCBR-1, VRFBG-1, VRFBG-2, VRFBG-3, OBGCS-2, OBGCS-4, OBGCS-5, OBGCV-2, Katehi,

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Sakhi Gopal, Green Jhalari, Kateri, Preethi, Meghna, testers IC-085611, IC-085612, Jaunpuri Green and Pusa Do Mausami (SC) were included in the present investigation. All the lines were hand-pollinated with each other to produce all the possible combinations of F₁ hybrids in line × tester mating fashion (Kempthorn, 1957) [19]. The observations were recorded from five randomly selected plants for fifteen economically important traits, *viz.*, days to 50% staminate flowering, days to 50% pistillate flowering, node number at which 1st staminate flower appears, node number at which 1st pistillate flower appears, number of primary branches plant⁻¹, plant height (m), internodal length (cm), number of staminate flowers plant⁻¹, number of pistillate flowers plant⁻¹, sex ratio (staminate: pistillate), fruit length (cm), fruit diameter (mm), average fruit weight (g), number of fruits plant⁻¹ and fruit yield plant⁻¹ (kg). Magnitude of heterosis signifies increased or decreased vigour of the F₁ hybrids and can be defined as the hybrid vigour or the superiority of the hybrids over mid-parent (MP), better parent (BP) and standard check (SC) values (Shull, 1914) [20] using the method of Turner (1953) [25] and Hayes *et al.* (1956) [7] in bitter melon.

Results and Discussion

The magnitude of heterosis was calculated as per cent increase or decrease in the performance of F₁ hybrid over relative parent, better parent and standard check in respect of all the traits (Presented in Table: 1 to 8). The negative estimates of heterosis for earliness were considered desirable for the traits *i.e.*, days to 50% staminate flowering, days to 50% pistillate flowering, node at which 1st staminate flower appears, node at which 1st pistillate flower appears, number of staminate flower plant⁻¹ and sex ratio (staminate: pistillate), however, for rest of the traits, considered as desirable positive heterosis. This is in conformity to the earlier reporter of Rani *et al.*, 2014 [17].

High degree estimates of heterosis, for days to 50 % staminate flowering, cross combination VRFBG-1 × Jaunpuri Green and OBGCS-5 × Jaunpuri Green expressed significant negative heterosis over mid-parent; whereas OBGCS-5 × Jaunpuri Green and VRFBG-1 × Jaunpuri Green showed significant negative heterosis over better parent; similarly, VRFBG-1 × IC-085611 and OBGCS-5 × Jaunpuri Green showed significant negative heterosis over commercial check for this trait. For the trait, days to 50 % pistillate flowering, cross OBGCS-2 × IC-085611 showed significant negative heterosis over relative parent; however OBGCBR-1 × IC-085611 and OBGCBR-2 × Jaunpuri Green showed significant negative heterosis over better parent and standard check, respectively. Node at which 1st staminate flower appears, cross OBGCBR-1 × Jaunpuri Green revealed significant negative heterosis over mid parent, better parent and standard check. For node at which 1st pistillate flower appears, cross Meghna × IC-085612 exhibited significant negative heterosis over mid parent and better parent; while OBGCBR-2 × Jaunpuri Green and OBGCBR-1 × Jaunpuri Green observed negative significant heterosis over the standard check for this trait. This is in accordance with the findings of Ranpise (1992) [18].

The best crosses OBGCV-2 × IC-085612 and VRFBG-3 × IC-085612 registered significant positive heterosis over mid parent and better parent for number of primary branches plant⁻¹; similarly OBGCBR-2 × IC-085611 and OBGCBR-2 × Jaunpuri Green showed positive significant heterosis over the standard check for this trait. Heterosis for plant height recorded positive significant heterosis in the cross OBGCS-4

× IC-085612 over mid parent, better parent and standard check. Similar findings were reported by Rani *et al.* (2014) [17], Ranpise *et al.* (1992) [18] and Kumar *et al.* (2011) [10].

In case of internodal length, lower internodal length is desirable for higher productivity point of view. The crosses Katehi × IC-085612 and OBGCBR-1 × IC-085611 registered significant desirable as negative heterosis over mid parent for internodal length; similarly Katehi × IC-085612 and VRFBG-2 × IC-085611 showed negative significant heterosis over better parent; while not a single cross showed significant heterosis over standard check for this trait. For number of staminate flowers plant⁻¹ OBGCBR-2 × Jaunpuri Green and Meghna × Jaunpuri Green exhibited negative significant heterosis over the mid parent; similarly Green Jhalari × IC-085612 significant positive heterosis over better parent; and OBGCBR-2 × IC-085611 and Green Jhalari × IC-085611 showed significant negative heterosis over standard check for the same. Regarding, number of pistillate flowers plant⁻¹, the significant positive heterosis expressed in the cross combination *i.e.*, OBGCV-2 × IC-085612 over the mid parent and better parent; likewise OBGCBR-2 × Jaunpuri Green expressed significant positive heterosis over the standard check. A lower sex ratio is most criterion influencing yield, which reflects the ratio of male to female flowers *i.e.*, OBGCV-2 × IC-085612 and Meghna × Jaunpuri Green exhibited highly significant negative heterosis over mid parent and better parent; however OBGCBR-1 × IC-085612 and OBGCBR-2 × Jaunpuri Green expressed significant negative heterosis over standard check for this trait. This is in conformity to the earlier reporter of Ram *et al.* (1997) [16], Singh *et al.* (2001) [21], Sanandia *et al.* (2008) [19] and Kandasamy (2015) [8].

With respect to fruit length, cross combination OBGCV-2 × IC-085612 and OBGCBR-2 × Jaunpuri Green recorded positive significant heterosis over mid parent and better parent; while OBGCBR-2 × Jaunpuri Green showed significant positive heterosis over standard check. For the trait, fruit diameter, crosses Green Jhalari × Jaunpuri Green registered significant positive heterosis over mid parent and better parent; while none of the cross showed significant positive heterosis for this trait. Regarding, average fruit weight, crosses OBGCBR-2 × Jaunpuri Green and Meghna × Jaunpuri Green exhibited highest significant positive heterosis over mid parent and better parent; whereas OBGCBR-2 × IC-085611 and OBGCS-2 × IC-085611 recorded significant positive heterosis over standard check. Highly significant positive heterosis observed in the cross Meghna × Jaunpuri Green over the mid parent and better parent; while OBGCBR-2 × IC-085611 exhibited significant positive heterosis over the standard check for number of fruit plant⁻¹. For the trait, fruit yield plant⁻¹ in kg estimated high degree of heterosis in the crosses OBGCBR-2 × Jaunpuri Green and Meghna × Jaunpuri Green over mid parent; OBGCV-2 × IC-085612 and OBGCBR-2 × Jaunpuri Green over the better parent; whereas, OBGCS-4 × IC-085611 and OBGCBR-2 × Jaunpuri Green over the standard check for this trait. These findings are similar to the earlier reports of Lawande and Patil (1990) [11], Miniraj *et al.* (1993) [13], Mishra *et al.* (1994) [14], Sundaram (2008) [22], Yadav *et al.* (2009) [27], Thangamani and Pugalendhi (2013) [24], and Verma and Singh (2014) [26].

Therefore, the results of the present investigation indicated that for best promising hybrids revealed for further action on the basis of superiority over the standard check and their parents, cross combination *viz.*, OBGCBR-2 × Jaunpuri Green, OBGCBR-2 × IC-085611, OBGCS-2 × IC-085611,

OBGCV-2 × IC-085612, Meghna × Jaunpuri Green were exhibited for earliness as well as highest fruit yield over standard checks. Thus, these hybrids need to be further tested

in observational or multi-location trials before the commercial exploitation of its heterotic potential.

Table 1: Estimation of heterosis of 45 F₁ hybrids for days to 50 % staminate flowering and days to 50 % pistillate flowering in bitter gourd (*Momordica charantia* L.)

Crosses	Days to 50 % staminate flowering			Days to 50 % pistillate flowering		
	MPH	BPH	Std H	MPH	BPH	Std H
OBGCBR-2 × IC-085611	3.76	-5.47	-3.82	-13.40**	-14.53**	-16.62**
OBGCBR-2 × IC-085612	-5.81	-9.44	-7.85	-1.35	-4.69	4.13
OBGCBR-2 × Jaunpuri Green	-6.33	-8.84	-1.99	-6.42	-8.13	-20.38**
OBGCBR-1 × IC-085611	8.82	0.83	-1.15	-15.08**	-19.48**	-4.40
OBGCBR-1 × IC-085612	1.69	-0.46	-2.41	-8.68*	-15.17**	0.72
OBGCBR-1 × Jaunpuri Green	1.48	-2.99	4.29	-1.25	-6.84	10.60 *
VRFBG-1 × IC-085611	-9.12	-17.17**	-15.81**	-0.35	-1.82	4.47
VRFBG-1 × IC-085612	3.24	-0.69	0.94	-1.14	-1.82	1.40
VRFBG-1 × Jaunpuri Green	-18.69**	-20.91**	-14.97 *	-5.05	-5.95	-0.99
VRFBG-2 × IC-085611	2.98	-8.76	-1.15	-2.58	-3.10	3.11
VRFBG-2 × IC-085612	-3.49	-9.92	-2.41	-9.80 *	-11.26*	-6.58
VRFBG-2 × Jaunpuri Green	-3.36	-3.73	4.29	-7.57	-7.57	-2.70
VRFBG-3 × IC-085611	10.69	1.86	1.36	-2.82	-4.39	1.74
VRFBG-3 × IC-085612	5.68	2.70	2.20	-1.67	-2.20	0.72
VRFBG-3 × Jaunpuri Green	-4.50	-8.06	-1.15	-6.55	-7.57	-2.70
OBGCS-2 × IC-085611	7.45	-3.43	1.28	-16.71**	-18.42**	-19.48**
OBGCS-2 × IC-085612	4.93	-0.55	4.29	-2.62	-6.61	3.62
OBGCS-2 × Jaunpuri Green	-12.44*	-13.51*	-7.02	-6.84	-9.23	0.72
OBGCS-4 × IC-085611	0.86	-7.00	-7.85	5.86	3.32	9.94
OBGCS-4 × IC-085612	-7.11	-9.53	-10.37	1.85	1.56	3.45
OBGCS-4 × Jaunpuri Green	-4.30	-8.06	-1.15	0.83	-1.08	4.13
OBGCS-5 × IC-085611	10.51	4.95	-2.41	1.51	0.43	6.86
OBGCS-5 × IC-085612	11.61*	11.06	4.29	0.77	-0.33	3.79
OBGCS-5 × Jaunpuri Green	-16.02**	-21.69**	-15.30**	-2.17	-2.70	2.42
OBGCV-2 × IC-085611	10.89	2.55	0.94	-3.68	-6.95	-0.99
OBGCV-2 × IC-085612	-6.86	-9.00	-10.43	-5.32	-6.56	-14.83**
OBGCV-2 × Jaunpuri Green	-4.00	-8.06	-1.15	2.20	-0.76	4.47
Katehi × IC-085611	12.65*	8.88	-2.41	-1.67	-5.35	0.72
Katehi × IC-085612	13.65*	11.06	4.29	2.95	1.22	3.11
Katehi × Jaunpuri Green	2.83	-5.72	1.36	4.75	1.35	6.69
Sakhi Gopal × IC-085611	9.63	-0.58	2.20	-8.31	-8.56	-2.70
Sakhi Gopal × IC-085612	-13.55**	-17.29 **	-14.97*	-2.03	-3.87	1.74
Sakhi Gopal × Jaunpuri Green	-6.00	-8.06	-1.15	-5.49	-5.75	-0.24
Green Jhalari × IC-085611	8.16	0.43	-1.99	-5.79	-8.56	-2.70
Green Jhalari × IC-085612	8.92	6.87	4.29	-10.38*	-11.13*	-9.48
Green Jhalari × Jaunpuri Green	-12.60*	-16.63**	-10.37	1.35	-1.11	4.10
Katheri × IC-085611	8.82	0.83	-1.15	-8.05	-10.61*	0.72
Katheri × IC-085612	1.69	-0.45	-2.41	2.49	-2.42	9.94
Katheri × Jaunpuri Green	1.48	-2.99	4.29	-5.07	-8.18	3.45
Preethi × IC-085611	-2.13	-4.76	-15.01**	-3.12	-3.88	3.91
Preethi × IC-085612	10.74	7.49	0.94	1.79	-1.15	6.86
Preethi × Jaunpuri Green	-13.20*	-20.00**	-14.89 *	-2.72	-3.99	3.79
Meghna × IC-085611	11.19*	1.66	2.62	-6.30	-7.99	1.56
Meghna × IC-085612	1.03	-2.49	-1.57	-6.70	-10.31 *	-0.99
Meghna × Jaunpuri Green	-9.58	-12.34*	-5.76	-3.63	-5.86	-13.92**

* Significant at p= 0.05, ** Significant at p= 0.01

Table 2: Estimation of heterosis of 45 F₁ hybrids for node at which 1st staminate flower appears and node at which 1st pistillate flower appears in bitter gourd (*Momordica charantia* L.)

Crosses	Node at which 1 st staminate flower appears			Node at which 1 st pistillate flower appears		
	MPH	BPH	Std H	MPH	BPH	Std H
OBGCBR-2 × IC-085611	4.74	3.82	0.66	-12.78 **	-14.15 **	-18.18 **
OBGCBR-2 × IC-085612	-8.41	-10.18	-14.45	-2.45	-7.90	-1.18
OBGCBR-2 × Jaunpuri Green	-19.30**	-26.89**	-14.21	-15.25**	-18.33**	-22.16**
OBGCBR-1 × IC-085611	-20.76**	-27.60**	-15.18	0.28	-2.39	-4.84
OBGCBR-1 × IC-085612	-22.28**	-30.76**	-18.89 *	-6.35	-10.63 *	-4.11
OBGCBR-1 × Jaunpuri Green	-34.77**	-34.83**	-23.52**	-15.05**	-19.01**	-21.05**
VRFBG-1 × IC-085611	-24.01**	-26.69**	-22.58**	-5.29	-9.83	-7.94
VRFBG-1 × IC-085612	-12.46	-17.81 *	-14.25	-8.57	-10.79 *	-4.28
VRFBG-1 × Jaunpuri Green	-26.82**	-30.88**	-18.39 *	-8.13	-14.30**	-12.50*

VRFBG-2 × IC-085611	-24.14**	-28.87**	-21.21 *	3.81	-1.65	1.46
VRFBG-2 × IC-085612	-12.96	-20.50**	-11.94	-2.41	-4.28	2.70
VRFBG-2 × Jaunpuri Green	-10.60	-13.10	1.97	9.81 *	1.95	5.18
VRFBG-3 × IC-085611	-4.80	-7.45	-4.98	-7.76	-10.51	-12.16*
VRFBG-3 × IC-085612	2.60	-2.93	-0.35	-9.29 *	-13.15**	-6.81
VRFBG-3 × Jaunpuri Green	-15.73*	-21.00**	-7.30	-9.26	-13.78 **	-15.37**
OBGCS-2 × IC-085611	-11.86	-16.43*	-9.62	-12.49 *	-13.13 *	-19.81**
OBGCS-2 × IC-085612	-11.82	-18.57*	-11.94	-1.45	-8.95	-2.31
OBGCS-2 × Jaunpuri Green	-9.56	-13.10	1.97	5.87	4.37	-5.07
OBGCS-4 × IC-085611	-3.98	-9.92	-0.35	0.90	-3.04	-2.93
OBGCS-4 × IC-085612	0.86	-7.82	1.97	-21.54**	-24.17**	-18.63**
OBGCS-4 × Jaunpuri Green	-26.80**	-28.90**	-16.57	2.16	-3.82	-3.71
OBGCS-5 × IC-085611	-17.06*	-23.13**	-12.71	10.98 *	10.70	2.70
OBGCS-5 × IC-085612	3.94	-6.12	6.60	4.13	-2.92	4.17
OBGCS-5 × Jaunpuri Green	-23.72**	-24.95**	-11.94	-4.89	-7.14	-13.85**
OBGCV-2 × IC-085611	10.70	0.75	19.08 *	4.81	3.81	-2.31
OBGCV-2 × IC-085612	-13.83	-23.53**	-9.62	-7.35	-13.04**	-6.70
OBGCV-2 × Jaunpuri Green	-19.32**	-19.61**	-4.98	8.05	4.76	-1.41
Katehi × IC-085611	-11.40	-15.58	-9.62	-11.10 *	-13.90 **	-20.53**
Katehi × IC-085612	5.00	-2.60	4.29	9.83 *	-0.82	6.42
Katehi × Jaunpuri Green	-19.45**	-22.98**	-9.62	4.58	3.46	-8.56
Sakhi Gopal × IC-085611	-20.08**	-23.50**	-17.80 *	3.68	-1.59	1.13
Sakhi Gopal × IC-085612	7.90	0.55	6.60	-21.13**	-22.80**	-17.17**
Sakhi Gopal × Jaunpuri Green	-14.92*	-19.03*	-4.98	-6.44	-12.98 *	-10.58*
Green Jhalari × IC-085611	-1.21	-2.79	-5.76	-3.65	-6.60	-8.16
Green Jhalari × IC-085612	-7.52	-8.64	-14.25	-0.11	-4.28	2.70
Green Jhalari × Jaunpuri Green	-5.63	-15.08*	-0.35	-8.86	-13.47 **	-14.92**
Katheri × IC-085611	-17.33*	-22.40**	-14.25	5.38	3.70	-1.13
Katheri × IC-085612	-12.84	-20.31*	-11.94	-14.14**	-18.92 **	-13.00*
Katheri × Jaunpuri Green	-14.56*	-17.05*	-2.67	14.67**	10.49	5.35
Preethi × IC-085611	-8.77	-13.39	-6.57	1.69	-1.91	-9.46
Preethi × IC-085612	-12.47	-19.08*	-12.71	9.59 *	-1.40	5.80
Preethi × Jaunpuri Green	-15.11*	-18.53*	-4.40	6.34	4.78	-7.39
Meghna × IC-085611	-4.52	-8.84	-2.82	-4.89	-5.57	-12.83*
Meghna × IC-085612	-7.62	-14.13	-8.46	-22.18**	-26.25**	-20.86**
Meghna × Jaunpuri Green	-5.14	-9.48	6.22	-1.41	-2.82	-11.58

* Significant at p= 0.05, ** Significant at p= 0.01

Table 3: Estimation of heterosis of 45 F₁ hybrids for number of primary branches plant⁻¹ and plant height (m) in bitter gourd (*Momordica charantia* L.)

Crosses	Number of primary branches plant ⁻¹			Plant height (m)		
	MPH	BPH	Std H	MPH	BPH	Std H
OBGCBR-2 × IC-085611	27.02**	20.60*	19.85 *	36.60**	31.18*	36.77**
OBGCBR-2 × IC-085612	2.88	-5.47	-6.05	22.23*	11.73	4.18
OBGCBR-2 × Jaunpuri Green	21.55 *	15.41	14.69*	32.17**	17.88	16.17
OBGCBR-1 × IC-085611	16.06	16.06	3.67	25.24 *	-0.52	22.37
OBGCBR-1 × IC-085612	23.65**	19.44	6.70	50.95**	34.08 **	25.02*
OBGCBR-1 × Jaunpuri Green	1.94	1.94	-8.93	24.42*	7.92	6.36
VRFBG-1 × IC-085611	-4.00	-7.69	-10.67	-10.74	-19.56	-1.05
VRFBG-1 × IC-085612	2.00	-5.13	-8.19	10.23	7.17	5.79
VRFBG-1 × Jaunpuri Green	-16.16	-19.38 *	-21.99*	7.18	7.09	5.71
VRFBG-2 × IC-085611	0.00	0.00	-10.67	-6.54	-9.74	11.02
VRFBG-2 × IC-085612	6.40	2.78	-8.19	12.12	1.69	16.49
VRFBG-2 × Jaunpuri Green	2.78	2.78	-8.19	-10.08	-16.36	-4.18
VRFBG-3 × IC-085611	35.24**	18.33	5.71	21.86 *	5.17	29.36*
VRFBG-3 × IC-085612	42.03**	28.17 **	6.70	10.53	8.20	0.88
VRFBG-3 × Jaunpuri Green	4.76	-8.33	-18.11*	25.48 **	19.59	17.86
OBGCS-2 × IC-085611	38.79**	27.22**	13.65	9.71	4.91	29.04*
OBGCS-2 × IC-085612	7.00	1.34	-15.63	-8.14	-15.91	-5.63
OBGCS-2 × Jaunpuri Green	15.15	5.56	-5.71	-0.99	-7.03	4.34
OBGCS-4 × IC-085611	18.38	5.56	-5.71	0.34	-14.19	5.55
OBGCS-4 × IC-085612	32.79**	22.21 *	1.74	58.49**	53.49 **	43.12**
OBGCS-4 × Jaunpuri Green	12.15	0.00	-10.67	16.31	9.71	8.13
OBGCS-5 × IC-085611	-8.33	-8.33	-18.11*	10.02	1.64	24.00
OBGCS-5 × IC-085612	22.44 *	18.28	5.66	-13.32	-17.90	-14.40
OBGCS-5 × Jaunpuri Green	2.78	2.78	-8.19	-14.00	-16.36	-12.79
OBGCV-2 × IC-085611	30.16**	13.89	1.74	-5.87	-17.20	1.85
OBGCV-2 × IC-085612	50.88**	36.15**	13.35	42.67**	42.55**	33.15**

OBGCV-2 × Jaunpuri Green	20.63*	5.56	-5.71	-20.54	-22.61	-23.73
Katehi × IC-085611	-6.76	-7.93	-15.63	-18.95 *	-19.88*	-1.45
Katehi × IC-085612	-9.19	-13.35	-20.60*	-11.65	-21.55 *	-5.71
Katehi × Jaunpuri Green	-12.24	-13.35	-20.60*	-26.96**	-33.53**	-20.11
Sakhi Gopal × IC-085611	3.97	-8.33	-18.11*	-30.91**	-36.10**	-21.40
Sakhi Gopal × IC-085612	14.70	4.32	-13.15	0.16	-5.23	-0.97
Sakhi Gopal × Jaunpuri Green	19.72 *	5.56	-5.71	-15.53	-17.94	-14.24
Green Jhalari × IC-085611	-12.21	-13.89	-23.08 *	-9.06	-23.22*	-5.55
Green Jhalari × IC-085612	-14.48	-15.80	-27.67**	8.86	3.88	-3.14
Green Jhalari × Jaunpuri Green	-17.87 *	-19.44	-28.04**	-6.67	-13.22	-14.48
Katheri × IC-085611	1.33	-2.56	-5.71	-19.76 *	-21.78 *	-3.78
Katheri × IC-085612	-0.76	-7.69	-10.67	-7.85	-17.15	-3.22
Katheri × Jaunpuri Green	-14.67	-17.95	-20.60*	-13.63	-20.39	-7.00
Preethi × IC-085611	7.69	0.00	4.22	-15.25	-18.57	0.16
Preethi × IC-085612	-17.94*	-26.19**	-23.08*	1.71	-7.31	5.07
Preethi × Jaunpuri Green	-25.38**	-30.71**	-27.79**	-2.96	-9.30	2.82
Meghna × IC-085611	2.41	-1.86	-12.33	-11.44	-22.56 *	-4.75
Meghna × IC-085612	-0.83	-1.64	-18.11*	3.56	2.93	-4.02
Meghna × Jaunpuri Green	30.00**	24.58*	11.29*	20.51*	36.57**	24.88*

* Significant at p= 0.05, ** Significant at p= 0.01

Table 4: Estimation of heterosis of 45 F₁ hybrids for internodal length (cm) and number of staminate flowers plant⁻¹ in bitter gourd (*Momordica charantia* L.)

Crosses	Internodal length (cm)			Number of staminate flowers plant ⁻¹		
	MPH	BPH	Std H	MPH	BPH	Std H
OBGCBR-2 × IC-085611	-2.10	2.52	10.91	-16.33*	-15.07*	-23.50**
OBGCBR-2 × IC-085612	-17.48 *	-21.20 *	-10.35	19.43	4.86	9.76
OBGCBR-2 × Jaunpuri Green	4.62	-3.60	9.68	-22.01**	-2.71	1.83
OBGCBR-1 × IC-085611	-18.11*	-23.79 *	-14.04	3.73	-1.93	-2.98
OBGCBR-1 × IC-085612	-4.95	-10.17	-7.02	-2.90	-4.38	-5.40
OBGCBR-1 × Jaunpuri Green	2.66	0.64	-3.48	8.74	6.56	5.43
VRFBG-1 × IC-085611	-17.06 *	-22.24 *	-12.28	4.96	4.35	-6.94
VRFBG-1 × IC-085612	-16.71	-18.64	-15.79	8.44	4.63	0.37
VRFBG-1 × Jaunpuri Green	7.69	6.16	4.80	13.28	9.83	4.30
VRFBG-2 × IC-085611	-12.17	-25.35**	-15.79	-3.06	-11.83	-5.12
VRFBG-2 × IC-085612	-5.00	-16.27	-13.33	-6.08	-11.18	-4.41
VRFBG-2 × Jaunpuri Green	15.38	5.18	0.88	1.58	-4.39	2.90
VRFBG-3 × IC-085611	-17.37 *	-22.24*	-12.28	-0.64	-6.55	-6.52
VRFBG-3 × IC-085612	-10.13	-11.86	-8.77	-7.03	-8.94	-8.91
VRFBG-3 × Jaunpuri Green	-16.06	-17.57	-17.98	-0.17	-2.70	-2.67
OBGCS-2 × IC-085611	7.65	-6.40	5.58	19.06 *	15.97	7.82
OBGCS-2 × IC-085612	-3.27	-12.68	-9.62	9.12	7.44	3.06
OBGCS-2 × Jaunpuri Green	28.53 **	20.12	15.20	-2.14	-3.17	-8.04
OBGCS-4 × IC-085611	6.16	-3.58	8.77	2.25	-4.13	-3.46
OBGCS-4 × IC-085612	-5.29	-10.51	-7.37	6.29	3.77	4.50
OBGCS-4 × Jaunpuri Green	6.35	4.24	-0.03	4.63	1.65	2.36
OBGCS-5 × IC-085611	15.07	-2.20	10.32	11.26	7.22	1.91
OBGCS-5 × IC-085612	15.38	1.69	5.26	-13.26	-13.66	-17.18*
OBGCS-5 × Jaunpuri Green	-1.67	-10.37	-14.04	-1.23	-1.27	-6.16
OBGCV-2 × IC-085611	-14.63	-19.75 *	-9.47	4.87	-4.07	1.94
OBGCV-2 × IC-085612	5.29	3.14	6.75	4.25	-0.82	5.40
OBGCV-2 × Jaunpuri Green	3.40	1.65	0.91	4.92	-0.66	5.57
Katehi × IC-085611	-10.10	-12.24	3.95	4.39	-3.54	0.25
Katehi × IC-085612	-21.91**	-26.83**	-13.33	-1.36	-5.17	-1.43
Katehi × Jaunpuri Green	-13.25	-21.50 *	-7.02	0.83	-3.52	0.28
Sakhi Gopal × IC-085611	4.55	-6.82	5.12	0.44	-0.44	-10.68
Sakhi Gopal × IC-085612	-4.86	-11.86	-8.77	12.01	8.38	3.96
Sakhi Gopal × Jaunpuri Green	-3.25	-7.10	-10.91	36.70**	32.92**	26.23**
Green Jhalari × IC-085611	4.36	-3.19	9.21	-9.88	-18.15 *	-11.64
Green Jhalari × IC-085612	0.61	-2.80	0.61	-19.25**	-23.75**	-17.68**
Green Jhalari × Jaunpuri Green	14.83	14.48	10.47	12.44	5.68	14.08
Katheri × IC-085611	-0.55	-6.66	5.29	-3.04	-15.25 *	-0.17
Katheri × IC-085612	1.59	-0.65	2.84	-10.39	-18.71**	-4.25
Katheri × Jaunpuri Green	-4.47	-5.94	-6.93	-3.28	-12.65	2.90
Preethi × IC-085611	0.59	-6.69	5.26	4.36	-2.44	-1.12
Preethi × IC-085612	-9.62	-12.68	-9.62	-2.85	-5.46	-4.19
Preethi × Jaunpuri Green	-10.46	-10.73	-13.86	2.94	-0.31	1.04
Meghna × IC-085611	-7.79	-10.01	1.52	8.01	2.61	0.48
Meghna × IC-085612	-2.20	-3.97	3.13	1.44	0.40	-1.69
Meghna × Jaunpuri Green	2.29	-3.19	3.98	-21.33**	-2.81	-14.84*

* Significant at p= 0.05, ** Significant at p= 0.01

Table 5: Estimation of heterosis of 45 F₁ hybrids for number of pistillate flowers plant⁻¹ and sex ratio (Staminate: pistillate) in bitter gourd (*Momordica charantia* L.)

Crosses	Number of pistillate flowers plant ⁻¹			Sex ratio (staminate : pistillate)		
	MPH	BPH	Std H	MPH	BPH	Std H
OBGCBR-2 × IC-085611	10.14	8.65	26.42**	-5.26	-12.90	-19.40*
OBGCBR-2 × IC-085612	13.37	8.33	22.64*	-2.40	-3.17	-8.96
OBGCBR-2 × Jaunpuri Green	23.81**	15.56	30.82**	-18.11 *	-20.00 *	-22.39*
OBGCBR-1 × IC-085611	0.61	-11.35	3.14	2.36	-13.33	-2.99
OBGCBR-1 × IC-085612	30.49**	21.34 *	25.16*	-26.09**	-32.00**	-23.88*
OBGCBR-1 × Jaunpuri Green	11.11	5.77	3.77	-2.86	-9.33	1.49
VRFBG-1 × IC-085611	4.26	-14.05	0.00	-5.34	-21.52**	-7.46
VRFBG-1 × IC-085612	19.01 *	3.05	6.29	-9.86	-18.99 *	-4.48
VRFBG-1 × Jaunpuri Green	9.42	-3.21	-5.03	2.78	-6.33	10.45
VRFBG-2 × IC-085611	-2.99	-12.43	1.89	-0.78	-16.88 *	-4.48
VRFBG-2 × IC-085612	7.35	2.44	5.66	-12.86	-20.78 *	-8.96
VRFBG-2 × Jaunpuri Green	20.00 *	17.31	15.09	-15.49 *	-22.08**	-10.45
VRFBG-3 × IC-085611	-0.91	-11.89	2.52	-3.17	-17.57 *	-8.96
VRFBG-3 × IC-085612	14.94	7.93	11.32	-21.17**	-27.03**	-19.39*
VRFBG-3 × Jaunpuri Green	4.00	0.00	-1.89	-3.60	-9.46	0.00
OBGCS-2 × IC-085611	20.24 *	9.19	27.04**	-1.69	-12.12	-13.57
OBGCS-2 × IC-085612	-0.32	-4.27	-1.26	8.53	6.06	4.48
OBGCS-2 × Jaunpuri Green	-2.28	-3.85	-5.66	0.76	0.00	-1.49
OBGCS-4 × IC-085611	0.31	-11.89	2.52	-2.29	-18.99 *	-4.48
OBGCS-4 × IC-085612	25.66**	16.46	20.13*	-15.49 *	-24.10**	-10.45
OBGCS-4 × Jaunpuri Green	23.65 *	17.31	15.09	-16.67 *	-24.05**	-10.45
OBGCS-5 × IC-085611	5.17	-6.49	8.81	2.44	-11.27	-5.97
OBGCS-5 × IC-085612	7.14	0.61	3.77	-17.91 *	-22.54 *	-17.91
OBGCS-5 × Jaunpuri Green	10.00	5.77	3.77	-10.29	-14.08	-8.96
OBGCV-2 × IC-085611	10.16	-9.19	5.66	-12.93	-32.63**	-4.48
OBGCV-2 × IC-085612	44.37**	25.00**	28.93**	-30.38**	-42.11**	-17.91
OBGCV-2 × Jaunpuri Green	34.78**	19.23	16.98	-23.75**	-35.79**	-8.96
Katehi × IC-085611	-10.63	-11.35	3.14	15.79	6.45	-1.49
Katehi × IC-085612	-7.51	-12.09	0.63	7.20	6.35	0.00
Katehi × Jaunpuri Green	4.14	-3.30	10.69	-3.94	-6.15	-8.96
Sakhi Gopal × IC-085611	3.34	-8.11	6.92	-4.20	-14.93	-14.93
Sakhi Gopal × IC-085612	9.74	3.05	6.29	3.08	0.00	0.00
Sakhi Gopal × Jaunpuri Green	17.33	12.82	10.69	15.15	13.43	13.43
Green Jhalari × IC-085611	-9.85	-18.38 *	-9.03	-3.88	-19.48 *	-7.46
Green Jhalari × IC-085612	9.55	4.88	8.18	-25.71**	-32.47**	-22.09*
Green Jhalari × Jaunpuri Green	9.15	7.05	5.03	4.23	-3.90	10.45
Katheri × IC-085611	4.22	-6.49	8.81	-8.70	-26.74**	-5.97
Katheri × IC-085612	17.04	10.98	14.47	-26.17**	-36.05**	-17.91
Katheri × Jaunpuri Green	25.41**	21.79*	19.50*	-21.85**	-31.40**	-11.94
Preethi × IC-085611	-3.12	-7.57	7.55	6.78	-4.55	-5.97
Preethi × IC-085612	9.04	7.74	13.84	-11.63	-13.64	-14.93
Preethi × Jaunpuri Green	3.09	-0.60	5.03	-2.29	-3.03	-4.48
Meghna × IC-085611	21.97 *	0.54	16.98	-17.99 *	-34.48**	-14.93
Meghna × IC-085612	27.46**	10.37	13.84	-21.33**	-32.18**	-11.94
Meghna × Jaunpuri Green	39.86**	23.72*	21.38*	-30.26**	-39.08**	-20.90*

* Significant at p= 0.05, ** Significant at p= 0.01

Table 6: Estimation of heterosis of 45 F₁ hybrids for fruit length (cm) and fruit diameter (mm) in bitter gourd (*Momordica charantia* L.)

Crosses	Fruit length (cm)			Fruit diameter (mm)		
	MPH	BPH	Std H	MPH	BPH	Std H
OBGCBR-2 × IC-085611	42.96 **	32.49**	15.54*	6.99	-3.24	11.56
OBGCBR-2 × IC-085612	10.07	7.35	-6.39	22.66**	12.89	-0.75
OBGCBR-2 × Jaunpuri Green	46.92**	41.86**	23.71**	24.57**	19.35 *	-3.92
OBGCBR-1 × IC-085611	28.47**	17.34 *	5.64	3.95	-0.99	0.00
OBGCBR-1 × IC-085612	9.30	4.97	-5.50	9.40	2.31	3.34
OBGCBR-1 × Jaunpuri Green	-9.26	-13.71	-22.32**	13.23	1.74	2.76
VRFBG-1 × IC-085611	42.55**	41.72**	5.49	-6.24	-11.92	-8.39
VRFBG-1 × IC-085612	4.83	-1.07	-18.00*	-25.42**	-31.18**	-28.42**
VRFBG-1 × Jaunpuri Green	15.20	9.79	-10.86	-1.32	-12.47	-8.96
VRFBG-2 × IC-085611	-3.52	-4.32	-27.58**	8.33	2.31	5.21
VRFBG-2 × IC-085612	9.35	4.60	-13.30	-19.61**	-25.44**	-23.32**
VRFBG-2 × Jaunpuri Green	15.32	11.41	-9.54	19.71**	6.71	9.74
VRFBG-3 × IC-085611	6.89	4.37	-22.32**	13.29	11.81	2.20
VRFBG-3 × IC-085612	6.14	-1.52	-18.37*	10.04	9.36	-2.66

VRFBG-3 × Jaunpuri Green	36.96**	28.30**	4.17	14.20	8.74	-3.20
OBGCS-2 × IC-085611	29.00**	14.86	9.49	-3.16	-6.34	-14.40
OBGCS-2 × IC-085612	-1.43	-7.86	-12.17	14.11	12.48	-1.11
OBGCS-2 × Jaunpuri Green	-7.09	-13.97	-18.00*	-0.54	-3.39	-17.50*
OBGCS-4 × IC-085611	5.99	3.36	-23.07**	-22.07**	-24.32**	-26.60**
OBGCS-4 × IC-085612	26.82**	17.52	-2.59	-4.91	-9.36	-12.09
OBGCS-4 × Jaunpuri Green	0.53	-5.95	-23.63**	5.69	-3.29	-6.21
OBGCS-5 × IC-085611	7.45	5.80	-18.75*	-8.00	-12.47	-20.00*
OBGCS-5 × IC-085612	4.59	0.75	-16.49*	-2.32	-5.32	-16.76*
OBGCS-5 × Jaunpuri Green	15.70	12.56	-8.60	7.14	5.83	-12.67
OBGCV-2 × IC-085611	18.99 *	16.73	-13.11	5.41	-3.78	-12.05
OBGCV-2 × IC-085612	53.33 **	42.91**	18.45*	6.29	-1.23	-13.17
OBGCV-2 × Jaunpuri Green	11.26	4.70	-14.99*	12.14	8.63	-12.55
Katehi × IC-085611	4.75	-6.14	-11.80	5.69	3.32	-5.57
Katehi × IC-085612	8.03	1.66	-4.47	20.02 *	19.59 *	5.14
Katehi × Jaunpuri Green	6.50	-0.74	-6.73	24.24**	19.41 *	4.24
Sakhi Gopal × IC-085611	15.70	5.63	-21.38**	-4.38	-4.55	-12.45
Sakhi Gopal × IC-085612	12.63	10.27	-8.60	-7.22	-9.14	-16.67*
Sakhi Gopal × Jaunpuri Green	30.10**	14.30	-7.20	-3.27	-9.19	-16.71*
Green Jhalari × IC-085611	7.29	-3.97	-9.54	-2.28	-11.16	-18.80*
Green Jhalari × IC-085612	-8.59	-14.08	-19.07*	7.31	-0.70	-12.70
Green Jhalari × Jaunpuri Green	14.07	6.20	0.04	26.96**	22.45 *	-1.43
Katheri × IC-085611	14.91	13.75	-13.58	-7.85	-12.12	-19.68*
Katheri × IC-085612	-6.22	-10.13	-25.51**	9.90	6.79	-6.12
Katheri × Jaunpuri Green	-4.26	-7.33	-24.76**	13.87	12.20	-6.95
Preethi × IC-085611	33.31**	28.33**	3.23	3.27	-7.44	-15.40
Preethi × IC-085612	-3.96	-5.37	-21.57**	10.35	0.64	-11.52
Preethi × Jaunpuri Green	-4.58	-5.02	-22.88**	25.24**	18.97	-4.23
Meghna × IC-085611	38.06**	22.81**	17.32*	-18.80*	-25.33**	-31.75**
Meghna × IC-085612	-7.66	-13.77	-17.62*	10.19	3.16	-9.30
Meghna × Jaunpuri Green	29.37**	19.67 *	14.32	11.19	8.57	-12.60

* Significant at p= 0.05, ** Significant at p= 0.01

Table 7: Estimation of heterosis of 45 F₁ hybrids for Fruit circumference/girth (cm) and average fruit weight (g) in bitter gourd (*Momordica charantia* L.)

Crosses	Average fruit weight (g)			Number of fruits plant ⁻¹		
	MPH	BPH	Std H	MPH	BPH	Std H
OBGCBR-2 × IC-085611	49.82**	25.11 *	48.61**	88.12 **	63.32**	46.01 **
OBGCBR-2 × IC-085612	25.63 *	20.31	4.63	43.92 **	42.65 **	-10.14
OBGCBR-2 × Jaunpuri Green	75.76**	70.46**	35.67**	93.49 **	76.94 **	31.46**
OBGCBR-1 × IC-085611	38.05**	2.02	21.19	84.45 **	49.43 **	6.14
OBGCBR-1 × IC-085612	45.57**	20.31	4.63	63.26 **	39.74 **	-13.52
OBGCBR-1 × Jaunpuri Green	31.52*	15.68	-13.48	89.18 **	74.40 **	-8.94
VRFBG-1 × IC-085611	7.28	-16.27	-0.54	53.04 **	26.50 *	-10.14
VRFBG-1 × IC-085612	16.03	2.46	-10.89	84.91 **	61.77 **	0.11
VRFBG-1 × Jaunpuri Green	20.90	14.31	-14.51	58.19 **	49.37 **	-22.0 **
VRFBG-2 × IC-085611	-4.97	-29.34**	-16.07	68.75 **	35.91 **	-3.46
VRFBG-2 × IC-085612	-7.67	-23.12	-33.14**	34.18 **	14.13	-29.37**
VRFBG-2 × Jaunpuri Green	48.39**	31.60**	-1.58	40.69 **	28.80	-32.75**
VRFBG-3 × IC-085611	-18.11 *	-19.87 *	-0.54	1.67	1.19	-27.44**
VRFBG-3 × IC-085612	-20.47 *	-32.37**	-16.06	22.79 *	14.38	-17.98*
VRFBG-3 × Jaunpuri Green	9.36	-12.37	8.76	51.01 **	30.49 **	-6.43
OBGCS-2 × IC-085611	37.73**	16.40	38.26**	80.39 **	63.01 **	25.79**
OBGCS-2 × IC-085612	22.59	19.09	3.57	33.77 **	28.86 *	-20.25**
OBGCS-2 × Jaunpuri Green	3.77	-0.78	-18.65	27.01 *	21.33	-30.43**
OBGCS-4 × IC-085611	-40.07**	-51.11**	-41.93**	17.24	1.92	-27.60**
OBGCS-4 × IC-085612	39.36**	29.77 *	12.86	13.75	15.10	34.96**
OBGCS-4 × Jaunpuri Green	22.43	22.26	-8.30	28.80 *	28.48	-32.58**
OBGCS-5 × IC-085611	-8.48	-24.98 *	-10.89	60.68 **	39.20 **	-1.13
OBGCS-5 × IC-085612	-14.75	-20.15	-30.55*	16.32	7.07	-33.74**
OBGCS-5 × Jaunpuri Green	7.93	7.11	-18.65	49.90 **	49.64 **	-21.86**
OBGCV-2 × IC-085611	1.86	-13.66	2.56	20.68 *	11.55	-20.77**
OBGCV-2 × IC-085612	60.65**	56.59**	36.19**	82.74 **	80.36 **	11.62
OBGCV-2 × Jaunpuri Green	23.11	17.31	-3.13	27.81 *	19.26	-28.11**
Katehi × IC-085611	2.49	-14.09	2.05	2.03	-6.91	-33.87**
Katehi × IC-085612	19.99	15.43	0.39	29.63 **	26.18 *	-12.91
Katehi × Jaunpuri Green	32.84 *	28.24*	3.05	14.82	8.58	-36.39**
Sakhi Gopal × IC-085611	-30.95**	-41.10**	-30.03*	11.21	1.53	-27.88**

Sakhi Gopal × IC-085612	-13.36	-14.91	-25.99*	1.72	-0.93	-38.69**
Sakhi Gopal × Jaunpuri Green	15.98	9.71	-7.99	12.55	6.36	-37.60**
Green Jhalari × IC-085611	-23.22 *	-29.34**	-16.07	-2.22	-6.35	-33.48**
Green Jhalari × IC-085612	22.52 *	14.61	14.46	-15.86	-17.90	-46.61**
Green Jhalari × Jaunpuri Green	19.20	4.24	4.09	14.24	2.98	-33.03**
Katheri × IC-085611	-36.12**	-39.27**	-27.86*	9.26	8.59	-12.87
Katheri × IC-085612	-10.29	-18.71	-12.96	8.55	2.15	-28.33**
Katheri × Jaunpuri Green	-12.81	-25.95 *	-20.72	6.50	-7.12	-34.84**
Preethi × IC-085611	41.68**	-3.20	14.98	84.70**	45.64**	3.48
Preethi × IC-085612	49.90**	12.46	-2.20	26.74 *	5.38	-34.79**
Preethi × Jaunpuri Green	18.27	-6.45	-30.03*	65.42**	47.68**	-22.89**
Meghna × IC-085611	4.19	-17.32	-1.79	20.62	1.60	-27.83**
Meghna × IC-085612	14.25	2.94	-10.48	76.60**	13.04	-30.04**
Meghna × Jaunpuri Green	69.52**	63.81**	22.51	111.48**	104.22**	36.63**

* Significant at p= 0.05, ** Significant at p= 0.01

Table 8: Estimation of heterosis of 45 F₁ hybrids for number of fruits plant⁻¹ and fruits yield plant⁻¹ (kg) in bitter gourd (*Momordica charantia* L.)

Crosses	Fruits yield plant ⁻¹ (kg)		
	MPH	BPH	Std H
OBGCBR-2 × IC-085611	38.34**	29.74**	23.61*
OBGCBR-2 × IC-085612	9.44	8.84	-9.20
OBGCBR-2 × Jaunpuri Green	41.76 **	35.85**	33.34**
OBGCBR-1 × IC-085611	29.07 **	7.91	2.82
OBGCBR-1 × IC-085612	23.91 *	10.04	-9.20
OBGCBR-1 × Jaunpuri Green	10.50	1.52	-22.37*
VRFBG-1 × IC-085611	4.84	-8.61	-12.92
VRFBG-1 × IC-085612	3.73	-3.61	-20.46*
VRFBG-1 × Jaunpuri Green	4.27	0.43	-23.20*
VRFBG-2 × IC-085611	-5.28	-20.43*	-24.19**
VRFBG-2 × IC-085612	-13.95	-23.19*	-36.62**
VRFBG-2 × Jaunpuri Green	22.11	12.78	-13.75
VRFBG-3 × IC-085611	-8.10	-8.70	-13.01
VRFBG-3 × IC-085612	-14.12	-19.38*	-24.19**
VRFBG-3 × Jaunpuri Green	9.91	-0.35	-6.30
OBGCS-2 × IC-085611	30.27**	20.87 *	15.16
OBGCS-2 × IC-085612	9.80	9.14	-9.94
OBGCS-2 × Jaunpuri Green	-6.55	-9.45	-26.18**
OBGCS-4 × IC-085611	-32.51**	-40.26**	43.08**
OBGCS-4 × IC-085612	24.12 *	17.27	-3.23
OBGCS-4 × Jaunpuri Green	8.68	6.50	-18.56*
OBGCS-5 × IC-085611	-9.22	-16.52	-20.46*
OBGCS-5 × IC-085612	-19.63 *	-20.88	-34.71**
OBGCS-5 × Jaunpuri Green	-5.51	-7.56	-26.10**
OBGCV-2 × IC-085611	0.37	-6.26	-10.69
OBGCV-2 × IC-085612	37.71**	37.58**	13.75
OBGCV-2 × Jaunpuri Green	7.03	3.01	-14.83
Katehi × IC-085611	-1.24	-6.61	-11.02
Katehi × IC-085612	4.80	3.32	-12.26
Katehi × Jaunpuri Green	11.09	5.56	-10.36
Sakhi Gopal × IC-085611	-26.29**	-31.13**	-34.38**
Sakhi Gopal × IC-085612	-17.09	-17.22	-31.48**
Sakhi Gopal × Jaunpuri Green	2.50	-1.40	-18.39*
Green Jhalari × IC-085611	-17.68 *	-20.43*	-24.19**
Green Jhalari × IC-085612	14.26	10.16	-2.07
Green Jhalari × Jaunpuri Green	9.32	1.68	-9.61
Katheri × IC-085611	-28.95**	-29.48**	-32.81**
Katheri × IC-085612	-11.51	-16.86	-21.96*
Katheri × Jaunpuri Green	-15.08	-22.95 *	-27.67**
Preethi × IC-085611	30.37**	3.22	-1.66
Preethi × IC-085612	24.30 *	4.02	-14.17
Preethi × Jaunpuri Green	-0.63	-14.19	-34.38**
Meghna × IC-085611	2.41	-9.57	-13.84
Meghna × IC-085612	2.61	-3.31	-20.22*
Meghna × Jaunpuri Green	38.91**	35.75 **	3.81

* Significant at p= 0.05, ** Significant at p= 0.01

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