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Heterosis and combining ability for fruit yield and its component traits in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]

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Abstract Heterosis studies with 50 hybrids generated through line x tester (10 lines and 5 testers) analysis were carried out to estimate the extent of heterosis over better parents and standard check (NDBG-104) for fruit yield and its contributing traits in bottle gourd. The range of heterosis observed in number of crosses exhibiting significantly negative and positive heterosis over better parent and standard check showed considerable differences from *Kharif* season to summer season. The results revealed that cross Punjab Long x Thar Samruddhi in E_1, Punjab Long x PSPL in E_2 and Arka Bahar x Punjab Komal in E_3 exhibited significant positive heterosis over better parent for fruit yield per plant. For standard heterosis, the cross ABG-1 x NDBG-517 in E_1, NDBG-104 x Thar Samruddhi in E_2 and Pusa Naveen x PSPL in E_3 had significant and high heterotic effects in positive directions. The crosses which had larger estimates of heterobeltiosis and standard heterosis for fruit yield per plant, also exerted significant positive heterotic effects for fruits per plant, fruit weight and main vine length in atleast two environments. These cross combinations can be exploited in breeding programmes in bottle gourd.

Keywords : Heterosis, combining ability, bottle gourd, *Lagenaria Siceraria*

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Introduction

Bottle gourd is one of the important cucurbitaceous vegetables due to prolific bearing habit, low cost of cultivation and its utility as a cooked vegetable. Considerable genetic diversity exists in this crop, which can be utilized for the exploitation of hybrid vigour. The size of the flower and monoecious condition makes the hybridization easy and convenient in this crop. The fruits being larger in size contain many seeds per fruit. The amount of cross pollination ranges from 60 to 80 per cent (Choudhury, 1987). The hybrid seed production in bottle gourd on commercial scale is very easy with little involvement of labour and cost. Hence, the present investigation was carried out to study the extent of heterosis over better parent and standard check in 50 hybrids obtained through Line x Tester crossing design.

Materials and methods

The experimental materials comprised of 15 diverse pure lines of bottle gourd. Fifty crosses were generated through line x tester mating design during *Summer*-2008 using 5 females as testers and 10 males as lines. At the same time all the lines were selfed to obtain adequate seeds for experiment. Thus, 50 crosses and their 15 parents formed the experimental material for the present study. The genotype NDBG-104 used as a parent as well as a standard check. These materials were raised in randomized block design with three replications in three different seasons (environments) *viz.*; *Kharif*-2008 (E_1), Summer-2009 (E_2) and *Kharif*-2009 (E_3). Each genotype was planted in a single row of ten dibbles keeping row to row distance of two metres and plant to plant distance within a row of one metre. The recommended agronomical practices were adopted to raise the crop. The data were recorded on fruit yield and its component traits *viz.;* first female flowering node, days to first picking, primary branches per plant, main vine length (m), fruit length (cm), fruit girth (cm), fruit weight (g), fruits per plant and seeds per fruit in all the three

environments and heterobeltiosis and standard heterosis were calculated as per the method given by Fonseca and Patterson (1968).

Results and discussion

The *per se* performance, heterobeltiosis, standard heterosis and sca effects of the top ranking three crosses for different characters in each individual environment are given in Table 1. For fruit length, the genotype with short fruit length was considered to be better because consumers prefer small sized fruits and it is convenient for transport and transaction. Hence, the heterotic effect was calculated accordingly. Fruit girth determines the marketable quality. Round fruited varieties have larger fruit girth than long cylindrical varieties. In market generally medium sized fruit girth is preferred by the consumers. Hence, intermediate type fruit girth considered as desirable and according the results are described in the present study.

Table 1: Top three crosses with respect to their *per se* performance, heterobeltiosis, standard heterosis and sca effect for various traits under three environments in bottle gourd

Env.		Rank	First female flowering node	Days to first picking
E_1	Performance	First	Pusa Naveen x NDBG-132 (6.47)	Punjab Long x PSPL (59.67)
		Sec.	Pusa Naveen x Thar Samruddhi (7.60)	ABG-1 x Narendra Rashmi (61.00)
		Third	Pusa Naveen x PSPL (7.73)	ABG-1 x Samrat (61.00)
	Heterobeltiosis	First	Pusa Naveen x NDBG-132 (-55.00**)	Arka Bahar x NDBG-613-4 (-11.59**)
		Sec.	Pusa Naveen x PSPL (-52.07**)	NDBG-104 x Narendra Rashmi (-8.50)
		Third	NDBG-104 x Samrat (-30.11*)	Pusa Naveen x Thar Samruddhi (-5.24)
	Standard	First	Pusa Naveen x NDBG-132 (-44.89**)	Punjab Long x PSPL (-14.35**)
	heterosis	Sec.	Pusa Naveen x Thar Samruddhi (-35.23**)	ABG-1 x Narendra Rashmi (-12.44**)
		Third	Pusa Naveen x PSPL (-34.09*)	ABG-1 x Samrat (-12.44**)
	SCA	First	Pusa Naveen x NDBG-132 (-4.44**)	Pusa Naveen x Punjab Komal (-5.69**)
		Sec.	Punjab Long x Narendra Rashmi (-4.13**)	Arka Bahar x NDBG-613-4 (-4.93*)
		Third	Punjab Long x PSPL (-4.11**)	Pusa Naveen x DBG-5 (-4.83*)
E_2	Performance	First	Punjab Long x DBG-5 (8.17)	Arka Bahar x DBG-6 (46.00)
		Sec.	ABG-1 x DBG-6 (11.66)	Arka Bahar x NDBG-613-4 (46.33)
		Third	ABG-1 x Punjab Komal (11.89)	ABG-1 x Punjab Komal (47.33)
	Heterobeltiosis	First	Punjab Long x DBG-5 (-34.96**)	Arka Bahar x NDBG-613-4 (-7.33)
		Sec.	Pusa Naveen x NDBG-132 (-19.13)	Arka Bahar x PSPL (-6.41)
		Third	NDBG-104 x Narendra Rashmi (-15.08)	Pusa Naveen x Punjab Komal (-5.48)
	Standard	First	Punjab Long x DBG-5 (-41.67**)	Arka Bahar x DBG-6 (-7.38)
	heterosis	Sec.	ABG-1 x DBG-6 (-16.75)	Arka Bahar x NDBG-613-4 (-6.71)
		Third	NDBG-104 x Narendra Rashmi (-15.08)	ABG-1 x Punjab Komal (-4.70)
	SCA	First	Punjab Long x DBG-5 (-4.70**)	Arka Bahar x DBG-6 (-4.03**)
		Sec.	Pusa Naveen x NDBG-132 (-3.69**)	Arka Bahar x NDBG-613-4 (-3.57**)
		Third	ABG-1 x Punjab Komal (-2.80**)	NDBG-104 x DBG-5 (-2.30)
E_3	Performance	First	Punjab Long x NDBG-613-4 (8.40)	ABG-1 x Samrat (53.33)
		Sec.	ABG-1 x Narendra Rashmi (9.00)	Arka Bahar x Thar Samruddhi (56.33)
		Third	NDBG-104 x Samrat (9.27)	Punjab Long x Punjab Komal (57.67)
	Heterobeltiosis	First	ABG-1 x Narendra Rashmi (-34.94**)	ABG-1 x Samrat (-16.23**)
		Sec.	Pusa Naveen x Punjab Komal (-38.86**)	Arka Bahar x Thar Samruddhi (-11.05**)
		Third	Pusa Naveen x NDBG-132 (-29.56**)	---
	Standard	First	Punjab Long x NDBG-613-4 (-42.73**)	ABG-1 x Samrat (-16.23**)
	heterosis	Sec.	ABG-1 x Narendra Rashmi (-38.64**)	Arka Bahar x Thar Samruddhi (-11.52**)
		Third	NDBG-104 x Samrat (-36.82**)	Punjab Long x Punjab Komal (-9.42**)
	SCA	First	Arka Bahar x DBG-6 (-6.32**)	Arka Bahar x Thar Samruddhi (-9.75**)
		Sec.	ABG-1 x Thar Samruddhi (-5.95**)	ABG-1 x Samrat (-6.39**)
		Third	Punjab Long x NDBG-613-4 (-5.92**)	Punjab Long x NDBG-613-4 (-5.32**)

*, ** significant at 5 and 1 % levels, respectively.

E_1: *Kharif* -2008, E_2: Summer-2009 and E_3: *Kharif*-2009.

Table 1. Contd..

Env.		Rank	Primary branches per plant	Main vine length
E_1	Performance	First	NDBG-104 x Samrat (9.53)	Arka Bahar x Samrat (15.70)
		Sec.	Pusa Naveen x DBG-6 (9.37)	Punjab Long x Thar Samruddhi (12.43)
		Third	NDBG-104 x NDBG-517 (8.80)	NDBG-104 x Punjab Komal (12.23)
	Heterobeltiosis	First	Pusa Naveen x DBG-6 (71.34**)	NDBG-104 x Punjab Komal (70.70**)
		Sec.	NDBG-104 x NDBG-517 (18.39)	NDBG-104 x DBG-6 (63.84**)
		Third	Pusa Naveen x Thar Samruddhi (7.05)	Arka Bahar x Samrat (54.43**)
	Standard heterosis	First	NDBG-104 x Samrat (33.64**)	Arka Bahar x Samrat (119.07**)
		Sec.	Pusa Naveen x DBG-6 (31.31**)	Punjab Long x Thar Samruddhi (73.49**)
		Third	NDBG-104 x NDBG-517 (23.36**)	NDBG-104 x Punjab Komal (70.70**)
	SCA	First	Pusa Naveen x NDBG-517 (2.40**)	Arka Bahar x Samrat (5.66**)
		Sec.	Arka Bahar x PSPL (2.08**)	Punjab Long x Thar Samruddhi (3.32**)
		Third	ABG-1 x NDBG-613-4 (1.98**)	NDBG-104 x Punjab Komal (2.74**)
E_2	Performance	First	NDBG-104 x Samrat (9.97)	Arka Bahar x Samrat (11.98)
		Sec.	NDBG-104 x DBG-5 (9.67)	Punjab Long x Thar Samruddhi (11.02)
		Third	Pusa Naveen x NDBG-613-4 (9.57)	NDBG-104 x Punjab Komal (10.87)
	Heterobeltiosis	First	NDBG-104 x Samrat (34.08**)	NDBG-104 x Punjab Komal (71.13**)
		Sec.	NDBG-104 x DBG-6 (26.91*)	NDBG-104 x DBG-5 (57.22**)
		Third	---	Punjab Long x Thar Samruddhi (38.28**)
	Standard heterosis	First	NDBG-104 x Samrat (34.08**)	Arka Bahar x Samrat (88.71**)
		Sec.	NDBG-104 x DBG-5 (30.04**)	Punjab Long x Thar Samruddhi (73.49**)
		Third	Pusa Naveen x NDBG-613-4 (28.70**)	NDBG-104 x Punjab Komal (71.13**)
	SCA	First	NDBG-104 x Samrat (1.98**)	Arka Bahar x Samrat (3.18**)
		Sec.	NDBG-104 x DBG-5 (1.85**)	Punjab Long x Thar Samruddhi (2.40**)
		Third	Arka Bahar x Narendra Rashmi (1.39*)	NDBG-104 x Punjab Komal (2.14**)
E_3	Performance	First	NDBG-104 x DBG-5 (8.13)	ABG-1 x DBG-5 (12.20)
		Sec.	NDBG-104 x Thar Samruddhi (8.10)	Arka Bahar x NDBG-517 (10.33)
		Third	Pusa Naveen x NDBG-613-4 (7.77)	NDBG-104 x DBG-5 (9.93)
	Heterobeltiosis	First	NDBG-104 x Thar Samruddhi (40.46**)	NDBG-104 x DBG-5 (80.61**)
		Sec.	NDBG-104 x DBG-5 (26.42**)	ABG-1 x DBG-5 (42.41**)
		Third	Pusa Naveen x NDBG-613-4 (25.95**)	NDBG-104 x Punjab Komal (38.35**)
	Standard heterosis	First	NDBG-104 x DBG-5 (41.04**)	ABG-1 x DBG-5 (130.19**)
		Sec.	NDBG-104 x Thar Samruddhi (40.46**)	Arka Bahar x NDBG-517 (94.97**)
		Third	Pusa Naveen x NDBG-613-4 (34.68**)	NDBG-104 x DBG-5 (87.42**)
	SCA	First	Pusa Naveen x NDBG-613-4 (1.94**)	ABG-1 x DBG-5 (3.21**)
		Sec.	NDBG-104 x Thar Samruddhi (1.60**)	Arka Bahar x NDBG-517 (2.34**)
		Third	NDBG-104 x DBG-5 (1.54**)	NDBG-104 x Punjab Komal (1.39**)

*, ** significant at 5 and 1 % levels, respectively.
E_1: *Kharif* -2008, E_2: Summer-2009 and E_3: *Kharif*-2009.

Table 1. Contd..

Env.		Rank	Fruit length	Fruit girth
E_1	Performance	First	Pusa Naveen x Punjab Komal (23.20)	Pusa Naveen x Thar Samruddhi (25.47)
		Sec.	Arka Bahar x Thar Samruddhi (23.33)	NDBG-104 x Thar Samruddhi (24.87)
		Third	Pusa Naveen x Thar Samruddhi (24.53)	Pusa Naveen x Punjab Komal (24.40)
	Heterobeltiosis	First	NDBG-104 x DBG-5 (-9.90)	Pusa Naveen x Narendra Rashmi (0.68)
		Sec.	Arka Bahar x Narendra Rashmi (-9.88)	NDBG-104 x DBG-6 (0.70)
		Third	Pusa Naveen x NDBG-132 (-8.82)	Arka Bahar x NDBG-517 (-1.14)
	Standard	First	Pusa Naveen x Punjab Komal (-34.83**)	Arka Bahar x Punjab Komal (0.00)
	heterosis	Sec.	Arka Bahar x Thar Samruddhi (-34.46**)	ABG-1 x NDBG-517 (0.70)
		Third	Pusa Naveen x Thar Samruddhi (-31.00**)	Arka Bahar x PSPL (-0.52)
	SCA	First	ABG-1 x Samrat (-8.54**)	Arka Bahar x DBG-5 (0.16)
		Sec.	Punjab Long x NDBG-132 (-8.28**)	Pusa Naveen x DBG-6 (0.29)
		Third	NDBG-104 x Punjab Komal (-6.77**)	NDBG-104 x DBG-6 (-0.06)
E_2	Performance	First	Pusa Naveen x Punjab Komal (21.10)	Pusa Naveen x Punjab Komal (23.40)
		Sec.	Pusa Naveen x Thar Samruddhi (21.44)	Pusa Naveen x DBG-6 (23.33)
		Third	NDBG-104 x DBG-5 (23.41)	Punjab Long x NDBG-132 (23.00)
	Heterobeltiosis	First	NDBG-104 x DBG-5 (-29.92**)	NDBG-104 x NDBG-613-4 (0.17)
		Sec.	Pusa Naveen x DBG-5 (-15.75*)	NDBG-104 x NDBG-517 (0.51)
		Third	Pusa Naveen x NDBG-613-4 (-15.34)	Arka Bahar x NDBG-517 (-.17)
	Standard	First	Pusa Naveen x Punjab Komal (-36.83**)	Pusa Naveen x NDBG-613-4 (0.53)
	heterosis	Sec.	Pusa Naveen x Thar Samruddhi (-35.81**)	Arka Bahar x NDBG-613-4 (1.23)
		Third	NDBG-104 x DBG-5 (-29.92**)	NDBG-104 x DBG-5 (-2.29)
	SCA	First	Punjab Long x NDBG-132 (-8.22**)	Punjab Long x Narendra Rashmi (0.00)
		Sec.	ABG-1 x Thar Samruddhi (-7.19**)	Punjab Long x PSPL (0.07)
		Third	Arka Bahar x PSPL (-6.73**)	Arka Bahar x DBG-6 (-0.13)
E_3	Performance	First	Pusa Naveen x Punjab Komal (22.06)	Pusa Naveen x Thar Samruddhi (23.67)
		Sec.	NDBG-104 x Punjab Komal (24.33)	Pusa Naveen x Punjab Komal (23.43)
		Third	Pusa Naveen x Thar Samruddhi (24.73)	Punjab Long x DBG-5 (23.10)
	Heterobeltiosis	First	NDBG-104 x DBG-5 (-14.40**)	Arka Bahar x NDBG-517 (1.71)
		Sec.	Arka Bahar x NDBG-132 (-12.73**)	Pusa Naveen x DBG-5 (1.87)
		Third	ABG-1 x Narendra Rashmi (-8.97*)	NDBG-104 x NDBG-517 (-0.58)
	Standard	First	Pusa Naveen x Punjab Komal (-37.34**)	ABG-1 x Narendra Rashmi (0.87)
	heterosis	Sec.	DBG-104 x Punjab Komal (-30.87**)	ABG-1 x Punjab Komal (1.74)
		Third	Pusa Naveen x Thar Samruddhi (-29.73**)	ABG-1 x Thar Samruddhi (-0.35)
	SCA	First	ABG-1 x Thar Samruddhi (-7.00**)	NDBG-104 x Thar Samruddhi (0.00)
		Sec.	Punjab Long x NDBG-132 (-6.57**)	ABG-1 x Narendra Rashmi (0.09)
		Third	Arka Bahar x PSPL (-4.76**)	Pusa Naveen x NDBG-132 (-0.04)

*, ** significant at 5 and 1 % levels, respectively.
E_1: Kharif -2008, E_2: Summer-2009 and E_3: Kharif-2009.

Table 1. Contd..

Env.		Rank	Fruit weight	Fruits per plant
E_1	Performance	First	Punjab Long x Punjab Komal (920.00)	Arka Bahar x Punjab Komal (6.56)
		Sec.	Punjab Long x DBG-5 (916.67)	Pusa Naveen x NDBG-613-4 (6.28)
		Third	Punjab Long x NDBG-613-4 (900.00)	Punjab Long x Narendra Rashmi (6.10)
	Heterobeltiosis	First	Punjab Long x DBG-5 (44.74**)	Punjab Long x Narendra Rashmi (70.01**)
		Sec.	Punjab Long x NDBG-613-4 (26.76**)	ABG-1 x NDBG-613-4 (61.34**)
		Third	NDBG-104 x DBG-6 (19.12*)	Arka Bahar x Punjab Komal (56.81**)
	Standard heterosis	First	Punjab Long x Punjab Komal (35.29**)	Arka Bahar x Punjab Komal (67.25**)
		Sec.	Punjab Long x DBG-5 (34.80**)	Pusa Naveen x NDBG-613-4 (60.03**)
		Third	Punjab Long x NDBG-613-4 (32.35**)	Punjab Long x Narendra Rashmi (55.50**)
	SCA	First	Pusa Naveen xThar Samruddhi (183.63**)	Arka Bahar x Punjab Komal (1.61**)
		Sec.	Arka Bahar x PSPL (171.63**)	Pusa Naveen x NDBG-613-4 (1.32**)
		Third	Punjab Long x Samrat (152.97**)	Punjab Long x Thar Samruddhi (1.09**)
E_2	Performance	First	Arka Bahar x NDBG-517 (846.67)	ABG-1 x Punjab Komal (6.75)
		Sec.	Pusa Naveen x Samrat (800.00)	Arka Bahar x Punjab Komal (6.54)
		Third	Pusa Naveen x Punjab Komal (796.67)	NDBG-104 x Punjab Komal (6.45)
	Heterobeltiosis	First	Pusa Naveen x Punjab Komal (18.91**)	Arka Bahar x Punjab Komal (60.74**)
		Sec.	Arka Bahar x NDBG-517 (16.78**)	Arka Bahar x Samrat (59.19**)
		Third	Pusa Naveen x Samrat (7.38)	NDBG-104 x Punjab Komal (58.61**)
	Standard heterosis	First	Arka Bahar x NDBG-517 (32.29**)	ABG-1 x Punjab Komal (65.98**)
		Sec.	Pusa Naveen x Samrat (25.00**)	Arka Bahar x Punjab Komal (60.74**)
		Third	Pusa Naveen x Punjab Komal (24.48**)	NDBG-104 x Punjab Komal (58.61**)
	SCA	First	Arka Bahar x NDBG-517 (162.03**)	Punjab Long x PSPL (2.38**)
		Sec.	Pusa Naveen x Punjab Komal (124.19**)	Pusa Naveen x NDBG-132 (1.86**)
		Third	Pusa Naveen x Samrat (85.21**)	NDBG-104 x DBG-5 (1.52**)
E_3	Performance	First	NDBG-104 x Thar Samruddhi (843.33)	Punjab Long x PSPL (7.53)
		Sec.	Arka Bahar x NDBG-517 (841.67)	Pusa Naveen x PSPL (7.43)
		Third	ABG-1 x NDBG-517 (816.67)	Pusa Naveen x NDBG-517 (6.43)
	Heterobeltiosis	First	Pusa Naveen x PSPL (32.00**)	Punjab Long x PSPL (66.32**)
		Sec.	Arka Bahar x NDBG-517 (31.51**)	Arka Bahar x DBG-5 (58.14**)
		Third	Arka Bahar x PSPL (20.44**)	Pusa Naveen x PSPL (40.28**)
	Standard heterosis	First	NDBG-104 x Thar Samruddhi (41.74**)	Punjab Long x PSPL (70.84**)
		Sec.	Arka Bahar x NDBG-517 (41.46**)	Pusa Naveen x PSPL (68.48**)
		Third	ABG-1 x NDBG-517 (37.25**)	Pusa Naveen x NDBG-517 (45.89**)
	SCA	First	NDBG-104 x Thar Samruddhi (182.33**)	Punjab Long x PSPL (1.59**)
		Sec.	ABG-1 x DBG-6 (104.68**)	ABG-1 x Punjab Komal (1.39**)
		Third	Punjab Long x NDBG-613-4 (99.12*)	NDBG-104 x DBG-6 (1.21**)

*, ** significant at 5 and 1 % levels, respectively.
E_1: *Kharif* -2008, E_2: Summer-2009 and E_3: *Kharif*-2009.

Table 1. Contd..

Env.		Rank	Fruit yield per plant	Seeds per fruit
E_1	*P*erformance	First	ABG-1 x NDBG-517 (6.37)	NDBG-104 x NDBG-132 (880.33)
		Sec.	Pusa Naveen x NDBG-517 (6.10)	Arka Bahar x Thar Samruddhi (742.67)
		Third	Arka Bahar x Punjab Komal (5.85)	NDBG-104 x PSPL (736.33)
	Heterobeltiosis	First	Punjab Long x Thar Samruddhi (92.74**)	NDBG-104 x NDBG-132 (92.84**)
		Sec.	ABG-1 x NDBG-517 (66.23**)	NDBG-104 x PSPL (43.58*)
		Third	Pusa Naveen x NDBG-517 (55.40**)	NDBG-104 x Narendra Rashmi (11.87)
	Standard heterosis	First	ABG-1 x NDBG-517 (53.78**)	NDBG-104 x NDBG-132 (92.84**)
		Sec.	Pusa Naveen x NDBG-517 (47.26**)	Arka Bahar x Thar Samruddhi (62.69**)
		Third	Arka Bahar x Punjab Komal (37.67**)	NDBG-104 x PSPL (61.30**)
	SCA	First	Arka Bahar x Punjab Komal (1.98**)	NDBG-104 x NDBG-132 (214.96**)
		Sec.	Punjab Long x Thar Samruddhi (1.88**)	ABG-1 x DBG-5 (163.94**)
		Third	Pusa Naveen x NDBG-517 (1.61**)	Pusa Naveen x Punjab Komal (160.78**)
E_2	*P*erformance	First	NDBG-104 x Thar Samruddhi (4.88)	Punjab Long x PSPL (993.50)
		Sec.	Arka Bahar x NDBG-517 (4.87)	NDBG-104 x NDBG-132 (896.00)
		Third	Punjab Long x NDBG-517 (4.86)	NDBG-104 x Samrat (861.50)
	Heterobeltiosis	First	Punjab Long x PSPL (108.66**)	Punjab Long x DBG-6 (77.89**)
		Sec.	Arka Bahar x NDBG-517 (92.11**)	Punjab Long x NDBG-517 (42.28**)
		Third	Arka Bahar x Samrat (88.57**)	NDBG-104 x NDBG-132 (31.44**)
	Standard heterosis	First	NDBG-104 x Thar Samruddhi (19.73*)	Punjab Long x DBG-6 (45.75**)
		Sec.	Arka Bahar x NDBG-517 (19.48*)	NDBG-104 x NDBG-132 (31.44**)
		Third	Punjab Long x PSPL (19.31*)	NDBG-104 x Samrat (26.38**)
	SCA	First	Punjab Long x PSPL (2.55**)	Punjab Long x DBG-6 (267.85**)
		Sec.	NDBG-104 x Thar Samruddhi (2.09**)	Arka Bahar x NDBG-613-4 (219.25**)
		Third	Arka Bahar x NDBG-517 (1.73**)	ABG-1 x PSPL (101.28**)
E_3	*P*erformance	First	Pusa Naveen x PSPL (5.72)	Punjab Long x NDBG-517 (960.83)
		Sec.	ABG-1 x PSPL (5.35)	Pusa Naveen x Thar Samruddhi (890.50)
		Third	Pusa Naveen x Samrat (5.38)	ABG-1 x NDBG-132 (883.17)
	Heterobeltiosis	First	Arka Bahar x Punjab Komal (97.06**)	ABG-1 x NDBG-132 (33.79**)
		Sec.	Pusa Naveen x PSPL (88.76**)	Punjab Long x NDBG-517 (32.10**)
		Third	Pusa Naveen x Samrat (77.50**)	ABG-1 x Samrat (20.18*)
	Standard heterosis	First	Pusa Naveen x PSPL (46.95**)	Punjab Long x NDBG-517 (32.10**)
		Sec.	ABG-1 x NDBG-517 (45.03**)	Pusa Naveen x Thar Samruddhi (22.43**)
		Third	Pusa Naveen x Samrat (38.18**)	ABG-1 x NDBG-132 (21.43**)
	SCA	First	Arka Bahar x Punjab Komal (2.14**)	Punjab Long x NDBG-517 (255.12**)
		Sec.	Pusa Naveen x Samrat (1.43**)	ABG-1 x Samrat (191.17**)
		Third	ABG-1 x NDBG-517 (1.35**)	ABG-1 x NDBG-132 (141.15**)

*, ** significant at 5 and 1 % levels, respectively.
E_1: Kharif -2008, E_2: Summer-2009 and E_3: Kharif-2009.

The result of present investigation revealed that the hybrids *viz.;* ABG-1 x NDBG-517, Pusa Naveen x NDBG-517 and Arka Bahar x Punjab Komal in E_1; NDBG- 104 x Thar Samruddhi and Punjab Long x PSPL in E_2 and Pusa Naveen x PSPL and Pusa Naveen x Samrat in E_3 were high yielding and showed higher standard heterosis along with significant positive sca effects for yield per plant. The results are in accordance with the findings of Kumar *et al.* (1999) as they observed high positive standard heterosis for this trait.

Hence, these hybrids were identified as potential for wide spread cultivation and commercial exploitation in respective environment.

For fruit yield per plant, ABG-1 x NDBG-517 and Pusa Naveen x NDBG-517 in E_1: *Kharif* -2008, E_2: Summer-2009 and E_3: *Kharif*-2009.

E_1; NDBG-104 x Thar Samruddhi in E_2 and Pusa Naveen x PSPL in E_3 maintained its ranking for all these three parameters. Under such a situation, the weightage should be given to each of these parameters while selecting such type of crosses for higher fruit yield in specific environmental condition.

The range of heterosis, number and identity of crosses exhibiting significantly negative and positive better parent and standard heterosis for different characters showed considerable differences from *Kharif* season to summer season. Maurya and Singh (1994) suported similar observations for many characters in different environments. This indicated that the genotype x environment interaction played important role in expression of heterotic expenses in F_1s for all the characters under study. The ranking of hybrids suggested that *per se* performance, heterosis and sca effects do not corroborate to each other. Therefore, while selecting a cross for further exploitation, critical analysis of all the aspects must be performed.

The crosses exhibiting high sca effect did not always involve both parents possessing high gca effects, thereby suggesting importance of intra as well as inter-allelic interactions. The high sca effect of crosses in general corresponds to their high heterotic response, but these might also be accompanied by poor and/or average gca effects of the parents. The crosses having high sca effect for fruit yield per plant had in general registered desirable sca effects for some of the yield component characters, but those might not necessarily had higher sca effects for these characters. This suggested cumulative effects of various yield contributing attributes as a high sca effect for fruit yield, and thereby high heterotic effects as well.

The crosses exhibiting positive and significant heterobeltiosis and standard heterosis for fruit yield per plant were found to possess positive, negative and average sca effects for this character in almost same frequencies. Similar trend was also observed for most of the other characters, which suggested that there was no apparent relationship between manifestations of heterosis with sca effect. However, majority of crosses showing significantly/positive heterobeltiosis and standard heterosis for fruit yield per plant in three environments involved good x good combiner parents followed by average x good and average x average combinations.

सारांश

लाईन x परीक्षक पदच्छेद द्वारा उत्पन्न 50 संकर के साथ संकर ओज का लौकी में संकर ओज के फैलाव जांच का उन्नत अभिवावक और स्तर परीक्षण (NDBG-104) के लिए फल उपज और इसके सहयोगी गुणों का अध्ययन किया गया। संकर ओज के घटने का संकर संख्या के निरिक्षण में खरीफ ऋतु से ग्रीष्म ऋतु यथेष्ट विभिन्नता नकारात्मक और सकतारात्मक सार्थकता उच्च उच्च अभिवावक एवं स्तर परीक्षक के लिए पाया गया। परिणाम द्वारा पाया गया कि संकर पंजाब लांग x थार समृद्धि, F_2 में पंजाब लाग x PSP_2 और F_3 में अर्का बहार x पंजाब कोमल फल उपज प्रति पौधे के लिए सार्थक सकारात्मक संकर ओज उच्च अभिवावक के लिए था। स्तर संकर ओज के लिए संकर E_1 में ABG-1 x NDBG-517, E_2 में NDBG-104 x थार समृद्धि और E_3 में पूसा नवीन x PDPL में सकारात्मक दिशा में सार्थक और उच्च संकर ओज प्रभावित था। संकर जिसमें 2 वातावरणों में हेट्रोवेल्टिवासिस की उच्च जाँच और आर्दश संकर ओज फल उपज प्रति पौध के साथ फल प्रति पौध, फल भार और मुख्य लता लम्बाई में सकारात्मक संकर ओज प्रभावी था। ये संकर सम्बन्ध लौकी में प्रजनक कार्यक्रम कर सकते हैं।

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