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Genetic architecture of yield and its components in brinjal (*Solanum melongena* L.)

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Abstract

A field experiment "Genetic architecture of yield and its components in brinjal (*Solanum melongena* L.)" was carried out comprised of 10 parents, 45 hybrids (produced through half-diallel mating design) and commercial hybrid ABH-1 as a check during 2014-15, at Regional Horticultural Research Station, Navsari Agricultural University, Navsari. The data were obtained for sixteen traits including fruit yield. The analysis of variance for all the traits revealed that parents were found to be significant for all the traits studied indicating presence of considerable amount of genetic variability in the parental material tested. IC 074224 x IIHR 635 (60.69), Surati Ravaiya Pink x Arka Neelkanth (58.81) and IIHR 635 x Arka Neelkanth (55.08) showed significant and desirable heterobeltiosis for fruit yield. Combining ability studies revealed non additive type of gene action involved in the expression of traits. IC 074224, Punjab Barsati and IC 11066-2 were good general combiners for fruit yield per plant. The ratio of *gca* variance/ *sca* variance were observed less than unity for all the characters which revealed the predominance of non-additive gene action. The overall analysis based on *gca* effect*, sca* effect*,* heterobeltiosis and standard heterosis revealed that parents IC 074224, IC 11066-2 and IIHR 635 and crosses IC 074224 x IC 11066-2, Surati Ravaiya (Pink) x Arka Neelkanth and IIHR 635 x Arka Neelkanth found promising for future breeding programme. Biparental mating with reciprocal recurrent selection would be appropriate to maintain the required genetic variability in breeding population and at the same rise the frequency of desirable genes. Top ranking hybrids may be further tested for area locations identifying for high yielding hybrids.

Keywords: brinjal, combining ability, gene action, heterosis, yield

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Introduction

Among the vegetables, brinjal a native of India is an important solanaceous vegetable crop in countries, like India, Japan, Indonesia, China, Bulgaria, Italy, France, USA and several African countries. Confirmation of this fact was made by Isshiki *et al.* (1994) based on isozyme and morphological variation noticed in large germplasm collections from India. It shows the secondary diversity in China and South East Asia (Zeven and Zhukovsky, 1975). However, it is widely cultivated in both temperate and tropical regions of the globe mainly for their immature fruits as vegetable (Rai *et al.,* 1995).

It is the third most important vegetable crop in India and contributing about 17.8 percent of the total production of vegetables in the country (Anonymous, 2013). It is named as "Poor man's vegetable" because of its low cost of production, ease of culture and availability throughout the year. Fruits are widely used in various culinary preparations *viz.,* sliced bhaji, stuffed curry, bertha, chutney, vangibath, pickles *etc*. Contrary to the common belief, it is quite high in nutritive value being rich in vitamins, minerals (calcium, magnesium, phosphorus) and fatty acids (Tomar and Kalda, 1996).

Exploiting hybrid vigour in a single cross hybrid depends on the two parents complementing each other with special reference to desirable traits. Therefore, the exploitation of hybrid vigour in brinjal has been recognized as a practical tool in providing the breeder a means of increasing yield and improves economic traits. The development of an effective heterosis breeding programme in brinjal needs to elucidate the genetic nature and magnitude of quantitatively inherited traits and judge the potentiality of parents in hybrid combinations. Combining ability studies like Diallel Analysis provide information in this direction particularly when large numbers of parents are to be screened for combining ability. Study of *gca* of genotypes helps in selection of superior parents while *sca* of genotypes helps in deciding superior hybrid. The information generated in the process is used to understand the magnitude of heterosis of F_1 hybrids.

The low fruit yield levels in India are due to insufficient crop genetic improvement and development of high yielding hybrids. Thus, under such circumstances, it is necessary to develop hybrids superior to these types for qualitative and quantitative traits. Keeping this in view, the present investigation is conducted with objectives to estimate the magnitude of heterosis for fruit yield and its components, to estimate the combining ability for fruit yield and its component traits and to identify good general combiners and specific combiners for fruit yield and its components for use in future breeding programme.

Materials and Methods

The experimental material consisted of ten diverse genotypes *viz*., IC 074224, IIHR-534, Surati Ravaiya (Pink), Punjab Barsati, IIHR 635, Punjab Sadabahar, Arka Anand, Arka Neelkanth, IC 11066-2 and Punjab Kranti obtained from the Vegetable Research Scheme, Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari. These ten genotypes crossed in all possible combinations excluding reciprocals to get 45 F_1's. The 56 entries, comprising of ten parents and their 45 F_1s excluding reciprocals and one check, were planted in a Randomized Block Design with three replications at Vegetable Research Scheme, Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during *Rabi* 2014-15. Each entry was represented by a single row of 6.0 m length. In each row 10 seedlings were transplanted keeping intra row spacing of 60 cm. The inter row distance was 75 cm. The guard rows were provided surrounding the experiment to avoid border effects. All the recommended agronomic practices and plant protection measures were carried out periodically for raising a good crop. The observations were recorded from five randomly selected competitive plants from each row on eleven distinct morphological characters. The data on days to first flowering, days to 50% flowering, days to first picking, plant height, no. of primary branches, no. of fruits per plant, no. of pickings, fruit weight, fruit length, fruit girth, yield per plant, no. of seeds per fruit, test weight, total phenol, TSS and anthocyanin content recorded for statistical analysis. In the present, the averaged mean values were subjected to statistical analysis to test the significance of variation for the experiment design with the model of Panse and Sukhatme (1978). The superiority of hybrids for various traits was calculated over better parent and standard variety according to the method of Fonseca and Patterson (1968). Studies of heterosis (better-parent and standard check) were estimated for yield and its component traits in F_1 generation of brinjal genotypes using method-II (Model-2) of diallel mating design (Griffing, 1956). The combining ability analysis was carried out according to the procedure given by Griffing (1956) as per Method 2 and Model I.

Results and Discussion

The analysis of variance indicated highly significant difference for both parents and hybrids for all the traits (except parents for days to first flowering, days to 50% flowering, days to first picking and plant height) (Table 1) indicating the existence of enormous amount of genetic variability in the genotype. The interaction effect of parent *vs*. hybrids was significant for total phenol content, TSS and anthocyanin content indicating presence of heterosis for these traits *i.e.* performance of group of parents differed with group of hybrids evaluated. For days to first flowering, days to 50% flowering and for days to first picking not a single cross showed significant desirable heterobeltiosis and standard heterosis. From the result, it is clear that there is no relation between days to first flowering, days to 50% flowering and days to first picking to the fruit yield. The result is similar with the earlier findings of Ingale and Patil (1997), Das and Barua (2001) and Chowdhury *et al*. (2010).

Hybrids IC 074224 x IC 11066-2, IC 074224 x IIHR 635 and IC 11066-2 x Punjab Kranti were the leader over standard check (Table 2). Hence, it is clear that fruit yield depended upon weight, girth and length of fruit. Such findings also noticed earlier by Bisht *et al.* (2009), Das *et al*. (2009) and Reddy *et al*. (2014).

IC 074224 x IIHR 635 (26.60%), Surati Ravaiya Pink x Arka Neelkanth (26.54%) and IIHR 635 x Arka Neelkanth (24.79%) are top three performing for heterobeltiosis and IC 074224 x IC 11066-2 (34.10%), IC 074224 x IIHR 635 (24.50%) and IC 11066-2 x Punjab Kranti (24.16%) were top three hybrids over standard heterosis which is directly related to number of fruits per plant and total fruit yield. All the three hybrids are also found to be best performer for no. of fruits per plant and fruit yield. (Table 3). These results are in harmony with the results earlier revealed by Suneetha *et al*. (2008), Nalini *et al* (2011) and Makani *et al.* (2013). Fruit yield also affected by fruit weight, fruit girth and fruit length.

The *gca* and *sca* effects for top three parents and top

Table 1: Analysis of variance for parents and hybrids in respect of yield contributing traits

Sr no.	Source of Variations	df	Days to first flowering	Days to 50% flowering	Days to first picking	Plant height (cm)	No. of primary branches	No. of fruit per plant	No. of pickings	Fruit weight (g)
1	Replicates	2.00	1.61	3.63	4.70	34.15	1.256 *	4.98	1.82	134.78
2	Treatments	54.00	52.41**	52.58**	65.32*	94.69 *	3.75**	14.32**	9.59 **	522.29 **
3	Parents	9.00	32.65	32.46	40.96	53.72	2.15 **	8.18 *	5.40 *	294.10 **
4	Hybrids	44.00	57.63**	57.84**	71.78**	105.21 **	4.16 **	15.90 **	10.65 **	580.82 **
5	Parent Vs. Hybrids	1.00	0.54	2.23	0.22	0.51	0.02	0.06	0.16	0.30
6	Error	108.00	27.48	27.19	40.69	58.73	0.34	3.79	2.34	80.93
7	Total	164.00	35.37	35.26	48.36	70.27	1.48	7.27	4.72	226.91

Sr no.	Source of Variations	df	Fruit length (cm)	Fruit girth (cm)	Yield per plant (g)	No. of seeds per fruit	Test weight (g)	Total phenol content (mg/100g)	TSS (%)	Anthocyanin content (µg/100g)
1	Replicates	2.00	2.12	0.46	464.00	2886.52 *	9.50 *	14.54 **	2224.44 **	51.06 **
2	Treatments	54.00	8.16 **	1.76 **	5099.31 **	31870.72 **	104.66 **	160.93 **	25152.89 **	565.77 **
3	Parents	9.00	4.59 **	0.99 **	2982.70 **	18641.89 **	61.22 **	94.15 **	14751.35 **	330.90 **
4	Hybrids	44.00	9.07 **	1.96 **	5645.43 **	35284.01 **	115.87 **	178.16 **	27839.11 **	626.36 **
5	Parent Vs.Hybrids	1.00	0.01	0.00	119.25	745.38	2.45	3.77 **	573.40 **	13.20 **
6	Error	108.00	1.26	0.27	381.16	638.23	2.56	0.34	18.88	1.34
7	Total	164.00	3.54	0.77	1935.71	10949.52	36.27	53.39	8321.61	187.80

** Significant at 1% level, * Significant at 5% level

Table 2: Most heterotic hybrids for yield per plant over standard check (ABH-1) and its standard heterosis for its component traits

Traits	IC 074224 x IC 11066-2	IC 074224 x IIHR 635	IC 11066-2 x Punjab Kranti
Yield per plant (g)	24.20**	7.97	6.91
Days to First Flowering	-7.58	-10.44	-10.32
Days to 50% flowering	-6.76	-9.37	-9.39
Days to first picking	-6.88	-9.48	-9.37
Plant height (cm)	-13.19*	-9.48	-9.36
No. of primary branches	34.10**	24.50**	24.16**
No. of fruits per plant	34.14**	24.51*	24.25*
No. of pickings	38.89**	25.00*	25.00*
Fruit weight (g)	34.06**	24.46**	24.17**
Fruit length (cm)	34.08**	24.47**	24.21**
Fruit girth (cm)	34.00**	24.45**	24.14**
No. of seeds per fruit	78.73**	55.46**	53.93**
Test weight (g)	78.78**	55.49**	53.94**
Total phenols content (mg/100g)	78.56**	55.32**	53.80**
TSS (%)	24.00**	7.85**	6.76**
Anthocyanin content (µg/100g)	78.57**	55.35**	53.82**

**Significant at 1% level, *significant at 5% level

Table 3: Classification of parents with respect to general combining ability effect for fruit yield and its component

Sr no.	Parents	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
P_1	IC 074224	G	G	G	G	A	A	A	G	A	A	G	P	A	A	G	G
P_2	IIHR-534	P	A	A	A	P	P	P	P	P	P	P	G	G	P	P	P
P_3	Surati Ravaiya (Pink)	P	A	A	A	P	P	P	P	P	P	P	G	G	P	P	P
P_4	Punjab Barsati	G	A	G	G	A	A	A	G	A	A	G	A	A	G	G	G
P_5	IIHR 635	G	A	G	G	A	A	P	A	A	A	A	A	A	A	G	A
P_6	Punjab Sadabahar	A	A	A	A	P	P	P	P	P	P	P	G	G	P	P	P
P_7	Arka Anand	A	A	A	P	P	P	P	P	P	P	P	G	G	P	P	P
P_8	Arka Neelkanth	A	A	A	P	P	P	P	P	P	P	P	G	G	P	P	P
P_9	IC 11066-2	G	G	G	G	A	G	A	G	A	A	G	G	G	P	P	P
P_{10}	Punjab Kranti	A	G	A	A	P	P	P	P	P	P	P	G	G	P	P	P

G = Good general combiners
A = Average general combiners
P = Poor general combiners

1. Days to 1st flowering
2. Days to 50% flowering
3. Days to 1st picking
4. Plant height
5. No. of primary branches
6. No. of fruits per plant
7. No. of pickings
8. Fruit weight
9. Fruit length
10. Fruit girth
11. Yield per plant
12. No. of seeds per fruit
13. Test weight
14. Total phenol content
15. TSS
16. anthocyanin content

three hybrids, respectively are given in Table 4. It was revealed that *gca* and *sca* effect were significant for all the traits (except *gca* effect for days to first flowering, days to 50% flowering and days to first picking). The magnitude of *gca* variance is lower than that of *sca* variance for all the traits, indicating the predominance of non-additive gene action. Non-additive gene action for days to first flowering has been reported earlier by Aswani and Khandelwal (2005) and Chodhary and Didel (2014). Non-additive gene action for days to 50% flowering has been earlier reported by Shinde *et al.* (2011), Patel *et al.* (2013). Aswani and Khandelwal (2005) and Suneetha *et al.* (2008) noticed non-additive gene action for days to first picking. Non-additive gene action for plant height as revealed in present finding has earlier also reported by Padmanabham and Jagadish (1996), Aswani and Khandelwal (2005), Suneetha *et al.* (2008), Patel *et al.* (2013) and Chodhary and Didel (2014). Padmanabham and Jagadish (1996), Panda *et al.* (2004), Patel *et al.* (2013) and Chodhary and Didel

Table 4: Top three parents and hybrids for per se performance and combining ability effect

Sr no.	Traits	Combining ability effect	
		gca	*sca*
1	Days to First Flowering	IC 11066-2 (-2.009*) IC 074224 (-0.418) Punjab Barsati (-0.154)	IC 074224 x IIHR 635 (-6.53**) Punjab Sadabahar x Arka Neelkanth (-6.3**) IIHR 534 x Arka Anand (-6.08**)
2	Days to 50% flowering	IC 11066-2 (-2.053*) IC 074224 (-0.961) Punjab Kranti (-0.067)	IC 074224 x IIHR 635 (-6.48**) Punjab Sadabahar x Arka Neelkanth (-6.45**) Arka Anand x Punjab Kranti (-6.39**)
3	Days to first picking	IC 11066-2 (-2.197*) IC 074224 (-0.65) Punjab Barsati (-0.118)	Punjab Sadabahar x Arka Neelkanth (-7.2**) IC 074224 x IIHR 635 (-7.13**) IIHR 534 x Arka Anand (-6.86**)
4	Plant height (cm)	IC 11066-2 (-2.83) Punjab Barsati (-0.73) IC 074224 (-0.71)	Punjab Sadabahar x Arka Neelkanth (-8.93) IC 074224 x IC 11066-2 (-8.80) [Surati Ravaiya (Pink)] x Punjab Kranti (-8.69)
5	No. of primary branches	IC 11066-2 (0.571**) IC 074224 (0.15) Punjab Barsati (0.15)	IC 074224 x IC 11066-2 (1.75**) Surati Ravaiya Pink x Punjab Kranti (1.73**) IIHR 534 x Arka Anand (1.63**)
6	No. of fruits per plant	IC 11066-2 (1.11**) Punjab Barsati (0.29) IC 074224 (0.286)	IC 074224 x IC 11066-2 (3.42**) Surati Ravaiya Pink x Punjab Kranti (3.38**) Punjab Sadabahar x Arka Neelkanth (3.25**)
7	No. of pickings	IC 11066-2 (0.911**) Punjab Barsati (0.272) IC 074224 (0.272)	IC 074224 x IC 11066-2 (3.08**) Punjab Sadabahar x Arka Neelkanth (2.83**) IIHR 534 x Arka Anand (2.69**)
8	Fruit weight (g)	IC 11066-2 (6.804**) Punjab Barsati (1.883) IC 074224 (1.139)	IC 074224 x IC 11066-2 (21.16**) Surati Ravaiya Pink x Punjab Kranti (20.18**) Punjab Sadabahar x Arka Neelkanth (20.5**)
9	Fruit length (cm)	IC 11066-2 (0.850**) Punjab Barsati (0.235) IC 074224 (0.142)	IC 074224 x IC 11066-2 (2.64**) Surati Ravaiya Pink x Punjab Kranti (2.51**) Punjab Sadabahar x Arka Neelkanth (2.50**)
10	Fruit girth (cm)	IC 11066-2 (0.396**) Punjab Barsati (0.109) IC 074224 (0.06)	IC 074224 x IC 11066-2 (1.22**) Surati Ravaiya Pink x Punjab Kranti (1.17**) Punjab Sadabahar x Arka Neelkanth (1.16**)
11	Yield per plant (g)	IC 11066-2 (21.95**) Punjab Barsati (5.78) IC 074224 (4.76)	IC 074224 x IC 11066-2 (75.10**) Surati Ravaiya Pink x Punjab Kranti (65.24**) Punjab Sadabahar x Arka Neelkanth (63.50**)
12	No. of seeds per fruit	Arka Neelkanth (-23.93) Arka Anand (-23.93) Surati Ravaiya (Pink)(-14.70)	Arka Neelkanth x IC 11066-2 (-199.39) IIHR 635 x Punjab Kranti (177.36) IC 074224 x IIHR 534 (-156.08)
13	Test weight (g)	Arka Neelkanth (-1.37**) Arka Anand (-1.12**) Surati Ravaiya (-0.84**)	Arka Neelkanth x IC 11066-2 (-199.39) IIHR 635 x Punjab Kranti (177.36) IC 074224 x IIHR 534 (-156.08)
14	Total phenols content (mg/100g)	IC 11066-2 (3.90**) Punjab Barsati (1.02**) IC 074224 (0.84**)	IC 074224 x IC 11066-2 (13.34**) Surati Ravaiya Pink x Punjab Kranti (11.59**) Punjab Sadabahar x Arka Neelkanth (11.28**)
15	TSS (%)	IC 11066-2 (48.77**) Punjab Barsati (12.86**) IC 074224 (10.55**)	IC 074224 x IC 11066-2 (166.87**) Surati Ravaiya Pink x Punjab Kranti (145.10**) Punjab Sadabahar x Arka Neelkanth (141.26**)
16	Anthocya-nin content (µg/100g)	IC 11066-2 (7.31**) Punjab Barsati (1.92**) IC 074224 (1.58**)	IC 074224 x IC 11066-2 (25.01**) Surati Ravaiya Pink x Punjab Kranti (21.73**) Punjab Sadabahar x Arka Neelkanth (21.15**)

* *Significant at 1% level, * significant at 5% level

(2014) for no. of primary branches. Non-additive gene action for fruit length and girth has been revealed earlier by Panda *et al*. (2004), Aswani and Khandelwal (2005), Patel *et al*. (2013) and Chodhary and Didel (2014). Padmanabham and Jagadish (1996), Chezhian *et al*. (2000), Aswani and Khandelwal (2005), Patel *et al*. (2013) and Chodhary and Didel (2014) noticed non-additive gene action for no. of fruits per plant, fruit weight and fruit yield as well. Non-additive gene action was also noticed earlier by Padmanabham and Jagadish (1996) for number of seeds per fruit and Suneetha *et al*. (2008) for test weight and for total phenol content.

General combining ability effects were estimated for parents while specific combining ability effects were estimated for hybrids. Average performance of genotype

Table 5: Top three hybrids for heterobeltiosis and standard heterosis for yield and its component traits.

Sr no	Traits	Heterosis	
		BP	SC
1	Days to First Flowering	IC 074224 x IIHR 635 (-14.70**) Surati Ravaiya Pink x Punjab Kranti (-14.33*) Surati Ravaiya Pink x Arka Neelkanth (-12.54*)	IC 074224 x IIHR 635 (-10.44) IC 11066-2 x Punjab Kranti (-10.32) Surati Ravaiya Pink x Punjab Kranti (-8.4)
2	Days to 50% flowering	IC 074224 x IIHR 635 (-13.96**) Surati Ravaiya Pink x Punjab Kranti (-12.48*) IC 074224 x Surati Ravaiya Pink (-10.90*)	IC 11066-2 x Punjab Kranti (-9.39) IC 074224 x IIHR 635 (-9.37) Arka Anand x Punjab Kranti (-7.21)
3	Days to first picking	IC 074224 x IIHR 635 (-13.42*) Surati Ravaiya Pink x Punjab Kranti (-13.09*) Surati Ravaiya Pink x Arka Neelkanth (-11.45*)	IC 074224 x IIHR 635 (-9.48) IC 11066-2 x Punjab Kranti (-9.37) Surati Ravaiya Pink x Punjab Kranti (-7.63)
4	Plant height (cm)	IC 074224 x IC 11066-2 (-13.74 %) Surati Ravaiya Pink x Punjab Kranti (-13.09 %) IC 074224 x IIHR 635 (-12.36 %)	IC 074224 x IC 11066-2 (-13.19 %) IC 074224 x IIHR 635 (-9.48 %) IC 11066-2 x Punjab Kranti (-9.36 %)
5	No. of primary branches	IC 074224 x IIHR 635 (26.60**) Surati Ravaiya Pink x Arka Neelkanth (26.54**) IIHR 635 x Arka Neelkanth (24.79**)	IC 074224 x IC 11066-2 (34.10**) IC 074224 x IIHR 635 (24.50**) IC 11066-2 x Punjab Kranti (24.16**)
6	No. of fruits per plant	IC 074224 x IIHR 635 (26.61**) Surati Ravaiya Pink x Arka Neelkanth (26.54**) IIHR 635 x Arka Neelkanth (24.82**)	IC 074224 x IC 11066-2 (34.14**) IC 074224 x IIHR 635 (24.51*) IC 11066-2 x Punjab Kranti (24.25*)
7	No. of pickings	Surati Ravaiya Pink x Arka Neelkanth (27.27*) IC 074224 x IC 11066-2 (25.00**) IC 074224 x IIHR 635 (25.00*)	IC 074224 x IC 11066-2 (38.89**) IC 11066-2 x Punjab Kranti (25.00**) IC 074224 x IIHR 635 (25.00**)
8	Fruit weight (g)	IC 074224 x IIHR 635 (26.52**) Surati Ravaiya Pink x Arka Neelkanth (26.48**) IIHR 635 x Arka Neelkanth (24.71**)	IC 074224 x IC 11066-2 (34.06**) IC 074224 x IIHR 635 (24.46**) IC 11066-2 x Punjab Kranti (24.17**)
9	Fruit length (cm)	IC 074224 x IIHR 635 (26.53**) Surati Ravaiya Pink x Arka Neelkanth (26.47**) IIHR 635 x Arka Neelkanth (24.70**)	IC 074224 x IC 11066-2 (34.08**) IC 074224 x IIHR 635 (24.47**) IC 11066-2 x Punjab Kranti (24.21**)
10	Fruit girth (cm)	IC 074224 x IIHR 635 (26.51**) Surati Ravaiya Pink x Arka Neelkanth (26.44**) IIHR 635 x Arka Neelkanth (24.59**)	IC 074224 x IC 11066-2 (34.00**) IC 074224 x IIHR 635 (24.45**) IC 11066-2 x Punjab Kranti (24.14**)
11	Yield per plant (g)	IC 074224 x IIHR 635 (60.69**) Surati Ravaiya Pink x Arka Neelkanth (58.81**) IIHR 635 x Arka Neelkanth (55.08**)	IC 074224 x IC 11066-2(24.20**) IC 074224 x IIHR 635 (7.97) IC 11066-2 x Punjab Kranti (6.91)
12	No. of seeds per fruit	Punjab Barsati x Punjab Kranti (-52.19 %) Arka Neelkanth x IC 11066-2 (-50.07 %) Punjab Sadabahar x Punjab Kranti (-48.44 %)	IIHR 635 x Punjab Kranti (-42.69 %) Arka Neelkanth x IC 11066-2 (-39.59 %) Punjab Sadabahar x Punjab Kranti (-35.52 %)
13	Test weight (g)	Punjab Barsati x Punjab Kranti (-52.19 %) Neelkanth x IC 11066-2 (-50.07 %) Punjab Sadabahar x Punjab Kranti (-48.46 %)	IIHR 635 x Punjab Kranti (-42.71 %) Arka Neelkanth x IC 11066-2 (-39.58 %) Punjab Sadabahar x Punjab Kranti (-35.53 %)
14	Total phenols content (mg/100g)	IC 074224 x IIHR 635 (60.23**) Surati Ravaiya Pink x Arka Neelkanth (58.33**) IIHR 635 x Arka Neelkanth (54.59**)	IC 074224 x IC 11066-2 (78.56**) IC 074224 x IIHR 635 (55.32) IC 11066-2 x Punjab Kranti (53.80**)
15	TSS (%)	IC 074224 x IIHR 635 (60.32**) Surati Ravaiya Pink x Arka Neelkanth (58.40**) IIHR 635 x Arka Neelkanth (54.48**)	IC 074224 x IC 11066-2 (24.00**) IC 074224 x IIHR 635 (7.85**) IC 11066-2 x Punjab Kranti (6.76**)
16	Anthocyanin content (µg/100g)	IC 074224 x IIHR 635 (60.22**) Surati Ravaiya Pink x Arka Neelkanth (58.28**) IIHR 635 x Arka Neelkanth (54.60**)	IC 074224 x IC 11066-2 (78.57**) IC 074224 x IIHR 635 (55.35**) IC 11066-2 x Punjab Kranti (53.82**)

**Significant at 1% level, * significant at 5% level in a series of cross is known as general combining ability. Specific combining ability is a performance of a parent under consideration, in a specific cross. The traits wise categorization of general combining ability is given in Table 3.

Nature and magnitude of combining ability provides a guideline in identifying good parents and way of their utilization in breeding programme. Parent IC 074224 is good to average general combiner for all the traits under study. Punjab Barsati is good general combiner for the traits like days to first flowering, days to first picking, plant height, fruit weight, yield per plant, total phenol content, TSS and anthocyanin content. IC 11066-2 is good general combiner for days to first flowering, days to 50% flowering, days to first picking, plant height, no. of fruits per plant, fruit weight, no. of seeds per fruit, test weight and fruit yield per plant while parent Punjab Kranti is noticed to be very poor general combiner in all the traits under study (except days to 50% flowering, test weight and no. of seeds per plant). Surati Ravaiya Pink, Arka Anand and Arka Neelkanth are also found to be poor general combiner for all the traits (except test weight).

In the present investigation, positive specific combining ability is favourable for all the traits under study except for days to first flowering, days to 50% flowering, days to first picking, plant height, no. of seeds per plant and test weight. IC 074224 x IIHR 635 (G x G), Punjab Sadabahar x Arka Neelkanth (A x A) and IIHR 534 x Arka Anand (P x A) are top three good specific combiners for the traits like days to first flowering, days to 50% flowering, days to first picking. Parents IC 074224 and IIHR 635 are good general combiners for all the traits (except no. of seeds per fruit and no. of pickings; respectively) produce good specific combiners for days to first flowering, days to 50% flowering. IC 074224 x IC 11066-2 (G x G) are found to be best specific combiner for all the trait under study (except days to first flowering, days to 50% flowering, days to first picking). IC 07424 x IC 11066-2 (G x G), Surati Ravaiya Pink x Punjab Kranti and Punjab Sadabahar x Arka Neelkanth are found to be top three good specific combiner for all the traits (except days to first flowering, days to 50% flowering, days to first picking). Hybrids Punjab Sadabahar x Arka Neelkanth, IC 074224 x IC 11066-2 and Surati Ravaiya (Pink) x Punjab Kranti are good specific combiners for plant height. Thus, poor and average general combiners also produced good specific combiners in desired direction.

The high positive or negative specific combining ability effect recorded by the crosses involved either good x good, good x average, good x poor, average x average, average x poor or poor x poor combining parents. The crosses involving one good general combining parent could produce desirable transgressive segregants in subsequent generation revealed that there was some degree of correspondence between *per se* performance and *sca* effects of hybrids as well as *gca* effects of parents and estimates of heterosis for most of traits (Table 4 and 5). Hence, *gca* and *sca* effects and *per se* performance all play important role in manifestation of heterosis for various traits. Biparental mating with reciprocal recurrent selection would be appropriate to maintain the required genetic variability in breeding population and at the same rise the frequency of desirable genes. Top ranking hybrids may be further tested for area locations identifying for high yielding hybrids.

सारांश

बैंगन में उपज एवं उनके घटक के लिए अनुवांशिक संरचना सुनिश्चित हेतु 10 पित्रों, 45 संकरों (अर्द्ध डायएलिल संकरण विधि से उत्पन्न) एवं व्यवसायिक संकर ए बी एच–1 को नियंत्रक के साथ क्षेत्रीय उद्यान अनुसंधान केन्द्र, नवसारी कृषि विश्वविद्यालय, नवसारी में वर्ष 2014–15 में प्रयोग किया गया। फल उपज सहित कुल 16 गुणों पर आंकड़े अंकित किये गये। भिन्नता विश्लेषण से स्पष्ट हुआ कि सभी पित्रों में सार्थकता है जो संकेत देता है कि अध्ययन में प्रयुक्त पित्रों में प्रचुर मात्रा में अनुवांशिक विविधता है। आई. सी. 074224 x आई.आई.एच.आर.–635 (60.69), सुराती रावैया पिंक x अर्का नीलकंठ (58.81) व आई.आई.एच.आर.–635 x अर्का नीलकंठ (55.08) ने फल उपज के लिए सार्थक एवं वांछित ओजोस्विता रखते हैं। संयोजन क्षमता के अध्ययन से पता चला कि अयोज्य प्रकार की जीन प्रक्रिया गुणों को प्रदर्शित करने में संलिप्त है। आई.सी. 074224, पंजाब बरसाती एवं आई.सी. 11066–2 उपज प्रति पौध के लिए अच्छे सामान्य संयोजक है। सामान्य संयोजन क्षमता/विशिष्ट संयोजन क्षमता का अनुपात एकता में कम सभी गुणों के लिए पाया गया जो अयोज्य जीन की प्रबलता को स्पष्ट करता है। सामान्य संयोजन क्षमता, विशिष्ट संयोजन ओजोस्विता तथा मानक ओज के कुल विश्लेषण से स्पष्ट होता है कि पित्र आई.सी. 074224, आई.सी. 11066–2 एवं आई.आई.एच.आर–635 तथा संकरों आई.सी. 074224 x आई.सी. 11066–2, सुराती रावैया (पिंक), अर्का नीलकंठ एवं आई.आई.एच.आर 635 x अर्का नीलकंठ आगामी प्रजनन हेतु उत्तम पाया गया। व्युतक्रमी देयक पितृ में प्रजनन कर हमें वांछित अनुवांशिक विविधता संरक्षित करने तथा वांछित जीन की बारम्बारता बढ़ाने में भी उत्तम है। सर्वोत्तम संकरों को चिन्हित संकर उत्पादक क्षेत्र में आगामी मूल्यांकन किया जा सकता है।

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