Website : www.asthafoundation.in
Frontiers in Crop Improvement
Vol 10 (1) : 19-23 (January-2022) Print ISSN : 2393-8234 Online ISSN : 2454-6011
Astha Foundation, Meerut (U.P.) India

Heterosis in Relation to Combining Ability for Yield and Yield Attributes in Brinjal (*Solanum melongena* L.)

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Abstract

Genetic studies on fruit yield ha^{-1} and its attributing traits were conducted following LxT mating design comprising of 10 Lines and 3 Testers. Crosses thus developed were evaluated at three locations and the studies were made on pooled data. The analysis revealed that B-SB-2 and SB-PL-28 were having high desirable gca effect and *per se* performance for yield. On basis of sca effect the cross combinations B-4-10 x Local Long (LxH), B-4-9 x APAU-Sel-4 (LxM), B-SB-2 x APAU-Sel-4 (HxM), B-4-10 x APAU-Sel-4 (HxM) and B-4-10 x Local Long (L x H) were identified best for fruit yield ha^{-1}.Five crosses viz B-4-9 x APAU-Sel-4, B-4-10 x Local Long, B-SB-2 x APAU-Sel-4,B-4-10 x APAU-Sel-4 and B-SB-19 x Swarna Mani with high *per se* performance, sca effect and heterotic response for yield and attributing traits were identified.

Key words *: Line x tester, combining ability, gene action, heterosis, brinjal.*

Introduction

Brinjal (*Solanum melongena* L.), also known as eggplant, is an important Solanaceous vegetable crop grown round the year in India. It is grown for its immature, unripe fruits which are used in the variety of ways as cooked vegetable in curries. In J&K state in general and Kashmir valley in particular there is a huge demand for Brinjal but, only few cultivars of Brinjal are available in Kashmir for commercial cultivation which are not very high yielders. So a need for development of heterotic hybrids suiting Kashmir conditions arises.

The common approach of choosing parents purely on the basis of their *per se* performance does not necessarily yield fruitful results (Allard, 1960), while as choosing parents on the basis of their gca for economic components and genetic divergence has been reported to be effective. Line tester analysis provides a method where a large number of lines can be evaluated through the performance of their test cross progenies (1). The elite lines that possess combination of very useful allelic resources can be identified and used in more pragmatic way. This biometrical design is useful in preliminary screening of large number of lines for their general and specific combining ability effects, components of genetic variance and heterosis.

Materials and Methods

The present investigation was conducted using 43 collections of eggplant. During *Kharif* 2018 the set of thirty crosses, along with their parents (ten lines and three tesers) were evaluated in RCBD with three replications at a spacing of 60 ×45 cm at three locations. The recommended package of practices was adopted to raise a healthy crop. All the lines and crosses were calculated for their general and specific combining ability. Heterosis of the crosses was also calculated. Five random plants per replication were selected to record observation on each genotype for nine different yield and yield attributing characters *viz.,* plant height (cm), plant spread (cm), number of branches plant^{-1}, fruit length (cm), fruit diameter (cm), number of fruits plant^{-1}, No of pickings plant^{-1}, average fruit weight (g) and fruit yield ha^{-1} (q). Line x tester analysis was carried out by the method suggested by (1). Heterosis was worked out over the standard commercial hybrid Shalimar Brinjal Hybrid-2.

Results and Discussion

The pooled analysis of variance revealed significance differences among treatments for all the characters studied. The variance components due to lines, testers and line× tester interaction revealed that the variances due to lines showed significant differences for all the traits (Table-1).

Similarly variance due to line × tester interaction were highly significant for all the characters and more in magnitude than their corresponding variance components due to lines and testers for all the traits except for plant height and plant spread. Study of Table-1 revealed that variance due to sca was more than gca variance for all the characters (except for plant spread and fruit length) indicating the preponderance of non additive gene action for majority of characters. In general the ^{2} line was significant and more than ^{2} tester (in pooled results) for all

Received : October-2021; Revised : November-2021; Accepted : November-2021

Table-1 : Estimation of the components of variance, degree of dominance and heritability for different yield and yield attributing traits in Brinjal (*Solanum melongena* L.)

Components of variance	Pt height (cm)	Pt spread (cm)	No of Brnch pt^{-1}	Frt len (cm)	Frt dia (cm)	No of frts pt^{-1}	No of piks pt^{-1}	Avg fr wt (g)	Frt yld ha^{-1}(q)
^{2} lines	22.04**	20.39**	0.127*	1.34**	0.40**	8.84**	1.55**	139.45*	2207**
	±9.39	±3.44	±0.06	±0.06	±0.13	±3.93	±0.15	±67.97	±1734
^{2} lines × E	1.22	5.20*	-0.03	0.33**	0.04**	0.01**	0.04**	5.55**	142.09**
	±0.65	±2.08	±0.015	±0.14	±0.003	±0.001	0.01	±0.24	±106.73
^{2} testers	5.61**	4.83**	0.53	3.59**	0.37**	3.07	0.498	79.99	16396.19**
	±2.83	±2.32	±0.238	±2.18	±0.11	±2.19	±0.277	±58.66	±7428
^{2}testers × E	-1.11	-1.31	-0.038	0.04	0.03	-0.006	-0.07	1.77	-18.45
	± 0.68	±0.86	± 0.015	±0.02	±0.01	±0.007	±0.007	±1.06	±22.35
^{2} gca	10.7**	7.65**	0.23**	3.07**	0.38**	3.40**	0.740**	170.64**	22995.4**
	± 2.07	±2.82	±0.075	±0.96	±0.06	±1.91	±0.300	±50.52	± 7324.91
^{2} gca × E	1.37**	2.21**	0.21*	0.01**	0.01**	0.02**	0.03**	2.64**	28.59 **
	±0.38	±0.28	±0.009	±0.002	±0.14	±0.006	±0.007	±0.07	±13.03
^{2} sca	30.00**	6.6**	0.23**	2.16**	1.18**	10.38**	1.42**	462.68**	5481**
	±4.16	±2.63	0.075	±0.88	±0.006	±3.29	±0.47	± 148.48	±2172
^{2}sca × E	2.09**	4.9**	0.06**	0.63**	0.12*	1.02**	0.06**	16.10*	51.8**
	±0.33	±0.50	±0.01	±0.41	±0.60	±0.1	0.02	±2.02	±18.3
^{2}e	0.021	0.20	0.007	0.09	0.002	0.02	0.03	6.12	1.62
^{2}A	30.13	17.31	0.88	2.16	0.76	8.81	1.42	341.28	109.17
^{2}D	33.33	26.60	0.43	2.04	1.18	10.38	1.48	462.48	229.41
^{2} A/ ^{2}D	0.89	0.65	2.04	1.05	0.64	0.84	1.03	0.73	0.47
Av. Degree of dominance	1.12	1.40	0.51	0.95	1.24	1.08	1.03	1.36	1.44
Heritability(n.s)	25.25	17.15	42.00	43.58	36.62	45.88	21.38	33.28	32.04

the traits under study except for fruit diameter revealing contribution of lines is more as compared to testers. In general ^{2}sca was found to be more than ^{2}gca for all the traits (except fruit length and no of branches^{-1}) which indicates that there is the preponderance of non-additive gene action for the traits. The non additive type of gene action for yield and yield related traits were observed by (2) for fruit weight, number of fruits plant^{-1} and fruit yield. The same results with average degree of dominance greater than unity for yield and yield traits in brinjal were observed by (3, 4). The high desirable gca effects for economic traits is useful for selecting parents possessing favourable genes for the respective traits. Table-2 on gca effect of parents for different traits revealed that none of the parents showed high desirable gca for all the traits, however each parent showed significant gca effects for at least four traits each.B-SB-8 showed significant positive gca effect for all the traits studied except fruit diameter for which it showed a negative but significant gca which is a desirable feature keeping in view the consumers preference of thin fruited varieties in Kashmir. Various researchers like (5, 6, 7) reported significant gca effect in brinjal for plant height; (8) for fruit diameter and fruit weight; (9) and (10) for fruit yield.

The knowledge of combining ability effect of parents and crosses along with their *per se* performance provides an important information to the breeder regarding the identification of superior genotypes for hybridization for the improvement of yield and other traits. Parents APAU-Sel-4 and Local Long were good both in terms of gca effects and *per se* performance for plant height (table-3). For plant spread, parent B-SB-2, Arka Nidhi and Swarna Mani were better in terms of *per se* performance with significant positive gca effect. In case of number of branches plant^{-1}, Swarna Mani and B-SB-19 were good in *per se* performance with significant positive gca effects. For fruit length parents B-SB-8, B-SB-1 and B-4-10 were having high desirable gca effects along with good *per se* performance while as for fruit diameter, Swarna Mani and Arka Nidhi were having desirable gca effects along with good *per se* performance. For number of fruits plant^{-1} B-4-9 and B-SB-2 were having positive significant gca effects with good *per se* performance. SB-PL-28 and APAU-Sel-4 proved to be good for number of pickings plant$^{-1,}$ with desirable gca effect. For average fruit weight, parents swarna Mani and B-SB-19 were better in terms of gca effects and *per se* performance. For fruit yield ha^{-1} parents B-SB-2 and SB-PL-28 were having high desirable gca effects along with good *per se* performance.

High desirable sca effect helps to generate desirable segregates during fixation of alleles. In the present study B-4-9 × APAU-Sel-4, B-SB-2 × APAU-Sel-4, B-4-10 x L. Long, B-4-10 × APAU-Sel-4 were good combinations in

Table-2 : General combining ability effects of lines and testers used in crosses of Brinjal (*Solanum melongena* L.) for different yield and yield attributing traits.

Lines	Pt height (cm)	Pt Spread (cm)	No of brnchs/pt	Fruit length (cm)	Fruit dia (cm)	No of fruits/pt	No of piks	Fruit weight(g)	Fruit yield/ha(q)
B-SB-1	2.21**	2.94**	0.295**	0.61**	-0.03	-0.729**	-0.096**	0.334	17.33
B-SB-2	0.30	1.52**	0.479**	0.30**	-0.05**	0.79**	0.165**	-8.077**	60.93**
B-SB-8	5.72**	1.60**	0.159**	0.79**	-0.05**	3.56**	0.375**	10.824**	91.53**
B-4-9	5.16**	-1.51**	0.245**	0.80**	0.048**	0.660**	0.041	12.351**	-14.71**
B-4-10	4.40**	-0.174	-0.232**	1.61**	-0.39**	-0.121	-0.10**	9.582**	24.79**
B-SB-11	-0.49**	-1.06**	-0.308**	0.57**	0.055**	1.287**	0.071*	-10.977**	-27.94***
B-SB-19	-6.39**	0.490*	0.323**	0.09	0.15**	-2.08**	-0.049	9.411**	- 63.13***
SB-PL-28	3.83**	-0.236	-0.22**	-1.49**	-0.19**	2.37**	0.079*	3.132**	70.41***
B-SB-29	-6.18**	3.39**	0.445**	0.50**	0.229**	-4.171**	-0.21**	10.876**	-85.05**
Arka Nidhi	-2.49**	7.882**	-0.479**	-1.79**	0.417**	-1.071**	-0.296**	-1.704**	-6.48
Line- S.E(gi)	0.18	0.26	0.04	0.18	0.02	0.18	0.035	0.18	7.47
S.E(gi-g)	0.11	0.37	0.07	0.25	0.03	0.12	0.49	0.12	10.57
CD at 5%	0.16	0.51	0.09	0.36	0.05	0.17	0.69	1.17	14.75
CD at 1%	0.21	0.68	0.12	0.47	0.07	0.23	0.91	1.23	19.46
Testers									
Local Long	6.25**	-1.38**	-0.551**	0.74**	-0.09**	2.02***	0.558***	-10.94**	48.36**
APAU-Sel-4	3.10**	-2.05**	-0.282**	0.27**	-0.56**	1.01**	0.329**	-4.06**	45.84**
Swarna Mani	-6.35**	3.85**	0.832**	-0.011	0.657**	-1.00**	-0.229**	15.00**	-2.51
Tester - S.E	0.04	0.14	0.02	0.09	0.015	0.04	0.09	0.78	4.09
S.E(gi-gj)	0.06	0.20	0.03	0.14	0.02	0.06	0.27	1.10	5.79
CD at 5%	0.09	0.28	0.05	0.19	0.03	0.09	0.38	1.54	8.08
CD at 1%	0.11	0.37	0.07	0.26	0.04	0.12	0.50	2.03	10.66

Table-3 : Best Parents based on pooled analysis in respect of gca effect and per se performance for different traits in Brinjal (*Solanum Melongena* L.).

S. No.	Trait	Parent	Gca value (pooled)
1.	Plant height (cm)	APAU-Sel-4	3.19**
		Local Long	6.25**
2.	Plant Spread (cm)	B-SB-2	1,52**
		Arka Nidhi	7.88**
		Swarna Mani	3.85
3.	Number of branches plant^{-1}	Swarna Mani	0.823**
		B-SB-19	0.323**
4.	Fruit Length (cm)	B –SB-8	0.79**
		B-SB-1	0.61**
		B-4-10	1.61**
5.	Fruit diameter (cm)	Swarna Mani	0.657**
		Arka Nidhi	0.417**
6.	Number of fruits plant^{-1}	B-4-9	0.660**
		B-SB-11	1.28**
		B-SB-2	0.79**
7.	Number of pickings plant^{-1}	SB-PL-28	0.079**
		APAU-Sel-4	0.329**
8.	Fruit weight (g)	Swarna Mani	15.00**
		B-SB-19	14.10**
9.	Fruit yield ha^{-1} (q)	B-SB-2	60.93**
		B-SB-28	91.53**

terms of sca effects for number of fruits plant^{-1}(Table-4). For number of pickings plant^{-1} B-4-10 × L. Long, B-4-9 × APAU-Sel-4, B-4-10 × APAU-Sel-4, B-SB-19 × APAU-Sel-4, B-SB-2 × L. Long were adjudged as best crosses with high sca effects. In case of average fruit weight B-4-9 × Swarna Mani, B-SB-11 × Swarna Mani, B-SB-8 × Swarna Mani and B-SB-28 × Swarna Mani were best combinations with respect to sca effects. For fruit yield ha^{-1} B-4-9 × APAU-Sel-4, B-4-10 × L. Long, B-SB-2 × APAU-Sel-4, B-4-10 × APAU-Sel-4 and B-SB-19 ×

Table-4 : Estimates of specific combining ability effects different yield and attributing traits in crosses of Brinjal (*Solanum melongena* L.).

Crosses	Pt ht (cm)	Pt Spread (cm)	No of Brnchs/pt	Frt len (cm)	Frt Dia (cm)	No of frts/pt	No of piks/pt	Frt wt (g)	Frt yield/ ha (q)
B-SB-1 × Local long	1.00	9.50**	0.108	-0.200	-0.344**	-1.146	-2.108**	-3.359	-13.59**
B-SB-1 × APAU-Sel-4	-12.12**	-0.742	0.013	-0.037	0.391**	-4.951**	-0.097	10.920**	21.08**
B-SB-1 × Swarnamani	13.44**	-0.708	-0.121	0.237**	-0.047	3.207**	2.20**	11.561**	18.50**
B-SB- 2 × Local long	1.11	8.267**	-0.742**	-0.251	0.126	5.77**	1.961**	17.976**	19.70**
B-SB-2 × APAU-Sel-4	-3.62**	8.053**	0.184	-0.237	-0.203**	-3.87**	-1.31*	-0.053	-14.34**
B-SB-2 × Swarnamani	2.5**	-6.32**	0.558**	0.488	-0.868**	-2.90**	-0.651	-1.923	-13.35**
B-SB-8 × Local long	12.14**	-3.586**	0.056	0.200	-0.150	4.68**	1.466**	12.116**	22.37**
B-SB-8 × APAU-Sel-4	-6.59**	-4.681**	0.072	-0.622	0.718**	1.031	0.172	-10.797**	11.08**
B-SB-8 × Swarnamani	-5.55**	8.268**	-0.016	0.422	-0.036	0.669	-1.638**	22.913**	12.09**
B-4-9 × Local long	-18.99**	-7.678**	0.657**	-0.38	0.234**	1.263	0.820	-27.048**	-14.98**
B-4-9 × APAU-Sel-4	6.43**	6.771**	-0.948**	2.630**	-0.198**	-0.8	0.007	0.076	14.71**
B-4-9 × Swarnamani	12.55**	0.907	0.291	-2.248**	-0.344**	-2.67**	-0.827	33.124**	13.06**
B-4-10 × Local long	9.71 **	-3.676**	-0.084	0.073	0.488**	1.57	0.722	0.025	7.09**
B-4-10 × APAU-Sel-4	-15.92**	-0.783**	0.033	0.553	0.296**	0.775	0.28	16.624**	16.16**
B-4-10 × Swarnamani	6.20 **	8.458**	0.05	-0.626	-0.784**	-2.23**	-1.00	8.899**	-19.35**
B-SB-11 × Local long	9.19**	0.140	0.590**	-1.83**	-1.48**	-3.293**	-0.932	-10.474**	-22.27**
B-SB-11 × APAU-Sel-4	1.05	0.725	-0.145	1.255**	-0.22**	-3.09**	-0.019	-3.682	15.79**
B-SB-11 × Swarnamani	-10.25**	3.864**	-0.445	0.575	1.70**	0.06	0.951*	33.156**	13.17**
B-SB-19 × Local long	-6.21**	5.466**	-0.310	0.291	2.897**	1.942**	-1.680**	1.101	0.347**
B-SB-19 × APAU-Sel-4	7.54**	-12.529**	-0.249	1.391**	-1.422**	-1.803**	0.047	1.195	0.116**
B-SB-19 × Swarnamani	-1.0**	7.063**	0.559*	0.310	-1.475**	1.78*	1.633**	1.095	0.047
SB-PL-28 × Local long	-8.10 **	3.142**	0.315	1.718**	-0.086	0.979	-1.680**	0.811	0.016
SB-PL-28 × APAU-Sel-4	9.65**	0.393**	0.603**	0.346	-0.323**	0.827	0.047	0.816	-0.10
SB-PL-28 × Swarnamani	-1.01 **	0.536	-0.288	1.483*	0.409**	2.139**	1.633**	8.101**	-0.023
B-SB-29 × Local long	-5.77**	-4.348**	0.050	0.491	-0.316**	-2.123**	-0.571	0.997	1.02**
B-SB-29 × APAU-Sel-4	9.00 **	0..505	0.095	-1.181**	0.493**	-2.897**	0.154	5.281	1.02**
B-SB-29 × Swarnamani	-3.23**	11.853**	0.150	1.227**	-0.177**	-2.225	0.417	5.716	0.56**
ArkaNidhi × Local long	8.34**	0.954	0.097	0.037	-0.625**	-1.27	-0.272	0.533	0.03
ArkaNidhi × APAU-Sel-4	4.43 **	16.289**	0.342	0.019	0.578**	3.98**	0.570	0.0255	0.002
ArkaNidhi × Swarnamani	-12.77**	0.336	-0.339	0.057	0 .047	-1.153	-0.499	2.278	-0.16
S.E(Sij)	0.20	0.64	0.24	0.44	0.068	0.86	0.49	3.49	0.04
S.E ± (Sij-Skj)	0.39	1.23	0.68	0.85	0.13	1.65	0.70	6.70	0.07
CD at 5%	0.77	2.43	1.68	1.68	0.25	3.26	0.22	13.22	0.15
CD at 1%	1.02	3.21	2.22	2.22	0.33	4.31	0.45	17.45	0.02

Swarna Mani were good combinations in terms of sca effects.

Standard heterosis for various yield and yield traits was calculated keeping Shalimar Brinjal Hybrid-2 as standard check (Table-5). The primary objective of heterosis breeding is improved and increased yield. In the present study four crosses showed high degree of heterosis for yield.

Some of the top ranking crosses for all the traits were identified on basis of *per* performance, sca effect and heterosis. Five crosses viz B-4-9 x APAU-Sel-4, B-4-10 x Local Long, B-SB-2 x APAU-Sel -4, B-4-10 x APAU-Sel-4 and B-SB-19 x Swarna Mani were identified on basis of high *per se* performance, sca effect and high high degree of heterosis over standard Shalimar Brinjal Hybrid-2 for productivity. Thus these five crosses could be exploited commercially after critical evaluation for stability across the locations over years

Table-5 : Standard heterosis for different yield and yield attributing traits in various crosses of brinjal (*Solanum melongena* L.).

S. No.	Cross	Plant height (cm)	Plant Spread (cm)	No of brnchs Pt^{-1}	Fruit length (cm)	Fruit diameter (cm)	No of fruits $plant^{-1}$	No of piks $plantt^{-1}$	Avg frt wt (g)	Frt yield ha^{-1}(q)
1.	B-SB-1 × Local Long	9.40**	27.11**	5.43**	16.29**	-24.4**	-21.44**	-27.40**	4.47	-19.13**
2.	B-SB-1 × APAU-sel-4	6.69**	4.88**	7.8**	-3.41**	-16.09**	0.61	-4.63**	12.51**	5.28**
3.	B-SB-1 × Swarna Mani	7.71**	23.88**	21.75**	-15.05**	39.00**	-11.33**	44.00**	24.40**	0.004
4.	B-SB-2 × Local Long	2.77	16.05**	3.90**	-6.40**	-16.09**	-35.33**	-23.01**	9.83**	-18.51**
5.	B-SB-2 × APAU-sel-4	5.1**	10.41**	12.83**	16.03**	-29.41**	40.77**	61.17**	33.59**	51.50**
6.	B-SB-2 Swarna Mani	-2.4	2.02	33.47**	8.00**	29.22**	-29.88**	-7.63**	11.17**	-29.01**
7.	B-SB-8 × Local Long	19.61**	2.98	6.6**	8.21**	-10.76**	0.38	-5.35**	17.82**	16.00**
8.	B-SB-8 × APAU-sel-4	-1.64	-3.9**	7.2**	-5.88**	3.09**	-30.50**	-24.99**	14.50**	-21.60**
9.	B-SB-8 × Swarna Mani	-15.33**	48.33**	20.20**	-29.11**	36.84**	-29.60**	28.98**	7.87**	4.30**
10.	B- 4-9 × Local Long	-3.34	-13.83**	12.41**	-5.40**	5.26**	-22.59**	-30.66**	24.62**	-25.30**
11.	B-4-9 × APAU-sel-4	16.32**	4.96**	3.02**	13.41**	2.19**	52.59**	62.03**	9.06**	62.34**
12.	B-4-9 × Swarna Mani	11.95**	28.38**	26.49**	-41.17**	54.17**	-30.44**	-29.85**	67.81**	-36.07**
13.	B-4-10 × Local Long	17.97**	-8.33**	4.18**	13.01**	0.30	30.55**	107.74**	17.70**	52.46**
14.	B-4-10 × APAU-Sel-4	-1.02	16.66**	6.07**	7.72**	10.52**	28.61**	60.60**	22.03**	44.44**
15.	B-4-10 × Swarna Mani	-13.26**	38.33**	16.45**	27.84**	15.17**	-36.66**	-56.22**	45.65**	-49.07**
16.	B-SB-11 × Local Long	10.5**	2.80	2.90**	12.41**	0.61	-30.11**	-8.46**	-7.24**	-36.41**
17.	B-SB-11 × APAU-sel-4	2.03	8.31**	-3.70**	5.4**	2.10**	-37.00**	-7.92**	9.23**	-33.65**
18.	B-SB-11 × Swarna Mani	-15.57**	36.46**	-6.72**	-14.7**	72.13**	-36.50**	13.75**	54.07**	-3.7**
19.	B-SB-19 × Local Long	-5.10**	4.93**	8.00**	5.80**	6.50**	-34.44**	-42.00*	34.83**	-12.69**
20.	B-SB-19 × APAU-sel-4	7.71**	21.63**	-0.89**	7.76**	1.23**	-20.50**	-32.24**	22.03**	2.46**
21.	B-SB-19 × Swarna Mani	-36.51**	30.33**	4.46**	-28.11**	56.65**	0.06	9.16**	36.48**	43.13**
22.	SB-PL-28 × Local Long	7.14**	7.90**	-7.67**	4.09**	0.61	-7.16**	-2.00**	32.94**	-21.60**
23.	SB-PL-28 × APAU-Sel-4	15.19**	0.36	8.92**	1.80**	9.59**	-19.61**	-15.01**	25.79**	18.50**
24.	SB-PL-28 × Swarna Mani	-21.12**	22.18**	11.99**	-41.21**	39.00**	-34.00**	-45.87**	62.35**	-47.53**
25.	B-SB-29 × Local Long	13.71**	0.57	6.69**	-3.51**	45.51**	-41.83**	-53.57**	30.48**	-28.39**
26.	B-SB-29 × APAU-Sel-4	-0.76	-10.17**	11.01**	-13.82**	-20.11**	-0.68	-56.83**	-2.50	-48.14**
27.	B-SB-29 × Swarna Mani	-28.9**	48.33**	23.15**	-21.29**	73.06**	-40.05**	-49.47**	-4.10	-23.15**
28.	Arka Nidhi × Local Long	17.91**	9.68**	-5.77**	-6.40**	21.98**	-16.88**	-29.76**	30.14**	-29.01**
29.	Arka Nidhi × APAU-Sel-4	1.59	43.16**	-5.29**	-14.06**	13.31**	0.02	19.42**	16.85**	37.65**
30.	Arka Nidh xi × Swarna Mani	-30.72**	32.71**	6.27**	-41.77**	34.98**	-36.05	-46.23**	40.40**	-11.72**

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