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Heterosis and combining ability studies on important biochemical traits of brinjal (*Solanum melongena* L.)

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Abstract
The experiment was under taken to asses breeding behavior of eight parental lines for important biochemical traits of brinjal like, total soluble solids content, vitamin C content and total phenol content in edible fruits. IBWL-1 x PRLP-1, PS x PB-101 and PB-6 x PB-101 cross combinations were identified as positive significant for T.S.S. While PLP-1 x PB-101, PR x PB-101 and PPR x IBWL-1 were yielded with significantly high vitamin C. Significant negative and desirable heterosis for total phenol content reported in PPR x IBWL-1, PS x PR and PS x PLP-1 cross combinations. Parental lines PS, PB-101 and *S.g* were identified as best general combiners for traits like total soluble solids content, vitamin C and low total phenol content respectively. Specific combining ability studies revealed specific cross combinations for these traits *viz.,* PS x PB-101 for T.S.S, PLP-1 x PB-101 for vitamin C and PPR x IBWL-1 for low total phenol content.

Keywords: Brinjal, heterosis, quality, biochemical

Introduction

Brinjal, eggplant or guinea squash (*Solanum melongena* L.), is one of the top ten vegetables of the world. It is a common, popular and principal vegetable crop, belonging to the nightshade family *Solanaceae*. Extracts of brinjal are known to have significant effect in reducing blood and liver cholesterol rates. The peel or skin of brinjal has significant amounts of anthocyanins with antioxidant activity and protects against cancer, ageing, inflammation and neurological diseases (Hanur, 2010) [18]. Nasunin, a major component of anthocyanin pigment of brinjal, has been shown to inhibit lipid peroxidation (Igarashi *et al.*, 1993) [22]. More recently, free radical scavenging and iron chelating activities of nasunin were demonstrated by electron spin resonance.

Brinjal fruit (unripe) is primarily consumed as cooked vegetable in various ways and dried shoots are used as fuel in rural areas. It is highly nutritive crop rich in Ca, Mg, P, and fatty acids. The nutritional value per 100 g of eggplant fruit contains 92.70 per cent moisture, 0.1 g fat, 5.7 g carbohydrate and 1.0 g protein (Chen and Li, 1996) [5]. In addition, it also contains mostly water, some protein and carbohydrates besides it is a good source of nutrients such as folate, ascorbic acid, vitamin K, niacin, vitamin B_6, pantothenic acid, potassium, iron, magnesium, manganese, phosphorus, and copper (USDA 2008) [23]. Eggplant contains a higher content of free reducing sugars, anthocyanin, phenols, glycoalkaloids (solasodine) and amide proteins. It has been reported that, the oblong-fruited eggplant cultivars are rich in total soluble sugars, whereas the long-fruited cultivars contain a higher content of free reducing sugars, anthocyanin, phenols, glycoalkaloids (such as solasodine), dry matter, and amide proteins (Bajaj *et al.*, 1979) [1]. Bitterness in eggplant is due to the presence of glycoalkaloids which are of wide occurrence in plants of Solanaceae family. The glycoalkaloid contents in the Indian commercial cultivars vary from 0.37 mg/100 g fresh weight to 4.83 mg) (Bajaj *et al.*, 1981) [2]. Brinjal is known to have many ayurvedic medicinal properties like white brinjal is said to be good for diabetic patients (Choudhary, 1976) [3]. Fried Brinjal fruit in Til oil is used to cure toothache (Chen and Li, 1996) [5]. It has also been recommended as an excellent remedy for those suffering from a liver complaint. Polyphenols have shown to be beneficial for human health due to its many biological activities like free-radical scavenging, regulation of enzymatic activity and anti-cancer activities and regulator of cell signaling pathways

(Sato *et al.*, 2011) [21]. Consequently, due to the multiple health benefits of eggplant, which include anti-diabetic, hypotensive, anti-oxidant, hepatoprotective and cardioprotective effects, the demand for eggplant has been on a accelerated and invariant rise in the recent years (Ojiewo *et al.*, 2007) [15].

The varieties of *Solanum melongena* display a wide range of variability of fruit shapes and colours, ranging from oval or egg-shaped to long club-shaped; and from white, yellow, green through degrees of purple pigmentation to almost black. There are three main botanical varieties under the species *melongena* (Choudhary, 1976) [3], the common brinjal, to which large, round or egg shaped fruited forms belong, are grouped under var. *esculentum*. The long, slender types are included under var. *serpentinum* and the dwarf brinjal plants are put under var. *depressum.* It is therefore indispensable to improve the yield potential of available land races through various genetic improvement programmes like estimation of variablility for selection of superior parent, and to determine GCA and SCA of parent's and F_1's respectively in order to yield good hybrids or varieties with desired traits.

Materials and Methods

The present investigation carried out *via* Half-Diallel analysis was conducted during 2016-2018 with the objectives to estimate the nature and magnitude of heterosis, combining ability of different biochemical traits. The parent materials for conducting experiment were collected from Vegetable Research Centre of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar. Cross combinations were developed during kharif season of 2016 by crossing eight parents of brinjal in half diallel mating design. Those eight parental lines were picked on the basis of divergence with respect to morphological and agronomical characters. The parental information is presented in (Table 1) and of cross combinations in (Table 2). Hence, the experimental materials comprising of 28 hybrids combinations and 8 parental lines including one check (Pant Samrat) which makes total of 36 entries.

The site of experiment was located at Vegetable Research Centre of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, Uttarakhand, India. Pantnagar is at 29.5° N latitude, 79.3° E longitude with an altitude of 243.84 meters above the mean sea level. This place is situated in the foot hills of sub-mountainous region of Shivalik hills, known as tarai region. The respective laboratory experiments were carried out in Horticulture Laboratory, Department of Horticulture, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, Uttarakhand, India.

T.S.S. was estimated in terms of Brix for this fruits collected from five tagged plants of each line were crushed into juice. Brinjal fruits juice was used for estimation of total soluble solids content with the help of Pocket Refractometer Pal-1, Atago (range 0 to 32).

Vitamin C content expressed in mg/100g and to determine fruits were collected from five randomly selected plants from every line independently. Collected fruits were made in to pulp. Ten grams of fruit pulp was grounded and blended with 3 per cent metaphosphoric acid (HPO_3) and volume made up to 100 ml with help of same. This content was allowed for shaking properly and filtered through Whatman No. 1 filter paper. Ten ml of the filtrate was titrated against 2, 6-Dichlorophenol-Indophenol dye until the light pink color persisted for at least 15 seconds. At this point the ascorbic acid content was estimated using the given formula and expressed as mg 100 g^{-1} (Ranganna, 1986) [18].

$$\text{Ascorbic acid (mg / 100 g)} = \frac{\text{Titre value x Dye factor x Volume made up}}{\text{Aliquot taken x Wt/Volume of sample taken}} \times 100$$

Total phenolics were estimated spectrophotometrically using Folin–Ciocalteau reagent (FCR) and expressed in mg CE/100 g on fresh weight basis.

Results and Discussion

Seventeen crosses exhibited significant estimates of heterosis for the total soluble solids content over mid parental value which ranged from 47.84% (IBWL-1x PR) to -25.75% (PS x PPR) (Table 3). Out of these sixteen crosses were in positive and desirable direction. Top five cross combinations under study were namely IBWL-1x PR (47.84%) followed by PS x PB-101 (39.50%), PS x PB-6 (38.29%), PB-6 x PB-101 (37.09%) and PB-6 x PR (32.84%). Fifteen cross combinations exhibited significant estimates of heterosis over better parent value which ranged from 41.73% (IBWL-1x PR) to -30.06% (PS x PPR) (Table 4). Out of these only seven cross combination were in positive direction. Highly heterotic cross combinations for this trit were namely IBWL-1x PR (41.73%) followed by PS x PB-101 (34.37%), PB-6 x PB-101 (31.42%), PB-6 x PR (27.99%) and PS x PB-6 (27.90%). For standard heterosis ten crosses exhibited significant estimates ranging from 34.37% (PS x PB-101) to -30.06% (PS x PPR) (Table 5). Out of these only seven cross combination was in positive direction. Top five combinations were namely PS x PB-101 (34.37%), PS x PB-6 (27.90%), PB-6 x PB-101 (21.75%), IBWL-1x PR (21.69%) and PS x IBWL-1 (16.74%). The findings of Das *et al.*, (2009) [5], Harza *et al.*, (2010) [20], Sao and Mehta (2010) [20] and Singh *et al.* (2011) [22] were similar.

For total ascorbic acid content thirteen crosses exhibited significant estimates of heterosis over mid parental value which ranged from 84.23% (PLP-1 x PB-101) to -14.95% (PS x PR) (Table 3). Out of these eleven crosses were in positive and desirable direction. The top five cross combination were PLP-1 x PB-101 (84.23%) followed by PR x PB-101 (82.95%), IBWL-1 x PB-101 (72.14%), PPR x IBWL-1 (68.05%) and PS x IBWL-1 (35.76%). Perusal of data for ascorbic acid content indicated that thirteen hybrids showed significant estimates of heterosis over standard check which ranged from 70.60% (PLP-1 x PB-101) to -23.34% (PS x PR) (Table 4). Out of these eight cross combinations were in positive direction and the top five were PLP-1 x PB-101 (70.60%) followed by PR x PB-101 (70.28%), IBWL-1 x PB-101 (69.48%), PPR x IBWL-1 (52.94%) and PB-6 x PB-101 (22.07%). Seventeen cross combinations exhibited significant estimates of heterosis over standard check value which ranged from 38.47% (PLP-1 x PB-101) to -29.77% (PPR x PB-6). Out of these five cross combination were in positive direction. The top five cross combination were PLP-1 x PB-101 (38.47%) followed by PR x PB-101 (36.69%), PPR x IBWL-1 (33.08%), IBWL-1 x PB-101 (20.95%) and PS x IBWL-1 (16.32%) (Table 5). Das *et al.,* (2009) [5], Dubey *et al.*, 2014 [12], Reddy and Patel (2014) [19], Ramani *et al.* (2015) [17], Baraskar *et al.* (2016) [4] and Kalaiyarasi *et al.*, (2018) [26] reported similar findings.

For total phenol content nineteen out of twenty eight crosses seventeen cross combination exhibited significant estimates of heterosis over mid parent value which ranged from -29.01% (PS x PR) to 111.53% (PPR x PB-6) (Table 3). Out of these four cross combinations were in negative direction namely PS x PR (-29.01%) followed by PPR x IBWL-1 (-24.55%), PS x PB-101 (-19.40%) and PS x PLP-1 (-8.44%). For total phenol content ninteen crosses exhibited significant estimates of heterosis over better parental value which ranged from -37.74% (PPR x IBWL-1) to 86.40% (PPR x PB-6) (Table 4). Out of these eight crosses were in negative direction. Top five were namely PPR x IBWL-1 (-37.74%) followed by PS x PB-101 (-31.45%), PS x PR (-31.24%), PS x PLP-1 (-23.79%) and PR x PB-101 (-15.00%). Perusal of data for total phenol content indicated that ninteen crosses possesed significant estimates of heterosis over standard check which ranged from -39.65% (PPR x IBWL-1) to 54.13% (PPR x PB-6) (Table 5). Out of ninteen significant crosses, ten were in negaitive direction. Top five were namely PPR x IBWL-1 (-39.65%) followed by PS x PB-101 (-31.45%), PS x PR (-31.24%), PB-6 x PB-101 (-26.79%) and PS x PLP-1 (23.39%). Similar results were noticed by Reddy and Patel (2014) [19], Ramani *et al.* (2015) [17], Balwani *et al.*, (2017) [3], Chintan *et al.* (2018) [6] and Kalaiyarasi *et al.*, (2018) [26].

The perusal of data for T.S.S. revealed that among eight parents seven parents showed significant estimates of GCA effects ranging from 0.647 to -2.503 (Table 6). Out of which six were found in desirable direction namely PS (0.647), PB-101 (0.520), PB-6 (0.457), IBWl-1 (0.451), PR (0.256) and PLP-1 (0.140). *S.g* (-2.503) was exhibited significant negative GCA effect explaining its undesirability. Desai *et al.*, (2017) [25], Kannan *et al.* (2017) [14], Yadav *et al.*, (2017b) [24] and Pramila *et al.*, (2017) [16] reported similar findings.

The read through of data for vitamin C revealed that among all the parents seven parents showed significant estimates of GCA effects ranging from 1.273 to -4.766 (Table 6). Out of seven significant parents only six were found desirable for the trait. PB-101 (1.273), PS (1.058), IBWL-1 (0.851), PR (0.655), PPR (0.610) and PLP-1 (0.467) exhibited highly significant positive GCA effects in desirable direction. Whereas, *S.g* (-4.766) showed significant negative GCA effects for the trait explaining its desirability in opposite direction. The findings of Sao and Mehta (2010) [20], Shafeeq *et al.* (2013), Varun *et al.* (2016), Desai *et al.*, (2017) [25], Kannan *et al.* (2017) [14], Yadav *et al.* (2017) [25], Yadav *et al.*, (2017b) [24] and Pramila *et al.*, (2017) [16] were similar.

GCA effect of eight parents for total phenol content ranged from -24.196 to 6.905 and eight out of eight parents showed significant GCA effect. Significant negative GCA effect in desirable direction was observed in *S.g* (-24.196) and PB-101 (-0.727) (Table 6) signifying that these were good general combiners for this trait, whereas the parent PLP-1 (6.905), PB-6 (5.786), IBWL-1 (5.378), PR (3.944), PPR (1.769) and PS (1.142) exhibited significant undesired positive GCA effect which indicated that it is a poor general combiner for total phenol content. Sao and Mehta (2010) [20], Shafeeq *et al.* (2013), Kannan *et al.* (2017) [14], Yadav *et al.* (2017) [25], Yadav *et al.*, (2017b) [24] and Pramila *et al.*, (2017) [16] reported similar findings.

The read through of data for T.S.S signifies that out of twenty eight cross combination, twenty four showed significant SCA effects ranged from 1.683 (PS x PB-101) to -2.357 (PS x *S.g*) (Table 7). Among twenty four significant crosses, only fourteen crosses exhibited significant positive SCA effect in desirable direction. Top five specific combiners for this trait were namely PS x PB-101 (1.683), IBWL-1 x PR (1.476), PS x PB-6 (1.406), PB-6 x PB-101 (1.210) and PPR x IBWL-1 (1.048). These same results were also observed by Pramila *et al.*, (2017) [16].

The read through of data for total ascorbic acid content revealed that among the twenty eight hybrid combinations, twenty two were found significant positive SCA effect for the traits which ranged from 5.158 (PLP-1 x PB-101) to -4.680 (PB-101 x *S.g*) (Table 7). Out of twenty two significant crosses, nine combinations were found good specific combiner for the trait in desirable direction. The top five cross combinations exhibited highly significant positive SCA effect in desirable direction were PLP-1 x PB-101 (5.158), PPR x IBWL-1 (4.887), PR x PB-101 (4.777), IBWL-1 x PB-101 (2.903) and PS x PB-6 (2.378).

The scrutiny of data for total phenol content revealed that among the twenty eight hybrid all were found significant SCA effect for the traits which ranged from -14.765 (PLP-1 x *S.g*) to 23.157 (PPR x PB-6) (Table 7). Out of twenty eight significant crosses, sixteen cross combinations were found good combiner for the trait in desirable direction. The top five cross combination exhibited significant negative SCA effect in desirable direction were PLP-1 x *S.g* (-14.765) followed by PPR x IBWL-1 (-14.625), PB6 x *S.g* (-13.645), IBWL-1 x *S.g* (-13.237) and PR x *S.g* (-11.803).

Table 1: List of parents along with their specific features

S. No.	Parents	Source	Features
1	Pant Samrat (PS)	G.B.P.U.A. & T., Pantnagar	Erect, long dark purple fruit, fruits occur in cluster
2	Pusa Purple Round (PPR)	IARI, New Delhi	Erect, round purple fruit
3	IBWL-2007-1 (IBWL-1)	IGKV, Raipur	Semi erect, thick long white fruits
4	PLP-1	G.B.P.U.A. & T., Pantnagar	Semi erect, oblong fruits
5	PB-6	G.B.P.U.A. & T., Pantnagar	Semi erect, long green fruit
6	Pant Rituraj (PR)	G.B.P.U.A. & T., Pantnagar	Semi erect, round dark purple fruit
7	PB-101	G.B.P.U.A. & T., Pantnagar	Erect, long white fruits
8	*Solanum gilo* (*S.g*)	G.B.P.U.A. & T., Pantnagar	Erect, small round fruits

Table 2: List of half diallel crosses

S. No.	Crosses	S. No.	Crosses	S. No.	Crosses
1.	PS x PPR	11.	PPR x PR	21.	PLP-1 x PB-101
2.	PS x IBWL-1	12.	PPR x PB-101	22.	PLP-1 x S.g
3.	PS x PLP-1	13.	PPR x S.g	23.	PB-6 x PR
4.	PS x PB-6	14.	IBWL x PLP-1	24.	PB-6 x PB-101
5.	PS x PR	15.	IBWL x PB-6	25.	PB-6 x S.g
6.	PS x PB-101	16.	IBWL x PR	26.	PR x PB-101
7.	PS x S.g	17.	IBWL x PB-101	27.	PR x S.g

8.	PPR x IBWL	18.	IBWL x S.g	28.	PB-101 x S.g
9.	PPR x PLP-1	19.	PLP-1 x PB-6		
10.	PPR x PB-6	20.	PLP-1 x PR		

Table 3: Estimation of relative heterosis (mid parent) for important biochemical traits in brinjal

S.N	Parentage	T.S.S. (Brix)	Vitamin C (mg/100g)	Total phenol content
1	PS x PPR	-25.75 **	-1.8	10.16 **
2	PS x IBWL-1	25.62 **	35.76 **	34.85 **
3	PS x PLP-1	4.64	-3.3	-8.44 **
4	PS x PB-6	38.29 **	23.91 **	9.45 **
5	PS x PR	11.53 **	-14.95 **	-29.01 **
6	PS x PB-101	39.50 **	12.29 **	-19.40 **
7	PS x *S.g*	-100.00 **	-100.00 **	-100.00 **
8	PPR x IBWL-1	25.40 **	68.05 **	-24.55 **
9	PPR x PLP-1	7.36 **	-4.53	47.50 **
10	PPR x PB-6	0.44	-10.83 *	111.53 **
11	PPR x PR	10.85 **	25.60 **	69.81 **
12	PPR x PB-101	9.91 **	-1	38.54 **
13	PPR x *S.g*	-100.00 **	-100.00 **	-100.00 **
14	IBWL-1 x PLP-1	15.66 **	7.35	68.75 **
15	IBWL-1x PB-6	13.07 **	8.55	25.03 **
16	IBWL-1x PR	47.84 **	3.86	-5.25
17	IBWL-1 x PB-101	4.8	72.14 **	34.45 **
18	IBWL-1 x *S.g*	-100.00 **	-100.00 **	-100.00 **
19	PLP x PB-6	14.61 **	15.71 **	104.71 **
20	PLP-1 x PR	26.23 **	-0.44	91.34 **
21	PLP-1 x PB-101	11.70 **	84.23 **	80.86 **
22	PLP-1 x *S.g*	-100.00 **	-100.00 **	-100.00 **
23	PB-6 x PR	32.84 **	29.80 **	4.13
24	PB-6 x PB-101	37.09 **	23.25 **	-4.01
25	PB6 x *S.g*	-100.00 **	-100.00 **	-100.00 **
26	PR x PB-101	2.33	82.95 **	-2.75
27	PR x *S.g*	-100.00 **	-100.00 **	-100.00 **
28	PB-101 x *S.g*	-100.00 **	-100.00 **	-100.00 **
	S. E. m±	0.11594	0.35805	1.03213
	CD at 5 per cent	0.2379	0.73466	2.11776
	CD at 1 per cent	0.30701	0.94809	2.73299

* Significance at 5 per cent level of significance ** Significance at 1 per cent level of significance

Table 4: Estimation of heterobeltiosis (better parent) for important biochemical traits in brinjal

S.N	Parentage	T.S.S. (Brix)	Vitamin C (mg/100g)	Total phenol content
1	PS x PPR	-30.06 **	-8.18 *	-10.20 **
2	PS x IBWL-1	16.74 **	16.32 **	32.78 **
3	PS x PLP-1	-4.25	-12.40 **	-23.39 **
4	PS x PB-6	27.90 **	5.64	-0.02
5	PS x PR	-0.32	-23.34 **	-31.24 **
6	PS x PB-101	34.37 **	-5.02	-31.45 **
7	PS x *S.g*	-100.00 **	-100.00 **	-100.00 **
8	PPR x IBWL-1	23.60 **	52.94 **	-37.74 **
9	PPR x PLP-1	4.09	-7.74	42.80 **
10	PPR x PB-6	-1.51	-19.29 **	86.40 **
11	PPR x PR	4.81	20.73 **	42.01 **
12	PPR x PB-101	7.39 **	-11.16 *	31.56 **
13	PPR x *S.g*	-100.00 **	-100.00 **	-100.00 **
14	IBWL-1 x PLP-1	13.74 **	0.87	42.99 **
15	IBWL-1x PB-6	12.48 **	7.9	15.84 **
16	IBWL-1x PR	41.73 **	-1.91	-6.81 *
17	IBWL-1 x PB-101	0.96	69.48 **	15.85 **
18	IBWL-1 x *S.g*	-100.00 **	-100.00 **	-100.00 **
19	PLP x PB-6	13.28 **	8.11	85.72 **
20	PLP-1 x PR	22.99 **	-0.98	64.40 **
21	PLP-1 x PB-101	5.89 *	70.60 **	77.29 **
22	PLP-1 x *S.g*	-100.00 **	-100.00 **	-100.00 **
23	PB-6 x PR	27.99 **	21.90 **	-2
24	PB-6 x PB-101	31.42 **	22.07 **	-11.31 **
25	PB6 x *S.g*	-100.00 **	-100.00 **	-100.00 **
26	PR x PB-101	-5.34	70.28 **	-15.00 **
27	PR x *S.g*	-100.00 **	-100.00 **	-100.00 **

28	PB-101 x *S.g*	-100.00 **	-100.00 **	-100.00 **
	S. E. m±	0.13388	0.41344	1.1918
	CD at 5 per cent	0.2747	0.84831	2.44537
	CD at 1 per cent	0.35451	1.09476	3.15579

* Significance at 5 per cent level of significance ** Significance at 1 per cent level of significance

Table 5: Estimation of standard heterosis (Pant Samrat) for important biochemical traits in brinjal

S.N	Parentage	T.S.S. (Brix)	Vitamin C (mg/100g)	Total phenol content
1	PS x PPR	-30.06 **	-8.18 *	-10.20 **
2	PS x IBWL-1	16.74 **	16.32 **	32.78 **
3	PS x PLP-1	-4.25	-12.40 **	-23.39 **
4	PS x PB-6	27.90 **	5.64	-0.02
5	PS x PR	-0.32	-23.34 **	-31.24 **
6	PS x PB-101	34.37 **	-5.02	-31.45 **
7	PS x *S.g*	-100.00 **	-100.00 **	-100.00 **
8	PPR x IBWL-1	9.26 **	33.08 **	-39.65 **
9	PPR x PLP-1	-7.99 **	-19.72 **	-3.84
10	PPR x PB-6	-12.94 **	-29.77 **	54.13 **
11	PPR x PR	-7.36 **	5.05	33.11 **
12	PPR x PB-101	-0.51	-22.70 **	-7.77 **
13	PPR x *S.g*	-100.00 **	-100.00 **	-100.00 **
14	IBWL-1 x PLP-1	-2.35	-18.13 **	38.60 **
15	IBWL-1x PB-6	-3.42	-23.00 **	12.29 **
16	IBWL-1x PR	21.69 **	-21.26 **	-9.68 **
17	IBWL-1 x PB-101	-6.47 *	20.95 **	12.29 **
18	IBWL-1 x *S.g*	-100.00 **	-100.00 **	-100.00 **
19	PLP x PB-6	-3.74	-12.25 **	53.56 **
20	PLP-1 x PR	2.09	-19.63 **	54.10 **
21	PLP-1 x PB-101	-1.9	38.47 **	24.29 **
22	PLP-1 x *S.g*	-100.00 **	-100.00 **	-100.00 **
23	PB-6 x PR	8.75 **	-2.14	-8.14 **
24	PB-6 x PB-101	21.75 **	-13.94 **	-26.67 **
25	PB6 x *S.g*	-100.00 **	-100.00 **	-100.00 **
26	PR x PB-101	-12.30 **	36.69 **	-20.33 **
27	PR x *S.g*	-100.00 **	-100.00 **	-100.00 **
28	PB-101 x *S.g*	-100.00 **	-100.00 **	-100.00 **
	S. E. m±	0.13388	0.41344	1.1918
	CD at 5 per cent	0.2747	0.84831	2.44537
	CD at 1 per cent	0.35451	1.09476	3.15579

* Significance at 5 per cent level of significance ** Significance at 1 per cent level of significance

Table 6: General combining ability effects of parents for biochemical traits in brinjal

Parents	T.S.S. (Brix)	Vitamin C (mg/100g)	Total phenol content
PS	0.647**	1.058**	1.142**
PPR	0.031	0.610**	1.769**
IBWL-1	0.451**	0.815**	5.378**
PLP-1	0.140**	0.467**	6.905**
PB-6	0.457**	-0.112	5.786**
PR	0.256**	0.655**	3.944**
PB-101	0.520**	1.273**	-0.727**
S.g	-2.503**	-4.766**	-24.196**
CD 1%	0.098	0.303	0.872
CD 5%	11.815	0.098	0.303

* Significance at 5 per cent level of significance ** Significance at 1 per cent level of significance

Table 7: Estimation of specific combining ability effects for different biochemical traits in brinjal

S. No.	Name of the cross	T.S.S. (Brix)	Vitamin C (mg/100g)	Total phenol content
1	PS x PPR	-1.214**	0.154	1.604*
2	PS x IBWL-1	0.825**	2.615**	15.498**
3	PS x PLP-1	0.034	-0.163	-8.906**
4	PS x PB-6	1.406**	2.378**	1.730*
5	PS x PR	0.124	-1.541**	-9.138**
6	PS x PB-101	1.683**	-0.167	-4.554**
7	PS x *S.g*	-2.357**	-4.465**	-9.001**
8	PPR x IBWL-1	1.048**	4.887**	-14.625**
9	PPR x PLP-1	0.453**	-0.511	-1.569*
10	PPR x PB-6	-0.124	-1.027**	23.157**

11	PPR x PR	0.370**	1.997**	16.439**
12	PPR x PB-101	0.466**	-1.641**	4.463**
13	PPR x *S.g*	-1.741**	-4.016**	-9.628**
14	IBWL-1 x PLP-1	0.329**	-0.544*	12.105**
15	IBWL-1x PB-6	-0.045	-0.496	2.507**
16	IBWL-1x PR	-1.214**	0.154	1.604*
17	IBWL-1 x PB-101	0.825**	2.615**	15.498**
18	IBWL-1 x *S.g*	0.034	-0.163	-8.906**
19	PLP x PB-6	1.406**	2.378**	1.730*
20	PLP-1 x PR	0.124	-1.541**	-9.138**
21	PLP-1 x PB-101	1.683**	-0.167	-4.554**
22	PLP-1 x *S.g*	-2.357**	-4.465**	-9.001**
23	PB-6 x PR	1.048**	4.887**	-14.625**
24	PB-6 x PB-101	0.453**	-0.511	-1.569*
25	PB6 x *S.g*	-0.124	-1.027**	23.157**
26	PR x PB-101	0.370**	1.997**	16.439**
27	PR x *S.g*	0.466**	-1.641**	4.463**
28	PB-101 x *S.g*	-1.741**	-4.016**	-9.628**
	CD 1%	0.329**	-0.544*	12.105**
	CD 5%	-0.045	-0.496	2.507**

* Significance at 5 per cent level of significance ** Significance at 1 per cent level of significance

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