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HYBRID VIGOUR STUDIES IN BRINJAL (*SOLANUM MELONGENA* L.)

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ABSTRACT
The seeds of sixty hybrids along with ten parents generated during *Rabi,* 2009 were evaluated for heat tolerance and earliness during summer, 2010 in a Randomized Block Design along with national check PH-6 in three replications for C.G. plains. Heterosis analysis was carried out for days to 50% flowering, days to first picking, plant height, number of primary branches per plant, average fruit length (cm), average fruit girth (cm), average fruit weight (g), total number of fruits per plant, number of fruits per plant per picking, marketable fruit yield per plant, total fruit yield per plant and total soluble solids (%). Highest standard heterosis was shown by IBWL x PPC (46.86%) followed by GL x PPL (46.13%), MK x IBWL (42.44%), PPC x WBPF (41.62%) and WBPF x PR (40.96%) for total fruit yield per plant.

INTRODUCTION

Brinjal is quite popular and is widely cultivated as the poor man's vegetable crop, mostly in the rainy season. In Chhattisgarh, productivity of brinjal is less as compared to national average, owing to use of low yielding local cultivars grown for local preferences and their susceptibility to insect pests and diseases. Besides these round variety set fruit at slightly lower temperature but highly susceptible to frost. Hence heat tolerant variety has to be identified for Chhattisgarh plains. Nagai and Kida (1926) were probably the first to observe hybrid vigor in a cross combination of some Japanese varieties of brinjal. Hence the required goal of increasing productivity in the quickest possible time can be achieved only through heterosis breeding which is feasible in the crop (Kakizaki,1931). Heterosis breeding is an important crop improvement method adopted in many crops all over the world. It is quick and convenient way of combining desirable characters which has assumed greater significance in the production of F1 hybrids. (Ramesh *et al.*, 2013). Hence the present work was carried with an objective to study the extent of heterosis in different crosses for earliness and yield and their utilization in future crop improvement programme.

MATERIALS AND METHODS

The experimental material used in the present study was supplied by All India Coordinated Vegetable Improvement Project, Department of Plant Breeding and Genetics, IGKV, Raipur (C.G) which consisted of ten parents *viz*., Green Long (GL), Mukta Keshi (MK), Pusa Purple Long (PPL), IBWL-2007-1, White Brinjal Purple Flower (WBPF), Pusa Purple Cluster (PPC), Pant Rituraj (PR), Pusa Purple Round (PPR), Safed Round (SR), Punjab Sadabahar (PS) and their 60 F_1's with national check Pusa Hybrid-6 (PH6). The parents were crossed during *Rabi*- 2009 and F_1's were evaluated in *Summer*-2010 in Randomized Block Design with three replication at Horticulture Research Farm in AICVIP (All India Coordinated Vegetable Improvement Project), Department of Plant Breeding and Genetics, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh), India. Observations on five randomly selected plants were recorded for days to 50% flowering, days to first picking, plant height (cm), number of primary branches per plant, average fruit length (cm), average fruit girth (cm), average fruit weight (g), number of fruits per plant, number of fruits per picking, total fruit yield per plant (g), marketable fruit yield per plant (g) and total soluble solids (%)

The statistical analysis for heterosis was done as per Panse and Sukhatme and magnitute of percent heterosis of F_1 over mid parent value and commercial check was calculated using Turner and Hayes *et al*. (1955).

RESULTS AND DISCUSSION

Analysis of variance was carried out which revealed that variance due to lines was significant for all the traits studied. The Heterosis value over mid parent value (relative heterosis), better parent value (heterobeltiosis) and economic heterosis (standard heterosis) was analyzed for important characters of brinjal.The important characters of the fruit are being discussed here.

The range of mid-parent heterosis *i*.e. per cent deviation of hybrid value from its mid parental value for days to first picking varied from -22.41% (IBWL x PS) to 24.32 % (GL x PPL, PPL x PS). The top ranking hybrids for this trait were, IBWL x PS,

WBPF x PPL, MK x WBPF, MK x SR, MK x PPC. The better parent heterosis ranged from -22.41 % (IBWL x PS) to 30.19 % (GL x PPL, PS x PPL). Out of sixty hybrids, forty eight hybrids showed significant heterosis, over their better parent. The range of standard heterosis *i.e.* per cent deviation of hybrid from the standard parent for this trait ranged from -16.67% (IBWL x PS) to -29.63% (WBPF x PS). In this out of sixty F_1's fifty two hybrids showed significant heterosis of which forty nine exhibited positive heterosis. Maximum negative standard heterosis were shown by IBWL x PS, MK x WBPF, MK x SR, IBWL x PPR. Early first picking which shows early 50% flowering is highly desirable trait for any local and distant market helping the farmer to fetch better price of their produce. Early summer hybrids of this study may be exploited for the same. These results are in agreement with the finding of Das and Barua (2001), Sao and Mehta (2010), Makani *et al*. (2013).

The range of the mid-parent heterosis for the trait plant height (cm) varied from -28.41 % (PS x GL) to 62.87 % (WBPF x PR). Thirty eight hybrids out of sixty showed significant negative mid-parent heterosis and twenty five F_1's revealed significant positive heterosis. The top ranking hybrids for this trait were PS x GL, WBPF x SR, GL x SR, WBPF x PPL and PPC x PPL. The better parent heterosis for plant height ranged from -18.64% (WBPF x PPL) to 86.05% (MK x PS). Out of sixty hybrids, forty four hybrids exhibited significant heterosis over better parent (better parent heterosis). Six hybrids showed significant negative better parent heterosis, some superior hybrids of them were PS x GL, WBPF x SR, GL X SR, WBPF X PPL and PPC x PPL. As far as standard heterosis is concerned plant height ranged from -26.15 % % (WBPF x PPL) to 69.74% (GL x MK) of thirty six significant hybrids only nine showed check and twenty seven F_1's showed significant positive standard heterosis. Top F_1's were WBPF x PPC, PPC x PPL, WBPF x SR, IBWL x PS, PS x GL. In general tall and dwarf plants both are desirable in brinjal which is coupled with the fruit and stalk length. Dwarf plants are being exploited particularly for small round group whereas, rest of the group *i.e.* long, oblong round etc. tall plant will be preferred. In this study heterosis is available for both the direction. Present findings are in agreement with the finding of Babu and Thirumurgan (2000,2001), Prasath *et al*. (2000),Prabhu *et al*. (2005), Bist *et al*.(2009), Sao and Mehta (2010), Makani *et al*. (2013)..

The average fruit weight determine the yield potential of the crop in each harvest along with other characters such as average fruit length, average fruit girth and finally total fruit yield per plant. Mid-parent heterosis for average fruit weight ranged from -69.06% (PR x MK) to 18.87% (IBWL x PPC). Fifty six out of sixty hybrids showed significant mid-parent heterosis for this trait. Two hybrids exhibited significant positive mid-parent heterosis. The top ranking hybrids were PPL x SR and PPC x IBWL. Better parent heterosis for average fruit weight ranged from -79.47% (SR x MK) to 4.26% (PPC x IBWL). Out of twenty one hybrids, only five hybrids showed significant positive better parent heterosis, top rankers were, SR X PPC, IBWL x PPL, PPC x PPL, PPC x GL, GL x PR and WBPF x SR. The standard heterosis for this character ranged from -84.81 % (PPC x SR) to -39.87% (MK x PPC) all hybrids showing significant negative standard heterosis**.** Present study showed most of the F_1's are with small are in accordance with findings of Singh *et al*. (2003), Prasath *et al*. (2000),Prabhu *et al*. (2005), Bist *et al*. (2009), Sao and Mehta (2010), Makani *et al*. (2013)..

The total harvest of the fruit doesn't mean the marketable fruit yield. However the important character really fluctuated as per market necessity. The mid-parent heterosis for marketable fruit yield per plant ranged from -79.15% (WBPF x IBWL) to 81.18% (MK x PR). Out of sixty hybrids seventeen exhibited significant positive mid-parent heterosis for this trait. Highest mid-parent heterosis was recorded by MK x PR, WBPF x PR, MK x PS, PR x PS, MK x PPR. The better parent heterosis over better parent ranged from -79.15% (WBPF x IBWL) to 81.18% (MK x PR). Out of sixty hybrids seventeen exhibited significant positive better-parent heterosis for this trait. The extent of standard heterosis for this character was observed from -52.83% (PS x PPL) to 47.9% (GL x PPL). Forty seven hybrids reported significant standard heterosis and twenty two out of them had positive value for this trait. Highest standard heterosis

Table 1: Analysis of variance for fruit yield and its component characters for summer season in brinjal

Source	D.F.	Characters (Mean Sum of Squares)					
		Days to 50% flowering	Days to first picking	Plant height(cm)	Number of primary branches per plant	Average fruit length (cm)	Average fruit girth(cm)
		1	2	3	4	5	6
Replication	2	4.1	28.37	53.63	89.18	70.62	241.48
Treatment	70	171.25**	80.51**	701.08**	18.18**	23.66**	94.87**
Error	140	9.02	11.73	5.53	17.49	2.2	1.3

*Significant at P = 0.05 level ** Significant at P = 0.01 level

Table 1: Analysis of variance for fruit yield and its component characters for summer season in brinjal

Source	D.F.	Characters (Mean Sum of Squares)					
		Average fruit weight (gm)	Total number of fruit per plant	Number of fruits per plantper picking	Marketable fruit yield per plant (gm)	Total yield per plant (gm)	T.S.S (%)
		7	8	9	10	11	12
Replication	2	10.96	7.6	7.1	6.9	6.3	7.3
Treatment	70	24.28**	8.67**	42.46**	47.3**	57.3**	9.56**
Error	140	2.37	6.57	3.00	1414.15	1518.00	0.09

* Significant at P = 0.05 level ** Significant at P = 0.01 level

Table 2: Range of heterosis and top crosses showing significant heterosis for twelve characters in Brinjal

S. No.	Characters	Range of heterosis (%) BP	SV	Top crosses showing significant heterosis
1	Days to 50% flowering	-9.52-38.64	-13.6-38.64	MK X IBWL, MK x WBPF, MK x PPR
2	Days to first picking	-22.41-30.19	-16.67-(–29.63)	IBWL X PS, MK X WBPF, IBWL x PPR
3	Plant height	-18.64-86.05	-26.15-69.74	WBPF X PPC, GL X PPL, MK X PPL
4	Number of primary branches	-37.78-33.75	–48.89-18.89	GL X MK, IBWL X PPL
5	Average fruit length	–69.94-27.55	-43.18-80.46	PPL X PPR, IBWL X GL, MK X PS, PPL X MK
6	Average fruit girth	-69.91-147.7	-64.95-71.13	IBWL x MK, GL x PPR, GL x MK, MK x PPR
7	Average fruit weight	-79.47-4.26	-84.81-(-39.87)	MK x PPC, MK x PR
8	Total number of fruits per plant	-63.33-471.43	-9.09-845.45	PPC x PR, PPC x SR
9	Total number of fruits per plant per picking	-84.62-266.67	-50.00-345.00	IBWL x PPL , MK x PPL, PPL x PPC, PPL x GL
10	Total fruit yield per plant	-50.24-88.18	-51.37-46.86	GL x PPL, PPC x WBPF, MK x IBWL, GL x PS, PPL x PPC
11	Marketable fruit yield	-79.15- 81.18	-52.83-47.9	GL x PPL, MK x IBWL, GL x PPR, IBWL x GL, IBWL x MK, PPL x WBPF
12	Total Soluble Solids	–32.00-15.22	-24.44-18.44	GL x PS, PPC x SR

BP = Better parent; SV = Standard variety

was observed for GL x PPL**,** IBWL x PPC, MK X IBWL, PPC X WBPF**,** WBPF x PR the hybrid, whereas, other twenty five hybrids showed significant negative standard heterosis for marketable fruit yield per plant. Present findings are in accordance with the findings of Deep *et al* (2000), Choudhary (2006), Sunitha and Katharia (2006), Vadadoria *et al*. (2007), Prakash *et al*. (2008), Prasath *et al*. (2000),Prabhu *et al*. (2005), Bist *et al*. (2009).

The estimates of mid-parent heterosis, better parent heterosis and standard heterosis were also obtained for fruit yield and its components. The mid-parent heterosis for this trait ranged from -67.53% (GL x SR) to 24.95% (MK x PPL). Four showed positive mid-parent heterosis and for this trait. The highest mid-parent heterosis was exhibited by MK x PPL, MK x PR, WBPF x PR, PPL x PPC. The better parent heterosis for this trait ranged from -50.24% (PPC x IBWL) to 88.18% (WBPF x PR). Out of sixty hybrids, twenty seven showed significant positive better parent heterosis for this trait. Highest better parent heterosis was reported in WBPF x PR, MK x PPL, MK x PR, PPL x PR, PPL x WBPF. The heterosis over check for total fruit yield per plant was observed from -51.37% (PS x PPL) to 46.86% (IBWL x PPC) (Table 1). Forty nine hybrids showed significant standard heterosis and twenty two out of them had positive value for this trait. Highest standard heterosis was shown by IBWL x PPC, GL x PPL (Table 1), MK x IBWL, IBWL x PPC, PPC x WBPF, WBPF x PR. Present findings are in accordance with the findings of Deep *et al* (2000), Choudhary (2006), Sunitha and Katharia (2006), Vadadoria *et al*. (2007), Prakash *et al*. (2008), Sao and Mehta (2010), Makani *et al*. (2013).

In summer, the heterosis over mid parent ranged from -32% (MK x WBPF) to 15.95% (GL x PPL) for this trait. Twenty nine hybrids out of sixty exhibited significant relative heterosis for this trait. Five hybrids showed positive significant relative heterosis, while, twenty four hybrids showed significant negative relative heterosis for this trait. The extent of heterosis over better parent (heterobeltiosis) ranged from –32.00% (MK x WBPF) to 15.22% (GL x PS). Out of sixty hybrids, forty hybrids showed significant heterobeltiosis and three among them exhibited significant positive heterobeltiosis. The top ranking hybrids for this trait were, GL x PS, GL x PPC and GL x WBPF.The standard heterosis for this trait was observed from -24.44% (MK x WBPF) to 18.44% (GL X PPC). Thirty six hybrids out of sixty had significant standard heterosis and ten showed among them exhibited significant positive value. The top ranking hybrids for this trait were, GL X PPC, GL X MK, GL X WBPF, GL X PS, PPC X SR, GL X PPL, GL X IBWL while, twenty six hybrids showed significant negative relative heterosis for this trait. Similar results were obtained by Melad *et al*. (2005) and Suneetha *et al*. (2006).

The present study reveal variability among the parents and high scope of exploitation of heterosis for improvement in fruit attributing charaters.Among the parents MK was found to be best parent as a line while the tester used as male parent varied as per the character desired. The hybrid MK X IBWL was found best for earliness, total fruit yield per plant and marketable fruit yield.

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