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Research Note

Heterosis for important qualitative and quantitative characters of mungbean

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Abstract

Forty hybrids incurred from five high yielding genetically diverse lines and eight testers for appraise eleven important quantitative and qualitative traits of mungbean. Mid parent, better parent and standard parent heterotic effects were estimated. The highest standard heterosis is observed for number of cluster per plant. The highest mid parent, better parent and standard parent heterosis for number of cluster per plant viz., 182.66 per cent, 173.44 per cent 196.61 per cent respectively, for the hybrid EC 396120 x IPM 99125. The highest standard heterosis of 31.5 percent for seed protein content was recorded for the hybrid between EC 396126 and CO GG 930. Based on *per se* performance and standard heterosis, hybrids were identified for heterosis breeding. The crosses, PANT M 103 x COGG 930, EC 396120 x IPM 99 125, AGG 10091 x CO 7, PANT M 103 x MH 565, AGG 100 91 x IPM 99 125, EC 396120 x IPM 0214, PANT M 103 x CO 7 and EC 396120 x PUSA VISHAL exhibited significant *per se* and standard heterosis for single plant yield. So these crosses were considered as superior crosses and further utilized in the breeding programme.

Key words

Mungbean, Heterosis, Hybrid, Yield component

Green gram commonly known as Mungbean (*Vigna radiate (L.) Wilczek*) is an economically important pulse crop ranking after chickpea and pigeonpea. In India the annual production of 1.61 m tonnes and productivity of 474 kg/ha during 2013-14 (Anonymous, 2014). India being the largest producer (18.5 million tonnes) and processor of pulses in the world, also imports around 3.5 million tonnes annually on an average to meet its ever increasing consumption needs of around 22.0 million tonnes (Patel, 2015). According to Indian Institute of Pulses Research's Vision document, India's population is expected to touch 1.68 billion by 2030 and the pulse requirement for the year 2030 is projected at 32 million tonnes with anticipated required annual growth rate of 4.2% (Anonymous, 2016). To get maximum yield, exploitation of heterosis breeding is gaining importance, which has been generally associated with deviation from the parental means accomplished by increased vigour and productivity obtained by crossing the inbred lines (Dhurai, 2016). The exploitation of heterosis to raise productivity in grain legumes depends on the direction and magnitude of heterosis, feasibility of large scale production and involvement of type of gene action (Reddy *et al.*, 2011). Heterosis is exploited in most of the field crops but its usefulness remained unexplored in legumes mainly because they are highly self-pollinated and lack male sterile lines. In mungbean, the utility of heterosis *per se* may not be of much use but cross combinations can be used in developing high yielding pure line varieties (Tantasawat *et al.*, 2015). Heterosis manifestation for yield is expressed in the form of increased yield which in-turn is dependent on the contribution of its components. Therefore, all the component traits of yield need to be studied together with regard to heterosis manifestation in order to assess the hybrid performance. The present study therefore made to know the magnitude of heterosis over mid parent, better parent and standard check variety for yield and its contributing character along with protein content in mungbean.

The present investigation was carried out at agricultural collage and research institute, Killikulam during 2016. The experimental materials for the study consisted five lines (PANT M 103, EC 396126, AGG 100 92, AGG 100 91, EC 396120) and eight testers (Co-7, IPM 99 125,MH 565, CO GG 930, IPM 205-7, COGG 1130, PUSA VISHAL, IPM

0214) obtained from different sources. A total of 40 crosses were generated utilizing thirteen parents by Line X Tester analysis. For the study of first filial crosses, 53 genotypes inclusive of 40 crosses and 13 parents were raised in a randomized block design with 2 replications during *Rabi* 2016. Each genotype was accommodated in a single row of 2 m length with a spacing of 40 × 20 cm. A total of fifteen plants were maintained in each row for both parents and crosses. True F1s were identified based on the morphological traits. Observations were recorded for 10 biometric traits viz., to days to 50% flowering, plant height (cm), primary branches per plant, number of clusters per plant, number of pods per cluster, pod length (cm), number of pods per plant, number of seeds per pod, 100-seed weight (g), protein content in seed and seed yield per plant on five randomly chosen plants from each replication, leaving the border plants. Protein content was estimated for 40 hybrids and 13 parents. These data were subjected to analysis of variance for mean performance (Panse and Sukhatme, 1957) and the relative heterosis (di) based on mid parental value, heterobeltiosis (dii) based on better parental value and standard heterosis using a standard check (CO-7) were estimated.

The analysis of variance for L x T in respect of yield and yield component characters was presented in Table 1. The analysis of variance revealed significant differences among all the 40 hybrids for all the 11 characters studied indicating the presence of wide variability among them. The observed heterosis range for 11 characters of mungbean were presented in table 2. A total of eight hybrids (Pant M 103 × CO GG 930, EC 396126 × IPM 205-7, AGG 10091 × CO, Pant M 103 × MH 565 AGG 10091 × IPM 99 125, EC 396120 × IPM 0214, Pant M 103 × CO 7, EC 396120 × Pusa Vishal) from 40 crosses exhibited significant and positive standard heterosis for single plant yield. Maximum of six traits had significant and positive standard heterosis value in the cross L1 x T4 (PANT M 103 x CO GG 930 for number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, protein content and single plant yield) and L5 x T8 (EC 396120 x IPM 0214 for number of primary branches per plant, number of clusters per plant, number of pods per plant, protein content, number of seeds per plant and single plant yield). The cross, L5 x T2 (EC 396120 x IPM 99 125) showed the positively significant standard heterosis for maximum number of five traits *viz.*, number of primary branches per plant, number of cluster per plant, number of pods per plant, protein content and single plant yield. Also, significant and positive standard heterosis was observed for four traits in L4x T1 (AGG 100 91 x CO 7 for days to 50% flowering, number of clusters per plant, number of pods per plant and single plant yield), L1 x T3 (PANT M 103 x MH 565 for number of clusters per plant, number of pods per plant, protein content and single plant yield), L4 x T2 (AGG 100 91 x IPM 99 125 for number of primary branches per plant, number of clusters per plant, number of pods per plant and single plant yield) and L1 x T1 (PANT M 103 x CO 7 for plant height, number of clusters per plant, number of pods per plant and single plant yield). Further, the cross L5 x T7 (EC 396120 x PUSA VISHAL) showed significant and positive standard heterosis for three traits (days to fifty per cent flowering, number of pods per plant and single plant yield). The results obtained in this study are in conformity with the earlier findings of Srivastava *et al.* (2013), Tantasawat *et al.* (2015) and Dhurai *et al.* (2016). Hence, the hybrids those exhibited significant superiority for the yield contributing traits presented in Table 3 can be very well exploited in heterosis breeding. The hybrid, L4 x T8 (AGG 10091 x IPM 0214), possessed the highest plant height than standard check variety CO 7. Research findings of Zubair *et al.* (2010) and Reddy *et al.* (2011) are also concurred with results of the present investigation on plant height. None of the hybrids retrieved positive significant heterosis per cent over standard check CO 7 for pod length but the cross, L1 x T5 (PANT M 103 x IPM 205-7), showed maximum negative and significant value. The hybrid, L2 x T4 (EC 396126 x CO GG 930) recorded the higher protein content than standard check (CO-7) but had negatively significant value for single plant yield and this corroborate with the findings of Khaimichho *et al.* (2014) and Purohit *et al.* (2017). The hybrids *viz.*, L5 x T8 (EC396120 x IPM 0214) and L5 x T5 (EC 396120 x IPM 0205-7) were exhibited higher positive significant per cent over standard check for the traits *viz.*, number of seeds per pod and hundred seed weight, respectively but for single plant yield, L5 x T8 (EC 396120 x IPM 0214) had positive significant standard heterosis while L5 x T5 (EC 396120 x IPM 0205-7) showed negatively significant value. The reports of Khaimichho *et al.* (2014), Tantasawat *et al.* (2015) and Bhavani *et al.* (2017) accordance with the present findings. In the present investigation, it was concluded that the eight promising hybrids presented in the table 3 have enormous potential to make use of the heterosis or to isolate desirable segregants.

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Table 1. Analysis of variance of combining ability for different traits

Source	df	Mean squares										Seed yield/ plant
		Days to 50 percent flowering	Plant height	No, of primary branches	No. of cluster/plant	No. of pods/ cluster	No. of pods/ plant	Pod length	SeedProtein content (%)	No. of seeds/pod	100 seed weight	
Hybrids	39	4.715**	59.877**	0.564**	16.915**	1.045**	278.337**	1.030**	18.205**	5.823**	0.253**	31.562**
Lines	4	13.019*	92.625	0.120	29.686*	1.253**	462.869	3.040*	59.913**	5.597	0.507	74.490
Testers	7	5.613	72.681	0.549	34.585*	0.693	392.773	0.737	20.967	5.923	0.342	24.193
Line x Testers	28	3.304	51.998**	0.631**	10.300**	1.103**	223.367**	0.816**	11.557**	5.830**	0.195*	27.415**
Errors	79	1.561	11.953	0.211	0.928	0.237	7.955	0.144	1.156	1.995	0.109	2.733

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

Table 2. Heterosis range for 11 characters of mungbean

Character	Relative heterosis (di)	Heterobeltiosis (dii)	Standard heterosis (diii)
Days to 50 per cent flowering (days)	-10.64 to 11.28	-16.00 to 10.45	-4.55 to 13.64
Plant height (cm)	-28.50 to 33.07	-35.87 to 19.9	-34.88 to 28.9
No, of primary branches	-40.85 to 66.67	-48.84 to 37.04	-4.55 to 95.45
No. of cluster per plant	53.13 to 182.66	-56.52 to 173.44	-49.15 to 196.61
No. of pods per cluster	-47.5 to 35.71	-57.14 to 18.75	-45.71 to 35.71
No. of pods per plant	-72.48 to 143.75	-68.42 to 108.93	-61.43 to 178.57
Pod length (cm)	-29.41 to 27.26	-34.43 to 24.03	-0.84 to -35.56
Protein content (%)	-34.61 to 27.83	-36.52 to 23.81	-25.33 to 31.50
Number of seeds per pod	-54.46 to 30.68	-57.50 to 21.93	-46.88 to 44.79
100 seed weight (g)	-18.75to 32.03	-27.78 to 21.69	-36.22 to 3.06
Seed yield per plant (g)	-78.94 to 116.75	-79.46 to 93.66	-77.56to 111.54

Table 3. List of promising hybrids

S.No.	Code No.	Cross combination
1.	L1 x T4	PANT M 103 x CO GG 930
2.	L5 x T2	EC 396120 x IPM 99 125
3.	L4 x T1	AGG 100 91 x CO 7
4.	L1 x T3	PANT M 103 x MH 565
5.	L4 x T2	AGG 100 91 x IPM 99125
6.	L5 x T8	EC 396120 x IPM 0214
7.	L1 x T1	PANT M 103 x CO 7
8.	L5 x T7	EC 396120 x PUSA VISHAL