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HETEROSIS STUDIES USING DIALLEL ANALYSIS FOR YIELD AND COMPONENT CHARACTERS IN MUNGBEAN (*VIGNA RADIATA* L. WILCZEK)

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ABSTRACT

Twenty one hybrids of mungbean along with their seven parental lines in diallel fashion excluding reciprocal were studied to assess the extent of standard heterosis over standard check i.e. Samrat for yield and seven component characters. Out of 21 F_1 hybrids, two crosses SML382 x WGG37 and PUSA9871 x WGG37 exhibited highly significant positive standard heterosis for number of clusters per plant, number of pods per cluster, number of pods per plant, number of seeds per pod, 100-seed weight and seed yield per plant. The hybrid SML382 X WGG37 was excelled for number of primary branches per plant. The crosses SML382 x WGG37 and PUSA9871 x WGG37 exhibited high standard heterosis for seed yield per plant which could be an excellent source for developing high yielding mungbean genotypes.

INTRODUCTION

Mungbean (*Vigna radiata* (L.) Wilczek) (2n=2x=22) is an imperative pulse crop, third important pulse crop following chickpea and pigeon pea, covering 2.92 mha area in India with an annual production of 1.42 MT and productivity 486 kg/ha (Dixit, 2005). It is an outstanding source of easily palatable protein containing about 24% protein (Yadav and Lavanya, 2011). Now a day, because of yield potential of improved varieties is not sufficient to attract the farmers as well as consumers due to smaller grain size, low yield potential and susceptibility to various biotic stresses, plant breeders have to hit out the superior crosses by utilization of heterosis (Srivastava and Singh, 2013). It is vital to measure the extent of genetic dissimilarity among the parental lines involved in hybridization programmes for exploitation of heterotic vigour because high genetic dissimilarity among parents exhibits utmost heterotic response (Moll and Stuber, 1976).

The heterosis phenomenon gets immense value due to vigorous performance of F_1 hybrids over its parents and standard check variety (Kumar *et al.*, 2013). In many cross pollinated species like maize, cotton, onion, alfalfa and some vegetables, heterosis has been successfully commercially exploited (Singh *et al.*, 2010). It has been mandatory to exploit heterosis in self pollinated crops like pulses for enhancing productivity. In pulses, a number of researchers has reported and exploited heterosis appreciably for various characters including yield contributing traits (Gupta *et al.*, 2003; Hedge *et al.*, 2007 and Adeyanju, 2009). The objective of present experiment was to estimate the magnitude of standard heterosis (economic heterosis) in 21 cross combinations of seven mungbean genotypes over the standard check variety 'Samrat'.

MATERIALS AND METHODS

The present investigation was undertaken to identify the most suitable F_1 hybrids which surpass the yield of standard check *i.e.* standard heterosis. The material consisted seven elite mungbean genotypes viz; ML287, PDM1, NARP1-1, HUM10, SML382, PUSA9871, WGG37 and a standard check (Samrat) provided by Department of Genetics and Plant Breeding, A. A. I. D. U. All possible crosses among these seven genotypes were made in diallel fashion system without reciprocals to obtain 21 direct crosses. Twenty one F_1 crosses along with seven parents and one check were planted at Field Experimentation Centre of the Department of Genetics and Plant Breeding, AAIDU, Allahabad in a randomized block design with three replications. The row to row distance for each genotype was 30cm and plant to plant 10cm. Five plants were randomly selected and averaged to obtain the mean data for yield and its seven components like no. of primary branches per plant, number of clusters per plant, number of pod per cluster, number of pods per plant, number of seeds per pod, days to maturity, 100-seed weight and seed yield per plant.

The observation for days to maturity was recorded when the colour of approximately 90% pods changed as of green to black/brown. The averaged data was statistically analyzed and analysis of variance was worked out according to Fisher and Yates (1938). While the percentage increase or decrease in performance observed in F_1 over the standard check was calculated according to Meredith and Bridge (1971).

RESULTS AND DISCUSSION

Heterosis, a fundamental tool, used for the improvement of crops in the form of F_1 and F_2 populations by improving the various yield contributing characters. The magnitude of heterosis was reported among the crosses, demonstrating potential of hybrid combinations of seven diverse parents for various traits enhancement in the present research. Table 1 illustrated the analysis of variance (ANOVA) for yield and its seven component characters among twenty one F_1 hybrids and their seven parents. Exceedingly, noteworthy differences among the parents as well as its cross combinations were observed for all characters. The extent of heterosis over standard check variety 'Samrat' for number of primary branches, number of clusters per plant, number of pods per cluster, number of seeds per pod, 100 seed weight (g), seed yield per plant and days to maturity are summarized in Table 2. The results exhibited that the significant heterosis occurred in the hybrids for number of primary branches, number of clusters per plant, number of pods per cluster, number of seeds per pod, 100 seed weight (g), seed yield per plant and days to maturity in consonance with Sharma and Sengupta *et al.* (2013), Makani *et al.* (2013), Singh *et al.* (2013).

The F_1 hybrid SML382 x WGG37 revealed significant positive standard heterosis for number of primary branches (19.64*) while two hybrids showed negative standard heterosis. For number of clusters per plant, the hybrid SML382 x WGG37 showed maximum standard heterosis (26.12*) followed by

Table 1: ANOVA for yield and its seven components in Mungbean

S. No.	Source	df	No. of primary branches	No. of clusters per plant	No. of pods per cluster	No. of pods per plant	No. of seeds per pod	Days to maturity	100-seed weight	Seed yield per plant
1	Replication	2	0.33	0.35	0.42	22.83**	1.65**	2.18	0.09	2.43
2	Treatment	27	0.76**	1.58**	7.81**	82.17**	0.33	96.07**	0.62**	37.71**
3	Parent	6	0.14	0.24	0.66	23.25**	0.21	2.19	0.13	3.52**
4	Hybrid	20	0.36**	1.54**	0.60**	12.94**	0.28	60.92**	0.68**	1.47
5	Parents vs Hybrids	1	12.44**	10.46**	195.10**	1820.32**	2.11**	1362.68**	2.30**	967.61**
6	Error	54	0.15	0.19	0.31	4.43	0.25	5.10	0.12	0.88
7	Total	83	0.35	0.65	2.75	30.17	0.31	34.63	0.28	12.90

** Significant at 1% level.

Table 2: Estimates of standard heterosis for yield and its seven components in Mungbean.

S. No.	Crosses	No of primary branches	No of cluster per plant	No of pods per cluster	No. of pods per plant	No. of seeds per pod	100-seed weight (g)	Seed yield per plant	Days to maturity
1	ML287 x PDM1	-0.30	-5.41	3.66	24.83**	4.39	3.11	1.38	18.54**
2	ML287 x NARP1-1	-6.98	6.88	12.71	26.24**	12.10**	-7.16	0.40	19.10**
3	ML287 x HUM10	-6.98	3.36	12.71	26.69**	8.80*	18.16*	4.74	23.60**
4	ML287 x SML382	-3.69	-7.88	18.22*	27.17**	3.30	-1.18	0.00	18.54**
5	ML287 x PUSA9871	16.95	-13.14*	3.66	5.27	5.51	7.87	-4.15	20.79**
6	ML287 x WGG37	-13.66	-8.93	21.82**	32.29**	8.80*	3.89	2.77	17.42**
7	PDM1 x NARP1-1	-0.2	1.58	12.71	32.76**	8.77*	12.15	4.55	10.11*
8	PDM1 x HUM10	-16.95	-0.21	7.31	32.28**	7.72	23.01**	1.98	20.79**
9	PDM1 x SML382	3.59	-5.47	16.42*	28.56**	4.42	11.24	1.58	19.10**
10	PDM1 x PUSA9871	13.56	-3.68	0.00	12.73	0.00	0.00	-1.98	19.66**
11	PDM1 x WGG37	-6.98	12.09*	14.57	28.18**	7.68	7.30	0.00	20.79**
12	NARP1-1 x HUM10	-20.24*	1.58	7.31	22.97**	6.59	-0.34	-1.58	19.16**
13	NARP1-1 x SML382	2.99	15.55*	10.97	32.29**	9.89*	1.26	5.93	17.42**
14	NARP1-1 x PUSA9871	0.30	5.10	14.57	33.22**	8.80*	29.31**	2.77	19.10**
15	NARP1-1 x WGG37	-3.69	8.62	14.51	29.96**	8.80*	14.29	-4.35	17.42**
16	HUM10 x SML382	6.38	15.55*	18.17*	27.17**	12.10**	16.09*	2.57	19.66**
17	HUM10 x PUSA9871	6.30	1.58	3.66	36.95**	8.80*	31.83**	5.73	19.10**
18	HUM10 x WGG37	-23.53*	-14.14*	10.91	21.12**	3.30	5.59	2.17	1.69
19	SML382 x PUSA9871	-6.98	13.82*	19.97*	37.41**	6.59	27.16**	2.17	5.62
20	SML382 x WGG37	19.64*	26.12*	27.28**	43.00**	9.92*	32.38**	12.25**	-0.56
21	PUSA9871 x WGG37	9.67	24.33*	25.48**	41.60**	8.80*	36.99**	10.87**	-1.69
	S.E.	0.3159	0.3541	0.4578	1.7199	0.4074	0.2826	0.7663	1.8447
	C.D. (0.05)	0.6335	0.7099	0.9178	3.4483	0.8169	0.5667	1.5364	3.6984
	C.D. (0.05)	0.8436	0.9454	1.2222	4.5922	1.0878	0.7547	2.0461	4.9254

*, ** Significant at 5 % and 1% level, respectively.

the hybrid PUSA9871 x WGG37 (24.33*) as similar to Singh *et al.* (2013). Noteworthy positive standard heterosis over check variety for number of primary branches per plant and number of clusters per plant was earlier reported by Kumar *et al.* (2009) and Srivastava and Singh (2013).

Out of 21 F_1 hybrids, the maximum positive standard heterosis for pods per plant revealed by hybrids SML382 x WGG37 (43.00**) followed by PUSA9871 x WGG37 (41.60**) and SML382 x PUSA9871 (37.41**) (Table 2). Zubair et al. (1989), Ghafoor *et al.* (1990) and Zubair *et al.* (2010) reported the similar findings in mungbean while Shinde and Deshmukh (1989) have found similar results in urdbean.

Out of twenty one F_1 hybrids, eleven hybrids exhibited positive heterosis over check 'Samrat' for number of seeds per pod (Table 2). Maximum positive standard heterosis for number of seeds per pod were showed by ML287 x NARP1-1 and HUM10 x SML382 (12.10**) followed by SML382 x WGG37 (9.92*). While, in case of 100-seed weight, out of 21 F_1 hybrids, eight F_1's showed significant positive standard heterosis. The hybrid PUSA9871 x WGG37 (36.99**) exhibited maximum heterosis for 100-seed weight followed by SML382 x WGG37 (32.38**). Similar results were also reported by Dhuppe *et al.* (2010) and Kumar *et al.* (2013).

The maximum standard heterosis for seed yield per plant were exhibited by SML382 x WGG37 (12.25**) followed by the hybrid PUSA9871 x WGG37 (10.87**). Similar results were also found by Kumar *et al.* (2009) in pigeon pea, Dethe and Patil (2008) and Rout *et al.* (2010) in mungbean. Thus, this outcome indicated that heterosis for seed yield was achieved through either heterosis for individual yield components or additive effects of the various yield contributing component traits/characters. The diverse magnitude of heterosis for different characters in F_1 over the parental lines indicated over all dominance or positively acting genes and increased diversity among the parental genotypes in the appearance of heterosis (Srivastava and Singh, 2013).

The present study indicated that low heterosis was reported in number of seeds per pod which can be improved by using genetically variable germplasm of mungbean. The crosses SML382 x WGG37 and PUSA9871 x WGG37 excelled for number of clusters per plant, number of pods per cluster, number of pods per plant, 100-seed weight and seed yield per plant while SML382 x PUSA9871 produced high standard heterosis for number of primary branches per plant. Consequently, the crosses exhibiting significant high heterosis should be exploited to develop high yielding varieties of mungbean. The promising hybrids have enormous potential to make use of the heterosis or to isolate desirable segregants.

REFERENCES

Adeyanju, A. O. 2009. Genetics of harvest index and leaf yield indices in cowpea. *J. Crop Improvement.* **23(3)**: 266-274.

Dethe, A. M. and Patil, J. V. 2008. Heterosis studies in mungbean (*Vigna radiata* (L.) Wilczek). *Legume Res.* **31(1):** 36-39.

Dhuppe, M. V., Wadikar, P. B. and Pole, S. P. 2010. Heterosis in mungbean (*Vigna radiata* L. Wilczek). *Res. J. Agril. Sci.* **1(4)**: 438-440.

Dixit, G. P. 2005. Project Coordinators Report. *Annual Group Meet* (kharif, 2005). IIPR, Kanpur.

Fisher, R. A. and Yates, F. 1938. Statistical tables for biological, agricultural, and medical research. 1st *edition Oliver and Boyd. Edinburgh.*

Ghafoor, A., Zubair, M., Bakhsh, A. and Bashir, M. 1990. Heterosis among seven parents and their crosses in mungbean. *Pakistan J. Agril. Res.* **11(3):** 169-173.

Gupta, S. K., Sarvjeet, S. and Ajinder, K. 2003. Heterosis for seed yield and its component traits in desi x desi and desi x kabuli crosses of chickpea (*Cicer arietinum* L.). *Crop Improvement.* **30(2):** 203-207.

Hedge, V. S., Yadav, S. S. and Kumar, J. 2007. Heterosis and combining ability for biomass and harvest index in chickpea under drought-prone short-duration environment. *Euphytica* **157(1-2):** 223-230

Kumar, A., Baranwal, D. K., Aparna, J. and Srivastava, K. 2013. Combining Ability and heterosis for yield and its contributing characters in Okra (*Abelmoschus esculantus* (L.) Moench). *Madras Agril. J.* **100(1-3):** 30-35

Kumar, C. V. S., Sreelakshmi, C. H. and Varma, P. K. 2009. Studies on combining ability and heterosis in pigeonpea (*Cajanus cajan* L.). *Legume Res.* **32(2):** 92-97.

Makani, A. Y., Patel, A. L., Bhatt, M. M. and Patel, P. C. 2013. Heterosis for yield and its contributing attributes in Brinjal (*Solanum melongena* L.) *The Bioscan.* **8(4):** 1369-1371.

Meredith, W. R. J. and Bridge, R. R. 1972. Heterosis and gene action in cotton (*Gossypium hirsutum* L.). *Crop Science.* **12:** 304-310.

Moll, R. H. and Stubber, C. W. 1976. Quantitative genetics: Empirical results relevant to plant breeding. *Advances in Agron.* **26:** 277-310.

Rout, K., Mishra, T. K., Bastia, D. N. and Pradhan, B. 2010. Studies on heterosis for yield and yield components in mungbean (*Vigna radiata* (L.) Wilczek). *Res. Crops* **11(1):** 87-90.

Sharma, A. and Sengupta, S. K. 2013. Genetic diversity, heritability and morphological characterization in bottle gourd (*Lagenaria siceraria* (mol.) stand). *The Bioscan* **8(4):** 1461-1465.

Shinde, N. V. and Deshmukh, R. B. 1989. Heterosis in urdbean. *Indian J. Pulses Res.* **2:** 119-124.

Singh, A. K., Shahi, J. P. and Rakshit, S. 2010. Heterosis and combining ability for yield and its related traits in maize (*Zea mays*) in contrasting environments. *Indian J. Agril. Sci.* **80(3):** 248-49.

Singh, A. K., Pan, R. S. and Bhavana, P. 2013. Heterosis and combining ability analysis in bittergourd (*Momordica charantia* L.). *The Bioscan.* **8(4):** 1533-1536.

Singh, M., Devi, E. L., Aglawe, S., Kousar, N. and Behera, C. 2013. Estimation of heterosis in different crosses of bread wheat (*Triticum aestivum* L.). *The Bioscan.* **8(4):** 1393-1401.

Srivastava, R. L. and Singh, G. 2013. Heterosis for yield and its contributing characters in mungbean (*Vigna radiata* (L.) Wilczek). *Indian J. Sci. Res.* **4(1):** 131-134.

Yadav, P. S. and Lavanya, G. R. 2011. Estimation of combining ability in mungbean (*Vigna radiata* L. Wilczek) crosses. *Madras Agril. J.* **98(7-9):** 213-215.

Zubair, M., Ghafoor, A., Malik, B. A. and Chaudhry, A. H. 1989. Heterosis, heritability and genetic advance in *Vigna radiata* (L.) Wilczek. *Pakistan J. Botany.* **21(2):** 252-258.

Zubair, M., Ajmal, S. U. and Ali, S. 2010. Heterosis for yield related attributes in mungbean *Vigna Radiata* (L.) Wilczek. *Pakistan J. Botany.* **42(5):** 3209-3214.