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Heterosis for Some Morphological Traits in Mungbean (*Vigna radiata* (L.) Wilczek)

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ABSTRACT

Heterosis over mid, better and top parent values for some important morphological traits (node of the first pod peduncle, nodes on the main stem, no. of pod clusters on the main stem, average internodal length) were estimated in 15 cross combinations derived from a half diallel involving 6 diverse mungbean genotypes. The low extents of heterosis effects were observed for node of the first pod peduncle and average internodal length in the existing mungbean germplasm. The cross combinations having ML-5 as one of the parent may produce segregates with yield potential through more number of pod clusters on main stem. The hybrid VC 3902A x ML-5, which produced high heterotic effects for nodes on main stem and pod clusters on main stem is suggested for exploitation for developing high yielding mungbean varieties.
Key words: heterosis, morphological traits, mungbean

INTRODUCTION

Heterosis has important implications for both in F_1 and for obtaining transgressive segregates in F_2 generation. Genetic information regarding heterosis provides a clue for selecting the most suitable parents for hybridization. The presence of heterosis in food legumes has been demonstrated by Singh *et al*. (1975), and Shinde and Deshmukh (1989). The presence of heterosis can only be utilized in pulse crops for the development of high yielding pure line varieties (Singh, 1971). Little information about heterosis is available in mungbean. The present study was carried out to estimate the extent of heterosis in a 6-parent diallel for utilization of existing genetic variability to develop mungbean cultivar with improved morphological traits.

MATERIALS AND METHODS

Three local (NM 92, 6601 and NM 89) and three exotic (VC 1560D, VC 3902A and ML-5) mungbean genotypes exhibiting wide range of genetic variation were crossed in all possible combinations, excluding reciprocals, during kharif 1997. The parents and F_1's were sown in spring/summer 1998 in a field in a randomized complete block design with three replications. The plot size of 0.6 m^2 (1 row of 2-m length) was assigned for each entry per replication. The row to row and plant to plant space was 30 cm and 10 cm, respectively. At pod maturity, ten competitive plants were randomly chosen to record data for the following characters:

1. Node of the first pod peduncle (The lowest node with a pod bearing peduncle)

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2. Nodes on the main stem (Total number of nodes on main stem)

3. Pod clusters on the main stem (The number of pod clusters on main stem)

4. Average internodal length (cm) [plant height from first node to last node/total number of nodes]

The data were subjected to analysis of variance following Steel and Torrie (1980). Heterosis and heterobeltiosis were calculated as percent increase or decrease over mid and better parent values, respectively. Further increase or decrease over top parent included in hybridization program was also calculated.

RESULTS AND DISCUSSION

The estimates of mean squares were highly significant for all the traits studied (Table 1). The heterosis over mid, better and top parents are presented in Table 2.

In mungbean pod peduncles start developing

Table 1 Means and analysis of variance for some important morphological traits in 6 parent half diallel cross of mungbean.

Genotypes	Node of the first pod peduncle	Nodes on main stem	Pod clusters on main stem	Average internodal length (cm)
NM 92	3.3[TP]	7.1	4.9	3.9[TP]
6601	4.9	8.1	4.1	5.0
NM 89	3.9	8.3	5.4[TP]	4.5
VC 1560D	5.5	8.9	4.5	4.4
VC 3902A	5.4	9.1	4.5	4.6
ML-5	4.9	9.5[TP]	4.9	5.0
NM 92 x 6601	3.7	8.0	5.3	4.1
NM 92 x NM 89	3.7	7.7	5.0	4.2
NM 92 x VC 1560D	3.7	7.3	4.6	4.3
NM 92 x VC 3902A	3.6	8.2	5.6	4.4
NM 92 x ML-5	3.8	8.5	5.7	4.5
6601 x NM 89	3.9	8.7	5.7	4.6
6601 x VC 1560D	4.3	8.4	5.1	4.6
6601 x VC 3902A	5.2	9.2	5.0	4.8
6601 x ML-5	4.7	9.6	5.9	4.7
NM 89 x VC 1560D	4.3	8.1	4.8	4.8
NM 89 x VC 3902A	4.4	9.2	5.8	4.6
NM 89 x ML-5	4.2	9.3	6.1	4.6
VC 1560D x VC 3902A	4.8	8.6	4.8	4.7
VC 1560D x ML-5	5.0	9.7	5.7	4.4
VC 3902A x ML-5	5.7	10.9	6.2	5.1
MS (Genotypes)	1.54**	2.33**	0.26*	1.02**

TP = Top parent *,** = Significant at 0.5 and 0.1 levels

Table 2 Heterosis over mid, better and top parental values for some important morphological traits in 6 parent half diallel cross of mungbean.

F_1 cross combination	Node of the first pod peduncle				Nods on main stem			
	Heterosis (%) over			Average heterosis (%)	Heterosis (%) over			Average heterosis (%)
	MP	BP	TP		MP	BP	TP	
NM 92 x 6601	-9.76	102.12	12.12	4.83	5.26	-1.23	-15.79	-3.92
NM 92 x NM 89	2.77	12.12	12.12	9.00	0.00	-7.23	-18.95	-8.73
NM 92 x VC 1560D	-15.90	12.12	12.12	2.78	-8.75	-17.98	-23.16	-12.68
NM 92 x VC 3902A	-18.18	9.09	9.09	0.0	1.23	-9.89	-13.68	-7.45
NM 92 x ML-5	-7.31	15.15	15.15	7.66	2.40	-10.53	-10.53	-6.22
6601 x NM 89	-11.36	0.0	18.18	2.27	6.09	4.82	-8.42	0.83
6601 x VC 1560D	-17.30	-12.24	30.30	0.25	-1.17	4.82	-11.58	-2.64
6601 x VC 3902A	0.00	6.12	57.58	21.23	6.97	1.10	-3.16	1.64
6601 x ML-5	-4.08	-4.08	42.42	11.42	9.09	1.10	1.05	3.75
NM 89 x VC 1560D	-8.51	10.26	30.30	10.68	-5.81	1.05	-14.74	-6.5
NM 89 x VC 3902A	-6.38	12.82	33.33	13.26	5.74	1.10	-3.16	1.23
NM 89 x ML-5	-4.54	7.69	27.27	10.14	4.49	-2.11	-2.11	0.09
VC 1560D x VC 3902A	-12.72	-11.11	45.45	7.21	-4.44	-5.49	-9.47	-6.47
VC 1560D x ML-5	-3.84	2.04	51.52	16.57	5.43	2.11	2.11	3.22
VC 3902A x ML-5	9.61	16.33	72.73	32.89	17.20	14.74	7.37	13.10
Average	-7.17	5.90	31.31		2.92	-1.57	-8.28	

F_1 cross combination	Pod clusters on main stem				Average internodal length (cm)			
	Heterosis (%) over			Average heterosis (%)	Heterosis (%) over			Average heterosis (%)
	MP	BP	TP		MP	BP	TP	
NM 92 x 6601	17.77	8.16	-1.85	8.03	-7.86	5.13	5.13	0.8
NM 92 x NM 89	-2.91	-7.01	-8.0	-5.97	0.00	7.69	7.69	5.13
NM 92 x VC 1560D	-2.12	-6.12	-14.81	-7.68	3.61	10.26	10.26	8.04
NM 92 x VC 3902A	19.14	14.29	3.57	12.33	3.52	12.82	12.82	9.72
NM 92 x ML-5	16.32	16.32	5.56	12.73	1.12	15.38	15.38	10.63
6601 x NM 89	20.00	5.56	5.56	10.37	-3.15	2.22	17.95	5.67
6601 x VC 1560D	18.60	13.33	-5.56	8.79	-2.12	4.55	17.95	6.79
6601 x VC 3902A	16.27	11.11	-7.41	6.66	0.00	4.35	23.08	9.14
6601 x ML-5	31.11	20.41	9.26	20.26	-6.00	-6.0	20.51	2.84
NM 89 x VC 1560D	-3.03	-11.11	-11.11	-8.42	7.86	-.09	23.08	13.34
NM 89 x VC 3902A	17.17	7.41	7.41	10.66	1.09	2.22	17.95	7.09
NM 89 x ML-5	18.44	12.96	12.96	14.79	-3.15	2.22	17.95	5.67
VC 1560D x VC 3902A	6.66	6.67	-11.11	0.74	4.44	6.82	20.52	10.59
VC 1560D x ML-5	21.27	16.33	5.56	14.39	-6.38	0.0	12.82	2.15
VC 3902A x ML-5	31.91	26.53	14.81	24.42	6.25	10.87	30.77	15.96
Average	15.11	8.99	0.32		-0.05	5.23	16.92	

MP = Mid parent, BP = Better parent, TP = Top parent from 4th to 7th node of the main stem (Khattak *et al*., 1999). The pod peduncle developed at these lower nodes of the main stem may produce more seed yield per plant in mungbean. Similar results have also been reported in chickpea by Saxena *et al*. (1980) that the lower nodes should also bear fruiting peduncles to produce more seed yield. The negative heterosis, therefore, is desired for the node of the first pod peduncle to develop mungbean genotypes with pods bearing peduncles on lower nodes of the main stem. The results regarding the node of the first pod peduncle showed that 12 cross combinations produced negative heterosis over mid and 3 over better parent. The extent of heterosis for this trait was very low in the existing mungbean germplasm.

Four cross produced a positive heterosis over mid parent, 7 over better parent and 12 over top parent for nodes on main stem. The cross combination VC 3902A x ML-5 produced maximum average heterosis effect. The results for pod clusters on main stem revealed that 3 hybrids produced positive heterosis over the mid parent, 3 over the better parent and 7 over the top parent. Twelve hybrids gave positive average heterosis for this trait. The cross combination VC 3902A x ML-5 produced the highest average heterosis. The heterotic effects for pod clusters on main stem were higher than nodes on main stem which indicated that seed yield per plant can be improved in existing mungbean germplasm through selection of more clusters on main stem.

In mungbean the erect plants with thick small internodes show resistance to lodging resistant (Tickoo *et al*., 1996 ; Khattak *et al*., 1999). Thus , short internodal length is desirable in mungbean and negative heterosis for average internodal length is useful. The results for average internodal length showed that 6 cross combinations produced negative heterosis over mid parent and 2 over better parent included in hybridization. The extent of heterotic effects for this character was very low which imposed restriction on the development of small internodal mungbean genotype using existing mungbean germplasm. Therefore, exotic lines of mungbean bearing erect plant with thick small internodes should be imported to breed lodging resistant mungbean genotypes particularly for the kharif season.

The present study revealed that the hybrid VC 3902A x ML-5 which produced high heterotic effects for nodes on main stem and pod clusters on main stem migth be exploited for the above traits to develop high yielding mungbean cultivars.

LITERATURE CITED

Khattak, G. S. S., M. A. Haq, M. Ashraf, and G. R. Tahir. 1999. Genetic variability and correlation studies in mungbean (*Vigna radiata* (L.) Wilczek). Suranaree J. Sci. Technol. 6 : 65-69.

Saxena, N. P. and A. R. Sheldrake. 1980. Physiology of growth development and yield of chickpea in India, pp. 106-120. *In* Proceedings of the International Workshop on Chickpea Improvement. ICRISAT, India.

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

Singh, K. B. 1971. Heterosis breeding in pulse crops. All-India Pulse Conference, Haryana Agricultural University, Hissar.

Singh, T. P., K. B. Singh, and R. S. Malhotra. 1975. Heterosis and combining ability in lentil. Indian J. Agric. Sci. 45 : 159-263.

Steel, R. G. D. and J. H. Torrie. 1980. Principles and Procedures of Statistics-Reference to the Biological Science. McGraw Hill Book Company, Inc., New York.

Tickoo, J. L., Gajraj, R. Matho, and C. Manji. 1996. Plant type in mungbean (*Vigna radiata* (L.) Wilczek), pp. 197-213. *In* A. N. Asthana and D. H. Kim (eds.). Proceedings of Recent Advances in Mungbean Research. Indian Society of Pulses Research, Kanpur.