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Genetic Inheritance For Yield and its Components Traits in *Vigna Radiata* L.wilczek

KEYWORDS

Manoj Katiyar	Rakesh Kumar Vishwakarma
Legume Section, C.S.Azad University of Agriculture and Technology, Kanpur-208002, India	Legume Section, C.S.Azad University of Agriculture and Technology, Kanpur-208002, India

ABSTRACT *Ten diverse (Vigna radiata L. Wilczek) genotypes of mungbean were crossed in a diallel fashion, excluding reciprocals, to produce 45 F1'S, F1 and F2 generations alongwith their parents were evaluated during Kharif 2014. Predominant role of non–additive gene action was observed for the inheritance of days to flower initiation, days of reproductive period, days to maturity, plant height and number of branches per plant in F1 and F2 generations. Average degree of dominance revealed presence of over-dominance for most of the traits in both the generations. Thus K851, T44, PDM11 and Pant M1 were good general combiners for all traits in both generations. The crosses T 44 x Pant M1, ML 267 x ML 337, K 851 x Pant M1, G 65 x ML 337, G 65 x ML 267 and K 851 x T 44 were common crosses in both the generations with significant sca effects in desirable direction for day to flowering initiation, days of reproductive period, days to maturity, plant height and number of branches per plant.*

INTRODUCTION

In India, there are about a dozen pulse crops, among them green gram is highly priced and being of short duration and having wide adaptability, it is grown all the year round. In the present day of input responsive agriculture, there is a need to breed varieties which as a result of their ability to respond to better quantity of grain besides early and synchronous in maturity. Equally important perhaps is the need to develop photo and thermo insensitive varieties with better harvest index. Viewed in this context, the present investigation has been taken up.

MATERIAL AND METHOD

Ten diverse mungbean (*Vigna radiata* L. Wilczek) genotypes viz., K 851, T 44, PDM 11, Pant M 1, Pant M 2, K 1125, Pusa 16, G65, ML267, and ML337 representing wide spectrum of variation were crossed in a diallel fashion, excluding reciprocals, to produce 45F_1's or The experiment consisting of 10 parental lines, 45F_1's and 45 F_2's were grown in randomized block design with 3 replications during *Kharif*, 2014. Parents and F_1's grown in a single row while F_2's length were grown two rows plot each of 3m length with spacing of 25 x 5 cm. Observations were recorded on 10 randomly competitive plants in parents and F_1's and 20 plants in F_2's from each replication for phenological traits (days to flower initiation, days of reproductive period, days to maturity) and structural traits (plant height in cm and number of branches per plant.) The data were subjected to analysis of components of genetic variance following Hayman(1954) and combining ability variances and effects was worked out using Griffing's method-II and Model-1 (Griffing, 1956).

RESULTS AND DISCUSSION

Estimates of components of genetic variance and related statistics are presented in Table 1. The dominance components (H_1 and H_2) were found to be significant in both F_1 and F_2 for all the traits indicating the preponderance of non-additive gene action in the inheritance of the traits. The values of H_1 in F_1 and F_2 were significant for all the traits except number of branches and days to flowering initiation in F_2 indicating unequal distribution of genes, whereas in case of number of branches and days to flower initiation in F_2 genes were found to be balanced distributed as evident by higher value of H_2 than H_1. Non-significant values of F indicated an excess of recessive allele for all the traits. The highly significant values of h^2 for days to flowering initiation, days of reproductive period and number of braches per plant in F_2 generation further confirmed predominant role of non-additive components in their inheritance. An estimate of average degree of dominance $[(H_1/D)^{0.5}]$ was negative in F_1 and in F_2 for days to flowering initiation and days of reproductive period suggesting the presence of partial and over-dominance, respectively. The partial dominance was also observed for number of branches per plant in both F_1 and F_2 generations. However, days to maturity and plant height exhibited over-dominance in F_1 as well as in F_2 generations. The values of $H_2/4H_1$ were very close to 0.25 for days to flower initiation and days of reproductive period in both F_1 and F_2 generations suggesting large measures of symmetry in the proportion of positive and negative alleles at loci exhibition dominance. However, in case of days to maturity, plant height and number of branches per plant, the ratio ($H_2/4H_1$) deviated significantly from 0.25 in both the generations' indicating asymmetry in gene distribution. The ratio of h^2/H_2 was more than unity for days to flower initiation in F_2 suggesting that this trait was governed by more than one major gene group, while in remaining cases it was either negative or positive but less than unity, which may probably be due to gene interaction.

Variances due to gca were significant for days to flower initiation in F_1, days of reproductive period, days to maturity and plant height in both the generations indicating role of non-additive gene actions in the inheritance of these traits (Table 2). Although, days to maturity and number of branches also had significant values of gca variances, which reflected preponderance of additive genetic variance. It may be suggested that reciprocal recurrent selection or biparental mating could effectively be employed for improvement of such traits. Non-additive gene action has also been reported by various *et al* workers for days to flowering (Deshmukh and Manjare, 1981, Naidu *et al*. 1992), days of reproductive period (Patel. 1988), days to maturity (Deshmukh and Manjare, 1981), plant height (Patel *et al*. 1988), number of branches (Singh, 1980 and Naidu *et al*. 1992). The estimates of gca effects of parents

Volume : 5 | Issue : 2 | Feb 2015 | ISSN - 2249-555X

for all the characters in both (F_1 and F_2) generations are given in Table 3. For days to flowering initiation, PDM11 followed by Pant mung 2, Pant mung 1, K 851, T 44 and ML 267 in F_1 and PDM 11 followed by ML 267, T 44, K 851 and ML 337 in F_2 were good general combiners for earlier flowering. With regards to days of reproductive period PDM 11 followed by K 851, Pant mung 1, T 44 and K 1125 in F_1 and PDM 11 followed by T 44, K 851, ML 337 and Pant mung 1 in F_2 were good general combiners. For early maturity K 851, followed by T 44, PS 16, ML 337, PDM 11 and ML 267 in F_1 and PS 16 followed by PDM 11, Pant mung 1, K 851 and T 44 were good general combiners. For plant height PS 16 followed by Pant mung 2, T 44, K 851 and K 1125 in F_2 and G 65 followed by PS 16, T 44, Pant mung 2, K 851 in F_2 were good general combiners for short plant stature. PDM 11 followed by T 44, K 851, Pant mung 1 in F_1 and K 851 followed by T 44, PDM 11 and Pant mung 1 in F_2 were good general combiners for number of branches per plant. The above genotypes high as good general combiners for various traits were also having high per se performance for respective traits.

As many as 13 crosses in F_1 and 9 crosses in F_2 showed significant desirable sca effects for days to flower initiation. Five cross combinations with desired sca effects in order of merit were T 44 X Pant mung 1, G 65 x ML 337, PDM 11 x ML 337, PS 16 x G 65 and ML 267 x ML 337 in F_1 and ML 267 x ML 337, PS 16 x G 65, PS 16 x ML 267, T 44 x Pant mung 1 and PDM 11 x ML 337 in F_2 generation. For days of reproductive period 18 crosses in F_1 and 15 crosses in F_2 showed desirable sca effects. The five best cross combinations in order of merit were PDM 11x G 65, G 65 x ML 337, PDM 11 x ML 337, T 44 x G 65 and G 65 x ML 267 in F_1 and T 44 x G 65, K 851 x K 1125, PS 16 x G 65, PS 16 x ML 267 and ML 267 x ML 337 in F_2 generation. Significant sca effects for days to maturity were observed in 17 crosses in F_1 and 16 in F_2. The best 5 crosses with high sca values in F_1 were K 1125 x M 267, T 44 x Pant mung 2, Pant mung 1 x PS 16, T 44 x ML 267and G 65x ML 337 and PDM 11 x ML 267, K 851 x Pant mung 2, K 851 x Pant mung 1, PS 16 x G 65 and PDM 11 x K 1125 in F_2 generation. For plant height 15 cross in F_1 and 16 crosses in F_2 showed desirable sca effects. The 5 best cross combinations in order of merit were K 1125 x ML 267, Pant mung 1 x Pant mung 2, K 851 x Pant mung 2 and G 65 x ML 267 in F_1 and Pant m 1 x ML 267, Pant mung 2 x ML 267, K 851 x T 44, K 851 x G 65 and T 44 x PDM 11 in F_2 generation. For number of branches per plant significant sca effects were recorded in 15 crosses in F_1 and 14 crosses in F_2. Five best crosses in order of decreasing values were K 851 x ML 337, K 851 x K 1125, ML 267 x ML 337, PS 16 x G 65 and Pant mung 1 x ML 267 F_1 and G 65 x ML 337, T 44 x Pant mung 2, K 851 x Pant mung 1, G 65 x ML 267 and PS 16 x ML 267 in F_2 generations. The above mentioned crosses for various traits involved all three combinations between parents with high and low gca effects; viz., high x high, high x low and low x low. A good cross combination does not always accrue as a result of crossing between high x high or high x low combiners. Low x low combiners are also likely to yield best crosses (Chowdhary, 1974).

Table 1: Components of Genetic Variance and related statistics

Components	Days to flower		Days to reproductive period		Days to maturity		Plant height		Number of branches per plant	
	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2
$\hat{D}$	-0.651	0.116	-0.434	0.336	1.022	0.901	4.774	4.394	-0.006	0.008
	±0.766	±0.249	±1.895	±0.554	±1.567	±0.870	±9.626	±7.092	±0.175	±0.053
$\hat{F}$	-1.350	0.172	-1.353	0.945	1.977	2.647	14.165	-2.534	-0.149	-0.006
	±1.767	±1.147	±4.371	±2.558	±.669	±.016	±.211	±32.726	±0.404	±0.224
$\hat{H}_1$	4.717**	0.497	13.116**	10.436*	9.242**	23.797**	73.066**	183.117**	0.797*	0.080
	±1.630	±2.116	±4.033	±4.720	±2.462	±7.411	±20.499	±60.382	±0.373	±0.450
$\hat{H}_2$	4.543**	0.554	12.942**	10.178*	7.198**	22.150**	57.625**	165.381**	0.661	0.091
	±1.386	±1.799	±3.427	±4.012	±2.093	±6.298	±17.415	±51.318	±0.316	±0.383
$\hat{h}^2$	-0.293	3.554**	-0.542	-7.520**	-0.107	-7.060	0.348	-56.328	-0.772	-1.657
	±0.928	±1.205	±2.296	±2.688	±1.402	±4.220	±11.668	±34.384	±0.212	±0.256
$\hat{E}$	1.438**	0.659**	1.899**	1.136**	0.381	0.500	3.842	4.293*	0.204**	0.126**
	±0.231	±0.075	±0.571	±0.167	±0.349	±0.262	±2.902	±2.138	±0.053	±0.016
$(\hat{H}_1/\hat{D})^{0.5}$	@	2.067	@	5.572	3.007	5.139	3.912	6.455	@	@
$(\hat{H}_2/4\hat{H}_2)$	0.241	0.279	0.247	0.244	0.195	0.233	0.197	0.226	0.207	0.286

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$\hat{}\ \hat{}$ $(4DH_1)^{0.5}$ +F / $\hat{}\ \hat{}$ $(4DH_1)^{0.5}$ +F	@	2.109	@	1.675	1.948	1.800	2.222	0.914	@	@
$\hat{}\ \hat{}$ h^2/H_2	-0.064	6.413	-0.042	-0.739	-0.015	-0.319	0.006	-0.341	-0.109	-18.216
r	0.744	-0.115	0.036	-0.261	-0.090	-0.824	0.797	-0.222	0.301	0.387

***significant at 5per cent level; **significant at 1per cent level**

Table 2: Analysis of Variance for Combining Ability

Components	df	Days to flower		Days to reproductive period		Days to maturity		Plant height		Number of branches per plant	
		F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2
G C A	9	2.743	0.856	3.707	1.168	2.636**	0.802	13.642	30.025**	0.593*	0.090
S C A	45	1.971*	0.794	4.330**	1.814*	2.187**	1.912**	17.914**	14.962**	0.293	0.128
Error	108	1.389	0.659	1.736	1.136	0.375	0.500	3.858	4.293	0.206	0.127
$\hat{\sigma}^2_g$		0.064	0.008	-0.051	-0.054	0.037	-0.092	-0.356	1.255	0.025	-0.003
$\hat{\sigma}^2_s$		0.582	0.105	2.596	0.678	1.811	1.411	14.056	10.669	0.086	0.001
$\hat{\sigma}^2_e$		1.389	0.659	1.736	1.136	0.375	0.500	3.858	4.293	0.206	0.127
$\hat{\sigma}^2_g/\hat{\sigma}^2_s$		0.110	0.076	-0.020	-0.080	0.021	-0.065	-0.025	0.118	0.291	-3.000
$(\hat{\sigma}^2_s/\hat{\sigma}^2_g)^{0.5}$		3.01	3.623	@	@	6.950	@	@	2.916	2.916	@

***significant at 5per cent level; **significant at 1per cent level**

Table 3: Estimates of General Combining Ability effects

Components	Days to flower		Days to reproductive period		Days to maturity		Plant height		Number of branches per plant	
	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2
K 851	-0.876**	-0.591**	0.640**	0.579**	-0.512**	-0.550**	-1.179**	-0.981**	0.278**	0.283**
T 44	-0.856**	-0.626**	0540**	0.645**	-0.502**	-0.541**	-1.314**	-1.00**	0.312**	0.276**
PDM 11	-0.962**	-0.673**	0.665**	0.768**	-0.446**	-0.561**	1.603	1.972**	0.345**	0.269**
Pant M 1	0.893**	0.633**	0.579**	-0.523**	0.884**	-0556**	-1.326**	1.999**	0.253**	0.258**
Pant M 2	-0.952**	0.359	-0.785**	-0.340	0.365*	0.794**	0.604	-0.993**	-0.472**	0.042
K 1125	0.948**	0.880**	0.323*	0.110	0.834**	-0.346	-1.055*	1.235**	0.226**	-0.387*
PS 16	0.986**	0.719**	-0.214	-0.665**	-0.462**	-0.563**	-1.939**	-1.982**	-0.148	-0.257**
G 65	0.664*	0.509*	-0.957**	-0.813**	0.733**	0.758**	0.972*	-2.785**	-0.372	-0.302**
ML 267	-0.819*	-0.654**	-0.854**	-0.889**	-0.448**	0.632**	1.805**	1.038	0.036	0.039
ML 337	0.974**	-0.556**	0.063	0.531**	-0.449**	0.932**	1.831**	2.295	-0.446**	-0.302**
S.E(gj)±	0.323	0.222	0.161	0.192	0.168	0.14	0.438	0.367	0.084	0.097
S.E(gi-gJ)±	0.481	0.331	0.538	0.435	0.250	0.289	0.802	0.846	0.185	0.145

***significant at 5per cent level; **significant at 1per cent level**

Table 4: Estimates of Specific Combining Ability

Cross	Days to flower		Days to reproductive period		Days to maturity		Plant height		Number of branches per plant	
	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2
K 851 X ML 267	-0.193	-0.177	0.591	1.49**	0.155	1.466**	6.459**	1.916	0.598**	0.011
PDM 11 X K 1125	0.210	0.221	-0.484	-3.66**	-0.245	-1.66	-1.895	1.498	-0.429*	0.574**
PM 1 X PM 2	2.596**	-0.268	-1.862**	0.942	0.769**	0.867**	-5.555**	-4.187**	-0.760*	-0.283
PDM 11 X G 65	-1.173**	0.238	4.333**	0.268	3.399**	2.817**	2.778*	-1.057	0.012	-0.215
K 1125 X G 65	2.024**	0.743	-2.462**	0.384	-0.415	1.260**	0.823	0.029	0.029	-0.157

K 851 X ML 337	-0.734	0.317	1.702	0.745	0.991**	1.220**	1.983	1.665	0.435*	0.117
T 44 X G 65	-0.432	1.102**	2.974**	3.938**	2.677**	1.515**	-2.320*	-3.322**	-0.043	-0.438**
T 44 X ML 267	1.757**	-0.920	-3.195**	1.102	-1.681**	0.368	0.603	1.312	-0.482**	0.054
PDM 11 X PM 1	-1.624**	0.065	1288	0.010	-0.531	-0.241	3.698**	0.572	0.643**	0.262**
PM 2 X ML 267	-0.798	0.873	1.849	-0.341	0.802	0.714	0.323	-7.262**	-0.329	-0.825**
PS 16 X ML 267	0.988	-1.247**	-0.862	1.758**	-0.117	0.476	0.210	10.799**	-0.527**	0.658**
T 44 X PM 1	-4.218**	-1.203**	2.334**	1.682**	-1.454**	-1.390**	-5.457**	3.695**	0.688**	0.541**
PM 1 X ML 337	-0.284	0.165	1.505	-0.200	0.966**	-0.064	1.385	1.832	0.162	-0.129
PM 2 X K 1125	-1.809**	1.252**	1.535**	-1.626**	2.571**	-0.454	3.268**	-4.732**	0.235	-0.662**
K 1125 X PS 16	2.627**	-1.071**	-2.259**	0.431	0.224	-0.692	2.335*	-1.977	0.190	-0.014
T 44 X PM 2	-1.168**	-0.336	-0.995	-0.262	-2.401**	-0.693	0.018	2.298	-0.149	0.795**
K 1125 X ML 267	0.271	1.263**	-3.579**	-2.647**	-3.551**	-1.433**	-6.401**	-0.009	-0.557**	0.070
ML 267 X ML 337	-1.854**	-1.731**	1.871**	1.695**	-1.217**	-1.182**	-3.556**	-4.210**	0.879**	0.604**
PDM 11 X PS 16	-0.712	0.701	2.224**	0.288	1.713**	1.132**	1.352	-0.610	-0.082	0.188
K 1125 X ML 337	-0.882	0.413	0.330	0.654-	0.534	1.275**	-1.986	1.910	1.810**	-0.420**
K 851 X PM 1	-1.727**	1.654**	1.506**	1.398**	-1.162**	-2.218**	-2.958**	-4.079**	0.527**	0.790**
PS 16 X G 65	-1.963**	-1.318**	1.634**	1.815**	-1.342**	-1.884**	-3.404**	-3.501**	0.871**	0.511**
K 851 X PS 16	0.485	0.913*	1.696**	0.009	1.933**	1.083**	5.404**	0.809	-0.177	-0.326
G 65 X ML 337	-2.641**	1.189**	4.154**	1.350**	-1.484**	-1.606**	-3.748**	-3.348**	0.615**	0.892**
T44 X ML 337	-0.959	0.759*	0.113	-0.313	-0.716	0.394	-3.674**	-1.442	0.254	0.148
PDM 11 X ML 267	0.138	0.144	-0.181	-2.081**	-0.020	-2.263**	2.458	2.395	-0.363	-0.323
K 851 X G65	-0.920	0.548	-0.317	-1.587**	-1.215**	-1.053**	-0.345	-5.152**	-0.090	0.030
G 65 X ML 267	-1.651**	-0.674	2.421**	1.483**	0.905*	-1.389**	-4.278**	3.633**	0.802**	0.675**
K 851 X T 44	-1.571**	1.017**	1.181**	1.360**	-0.854	-1.254**	-3.292**	-6.686**	0.640**	0.596**
PDM 11 X ML 337	-2.473**	-1.139**	3.102**	0.309	0.663	-0.349	-0.647	-1.696	0.685**	-0.408**
PM 2 X ML 337	0.568	-0.063	-2.154**	0.046	-1.465**	-0.046	-3.333**	-1.676	0.343	0.284
PS 16 X ML 337	-0.423	-0.602	1.277**	-0.627	0.983*	-1.303**	0.414	0.894	0.048	0.131
T 44 X K 1125	-0.587	-0.299	0.344	1.470**	-1.331**	1.109**	1.734	-1.484	-0.496**	0.160
PM 2 X G 65	0.235	0.573	0.246	-1.433**	0.344	-0.954*	4.494**	-0.526	-0.202	-0.431**
PM 1 X PS 16	0.991*	1.152**	-3.204**	-2.075**	-2.073**	-0.982*	-1.878	-0.416	-0.577**	-0.123
T 44 X PS 16	-0.459	0.676	-0.284	-0.661	-0.731*	0.007	-1.594	-2.664	0.232	0.393**
PM 1 X ML 267	-1.843**	1.473**	1.121**	1.591**	0.821*	-0.614	4.119**	-9.519**	0.713**	0.654**
PM 1 X K 1125	0.866*	0.542	0.319	-0.084	0.930*	0.456	3.595**	-3.906**	0.382	-0.253
PDM 11 PM 2	-0.845*	-0.059	1.435**	0.241	0.613	0.218	2.434*	-0.076	-0.960**	0.073
K 851 X PDM 11	0.818*	0.157	-2.181**	-0.647	-1.240**	-0.554	-0.901	-4.775**	0.260	0.025
PM 1 X G 65	0.441	0.442	0.416	0.927*	0.602	1.315**	2.109	6.293**	-0.313	0.167
K 851 X PM 2	1.530**	-0.832*	-1.901**	-1.552**	-0.342	-2.429**	-4.776**	2.459*	0.479**	0.469**
PM 2 X PS 16	-0.290	0.233	-0.945*	-1.603**	-1.379**	-1.406**	-3.605**	-2.964*	-0.190	0.032
T 44 X PDM 11	-0.368	-0.025	1.571**	1.292**	1.338**	1.233**	2.244*	-4.955**	0.201	0.410*
K 851 X K 1125	0.088	-0.753*	1.335**	1.929**	1.180**	1.136**	-2.990	5.203**	0.896**	-0.154

***significant at 5per cent level; **significant at 1per cent level**

REFERENCE

1. Hayman, B.I. 1954. Analysis of variance of diallel tables pea. Biometrics 10: 336-355. | 2. Griffing, 1956. Concept of general and specific combining ability in relation to diallel crossing system. Australian Journal of Biological sciences. 9 : 463-493. | 3. Singh, R.P. 1980. Genetics of certain yield characters in green gram [Vigna radiata(L.) Wilczek]. | 4. Deshmukh, R.B. and Manjare, M.R. 1981. Combining ability in mungbean (Vigna radiata L. Wilczek) Legume Research, 3 (2) :97-101. | 5. Patel, J.A.; Patel, S.A.; Zaveri, J.A. and Pathak, A.R. (1988). Combining ability analysis of mungbean. Indian Journal of Pulses Research, 1 (2) : 186-187. | 6. Naidu, N. V. Satyanarayana, A. and seenaiah, P. (1992). Combining ability for yield and yield components in mungbean [Vigna radiate (L.) Wilczek]. Indian journal of Pulses Research, 1(1) : 23-26. | 7. Chaudhary, B.D. 1974. Estimation of genetic parameters in barley by diallel and its modifications. Unpub. Ph.D. Thesis, Haryana Agril. University Hissar. | 8. Gavande,-N-A; Aher,-R-P; Patil,-C-M; Jagtap,-P-K.2007. Combining ability studies in green gram. Annals-of-Plant-Physiology; 21(1): 61-63 | 9. Marappa,-N; Savithramma,-D-L; Prabuddha,-H-R; Jayesh,-K-C 2008. Genetic variability study in mungbean and related species for yield and its attributes. Research-on-Crops; 9(2): 364-366. | 10. Muhammad Arshad Muhammad Aslam Muhammad Irshad 2009. Genetic variability and character association among morphological traits of mungbean, Vigna radiata L. Wilczek genotypes. Journal of Agricultural Research (Lahore).. 47: 2, 121-126. 15 ref. | 11. NBarad,-H-R; Pithia,-M-S; Vachhani,-J-H 2008. Heterosis and combining ability studies for economic traits in genetically diverse lines of mungbean [Vigna radiata (L.) Wilczek]. Legume-Research; 31(1): 68-71. | 12. Rout,-K; Mishra,-T-K; Bastia,-D-N; Pradhan,-B 2010. Studies on heterosis for yield and yield components in mungbean [Vigna radiata (L.) Wilczek] Research-on-Crops; 11(1): 87-90. | 13. Khajudparen, -p; tantasawat-p,2011. relationship and variability of agronomic and physiological characters in mung[Vigna radiata (L.) Wilczek]..;african journal of biotechnology; 10(49):9992-10000. |