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Genetic Variability and Character Association in Local Green (*Vigna radiata* (L.) Wilczek.) Genotypes of Karnataka

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Abstract

An experiment was conducted to evaluate the performance of green gram/mungbean genotypes during *kharif* of 2001 and *rabi*/summer of 2002. The experiment was laid out in the randomized block design with two replications to study the phenotypic and genotypic variance, coefficient of variance, heritability genetic advances, correlation coefficient and path coefficient analysis were conducted for yield and yield attributing components on 85 green gram genotypes. High heritability estimates coupled with high genetic advance were observed for 100 seed weight, pod length, plant height and number of seeds per pod in *kharif,* while in summer for plant height, seed yield, number of pods per plant and 100 seed weight. In *kharif* yield was positively and significantly correlated with number of pods per plant, seeds per pod, pod length and number of pods per cluster, while in summer with plant height, number of pimary branches, number of pods per plant and number of pods per cluster. In *kharif* number of pods per plant, pod length and number of pods per cluster contributing maximum positive and direct effect on yield, while in summer same trend but in addition to plant height on yield indicating these characters/traits should be given emphasis for selecting high yielding green gram cultivars for rainfed conditions.

Key words : Genetic variability, Correlation, Path analysis, Green gram.

Mungbean (*Vigna radiata* (L.) Wilczek) is the third most important pulse crop in India, covering an area of 3.4 million hectares with a total production of 1.31 million tones. The productivity in the country is 425 kg per hectares (1). The area under mungbean has doubled in the last two decades at an annual rate of 2.5% in the country. This crop has a great potential for expansion to many non-traditional areas due to its short duration (60 to 80 days) and ability to fit into a wide array of niches available in the existing cropping system. An extra crop of mungbean in between two major crops from the same piece of land helps the farmer to increase the farm productivity per unit area. Mungbean can be grown in all the seasons (*kharif, rabia* and summer) being a legume crop fixes atmospheric nitrogen and thereby increases soil fertility. But due to the expansion of high yielding varieties of cereal crops like wheat, rice and sorghum, mungbean area is stagnated. The low inherent yield potential habit of existing cultivars of this crop make this crop a poor competitor resulting in declining in area and production. On the other hand, development of early maturing photo neutral mungbean genotypes can play a vital role in arresting the declining area of this crop. However there are no serious efforts made to improve the productivity in mungbean. The varieties like pusaruby, chainamung, which were developed several decades are still being recommended for cultivation in Karnataka. In fact, these varieties are recommended for denotification at Andra Pradesh India level. Further, it has been observed that the varieties developed in other states and situations in the country were not found suitable to the state. Therefore, none of the varieties released recently at All India level could perform well in the state. In this diversion local germplasm lines from different parts of the state were collected. In this study, attempts were made to assess the genetic diversity for many productive traits in the local germplasm collection to identify suitable donors for breeding

Table 1. Estimation of genetic parameters for yield and yield components in mungbean. K = *Kharif* 2001, S = Summer 2002.

Parameters	Mean		Range		PCV	
	K	S	K	S	K	S
1. Days to 50% flowering	45.49	38.78	41.00–50.00	37.00—41.00	6.12	3.54
2. Plant height (cm)	43.89	26.57	30.5–56.25	13.25–35.00	13.29	16.56
3. Number of primary branches	5.31	2.80	3.75–6.75	1.75–4.50	14.50	22.97
4. Number of pods per plant	15.78	3.92	10.62–23.87	1.25–10.66	25.64	54.48
5. Number of seeds per pod	12.45	7.73	9.88–16.25	4.00–11.25	11.89	29.06
6. Pod length	8.96	6.65	6.48–11.58	3.5–8.57	14.32	17.54
7. Number of pods per cluster	3.83	1.93	3.12–5.00	1.00–4.00	14.50	40.61
8. 100 seed weight (g)	4.36	4.39	2.48–6.70	3.10–6.52	22.40	20.06
9. Yield per plant (g)	5.23	0.94	2.84–9.23	0.41–2.65	33.92	49.11

Table 1. Continued.

Parameters	GCV		Heritability (%)		GAM (%)	
	K	S	K	S	K	S
1. Days to 50% flowering	4.60	2.05	56.40	33.7	7.08	2.45
2. Plant height (cm)	11.37	13.35	73.20	65.00	20.03	22.17
3. Number of primary branches	5.67	9.81	15.20	18.20	4.5	8.57
4. Number of pods per plant	13.97	41.94	29.70	59.30	15.65	66.58
5. Number of seeds per pod	9.77	18.90	67.50	42.30	16.55	25.35
6. Pod length	13.00	7.17	82.40	16.70	4.11	6.00
7. Number of pods per cluster	9.44	15.19	42.30	14.40	12.53	11.92
8. 100 seed weight (g)	19.68	15.07	77.10	56.40	35.55	23.23
9. Yield per plant (g)	20.88	38.35	37.90	61.00	26.58	61.70

program in mungbean.

Methods

The 85 local green gram lines were collected from different parts of Karnataka were tested along with checks over two seasons, *kharif* and *rabi*/summer 2001-2002 in a randomized block design with two replications at AICRP on MULLARP, main research station of University of Agricultural Sciences, Dharwad, Each genotype was grown in single row of 2.5 meters per replication with a spacing of 30 cm between rows and 10 cm between plants. During *kharif* of 2001, the experiment was conducted under rainfed, while in summer 2002, under protective irrigation following all recommended agronomic practices. From each

Table 2. Genotypic (G) and phenotypic (P) correlation coefficients for 11 characters in green gram (*kharif* 2001).

		pH	NPB	NPPP	SPP	PL	NPPC	TW	SYP
1. DFF	G	0.617**	0.177	-0.347**	-0.147	-0.349**	-0.440**	-0.165	-0.512**
	P	0.445**	0.165	-0.019	-0.068	-0.217	-0.045	-0.160	-0.197
2. PH (cm)	G		0.656**	0.033	0.210	-0.084	0.007	-0.068	0.044
	P		0.286**	0.035	0.167	-0.041	-0.016	-0.015	0.078
3. NPB	G			0.151	0.610**	0.057	0.138	-0.176	0.164
	P			0.497**	0.269*	0.075	0.181	-0.096	0.391**
4. NPPP	G				0.226	-0.329**	0.957**	-0.600**	0.718**
	P				0.115	-0.157	0.632**	0.312**	0.624**
5. SPP	G					0.601**	0.188	-0.145	0.589**
	P					0.595**	0.135	-0.066	0.406**
6. PL	G						-0.294	0.643**	0.437**
	P						-0.149	0.574**	0.402**
7. NPPC	G							-0.474**	0.744**
	P							-0.335**	0.491

Table 3. Genotypic (G) and phenotypic (P) correlation coefficient for characters in green gram. (Summer 2002).

			PH	NPB	NPPP	SPP	PL	NPPC	TW	YPP
1.	DFF	G	0.288**	0.374**	0.352**	0.203	0.022	0.363**	-0.176	0.266*
		P	0.082	-0.072	0.062	0.067	-0.038	-0.004	-0.081	0.052
2.	PH (cm)	G		0.326**	0.164	0.007	-0.084	0.196	0.095	0.297**
		P		0.329**	0.168	0.064	0.046	0.093	-0.048	0.251
3.	NPB	G			0.327**	-0.063	-0.377**	0.186	0.228	0.531**
		P			0.352**	0.050	-0.062	0.109	0.030	0.244
4.	NPPP	G				0.535**	0.080	0.870**	-0.157	0.536
		P				0.378**	0.140	0.559**	-0.140	0.478**
5.	SPP	G					0.627**	-0.333**	-0.487**	0.143
		P					0.693**	0.261*	-0.182	0.130
6.	PL	G						-0.129**	-0.297**	-0.026
		P						0.230	0.068	0.106
7.	NPPC	G							-0.102	0.362**
		P							-0.024	0.326**

genotype 10 plants were randomly selected per replication and the observations on days to 50% flowering, plant height, number of primery branches, number of pods per cluster, pod length, number of pods per plant, number of seeds per pod, 100 grain weight and seed yield per plant were observed. The genotypic and phenotypic coefficient of variation, heritability, genetic advance, correlation coefficients among characters were estimated (2, 3). The path coefficient analysis was done by taking seed yield per plant as dependent variable and the remaining traits as independent variable (4).

Results and Discussion

Analysis of variance indicated significant differences among the genotypes for all the characters studied. Relatively higher value of genotypic variance was found for 100 seed weight followed by number of pods per plant and the lowest for days to 50% flowering (Table 1). Choudhury et al. (5) and Rohman et al (6) reported similar results. The difference in magnitudes between genotypic and phenotypic variance for both summer and *kharif* was high for number of pods per cluster, number of pods per plant and number of seeds per plant as compared to *kharif* and sumer crop indicating large environmental influence on these characters. A higher heritability estimate associated with good estimates of genetic advance over mean expected in the next generation for pod length, 100 seed weight, plant height, number of seeds per pod, plant height indicated in *kharif* and in summer plant height seed yield, number of pods per plant and 100 seed weight shown similar heritability pattern indi-

Table 4. Phenotypic path coefficient analysis of nine different characters on seed yield in green gram. (*Kharif* 2001). Residual effect = 0.2995. Diagonal values indicate direct effect and other values indicate indirect effect **Significant at5% level. DFF = Days to 50% flowering, PH = Plant height, NPB = Number of primary branches per plant, NPP = Number of primary pods per plant, SPP = Seeds per pod, PL = Pod length, NPPC = Number of pods per cluster, TW = 100 seed weight, PM = Powdery mildew.

	DFF	PH	NPB	NPP	SPP	PL	NPPC	TW	Correlation with seed yield
DFF	**-0.130**	0.043	0.004	-0.011	-0.001	-0.096	-0.011	-0.016	-0.197
PH	-0.058	**0.097**	0.006	0.020	0.003	-0.018	-0.004	-0.001	0.078
NPB	-0.022	0.028	**0.023**	0.280	0.004	0.033	0.042	-0.009	0.391**
NPP	0.002	0.003	0.011	**0.564****	0.002	-0.069	0.147	-0.030	0.624**
SPP	0.009	0.016	0.006	0.065	**0.016**	0.262	0.031	-0.006	0.406**
PL	0.028	-0.004	0.002	-0.088	0.009	**0.440****	-0.035	0.056	0.402**
NPPC	0.006	-0.002	0.004	0.356**	0.002	-0.065	**0.233**	-0.033	0.491**
TW	0.021	-0.001	-0.002	-0.176	-0.001	0.253	-0.078	**0.097**	0.104

cating that these characters are governed by additive gene effects to a greater extent. In expected genetic advance at 1% selection intensity expressed in percentage of population mean, the range was 4.5 for number of primary branches to 56.40 for 100 seed weight during *kharif* (Table 1) and in summer ranges 2.45 for days to 50% flowering to 66.58 for number of pods per plant. Higher genetic advance associated with higher heritability value indicated additive gene effect in controlling the characters and had considerable value to the breeder for plant selection (7). In the present investigation such characters were 100 grain weight, plant height, number of seeds per pod and number of pods per plant.

In the most of the cases, the genotypic correlation coefficient were slightly higher in magnitude than the phenotypic correlation coefficient indicating a fairly strong association between the characters studied (Table 2). The study was conducted under rainfed conditions with protective irrigation in both *kharif* and summer season. These results are also significant under both the seasons summer and *kharif* rainfed condition. During *kharif* seed yield showed strong positive genotypic correlation and phenotypic correlation with number of pods per plant, seeds per pod, pod length and number of pods per cluster, while in summer (Table 3) showed strong positive correlation with only number of pods per plant and number of pods per cluster. Days to flowering had strong positive correlation with plant height in both genotypic and phenotypic level in *kharif,* and in summer only at genotypic level and also showed strong negative association with number of pods per plant, pod length, seeds per pod, 100 seed weight and seed yield in both level during *kharif,* while in summer showed negative correlation with 100 seed weight at both levels and showed negative correlation with number of primary branches, pod length and number of pods per cluster only at phenotypic level. Plant height showed significant positive genotypic and phenotypic correlation with only number of primary branches, in both *kharif* and summer seasons and negative association with pod length at both levels and also showed negative phenotypic association with number of pods per cluster and 100 seed weight. Same results were reported by Rahman et al. (8). The strong genotypic correlation may be attributed to the close linkage of genes controlling recessive characters ; 100 seed weight showed positive and significant association with pod length at both genotypic and phenotypic level during *kharif* and in summer only at genotypic level and had strong negative association with number of pods per plant and number of pods per cluster at both genotypic and phenotypic level, and in summer 100 seed weight showed negative association with almost all characters except number of primary branches at both levels.

Ali and Shaik (9) and Hassan et al. (10) found that number of pods per plant and primary branches per plant positively and significantly correlated with seed yield Shamsuzzaman et al. (11) showed that number of pods per plant, primary branches per plant and number of seeds per pod had significant positive correlation with yield per plant.

The phenotypic correlation coefficient were partitioned into direct and indirect effect by various yield contributing characters (Tables 4 and 5), coefficient of analysis showed that number of pods per plant has maximum direct effect in both *kharif* (0.564) and summer season (0.442) followed by pod length (0.440), number of pods per cluster (0.2330), 100 grain weight (0.097), plant height and number of primary branches (0.23) on seed yield, while in summer pods per plant has maximum direct effect (0.442) followed by plant height (0.183), 100 seed weight (0.249), pod length (0.095) number of pods per cluster (0.063) and days to flowering.

Days to flowereing (0.130) and seeds per pod (0.087) showed negative direct effect on yield in *kharif* and summer season, respectively. The negative correlation of both the characters with grain yield was largely a reflection of negative indirect effect through most of the casual variables. The plant height did not have any noticeable effect either positive or negative through any of the characters studied. The indirect effect of plant height through grain yield, number of pods per cluster, pod length, and primary branches, pods per plant, seeds per pod inhibits each other and same trend has been observed in the summer season also. The highly significant and positive correlation of pods per plant was found with seed yield due to their highest positive direct effect and indiect positive effect via number of pods per plant and number of pods per cluster respectively observed in both summer and *kharif* seasons ; 100 grain weight showed medium positive direct effect in both the seasons.

Table 5. Phenotypic path coefficient analysis of nine different characters on seed yield in greengram. (Summer 2002). Residual effect = 0.2995. Diagonal values indicate direct effect and other values indicate indirect effect. **Significant at 5% level. DFF = Days to 50% flowering, PH = Plant height, NPB = Number of primary branches per plant, NPP = Number of primary pods per plant, SPP = Seeds per pod, PL = Pod length, NPPC = Number of pods per cluster, TW = 100 seed weight.

	DFF	PH	NPB	NPP	SPP	PL	NPPC	TW	Correlation with seed Yield
DFF	**0.024**	0.015	0.000	0.028	-0.006	-0.004	0.000	-0.020	0.052
PH	0.002	**0.183**	0.001	0.014	-0.006	0.004	0.006	-0.012	0.251
NPB	-0.002	0.060	**0.002**	0.155	-0.004	-0.006	0.007	0.008	0.244
NPP	0.002	0.031	0.001	**0.442****	-0.033	0.013	0.035	-0.035`	0.478**
SPP	0.002	0.012	0.000	0.167	**-0.087**	0.066	0.016	-0.045	0.130
PL	-0.001	0.008	0.000	0.062	-0.060	**0.095**	0.014	0.017	0.106
NPPC	0.000	0.017	0.000	0.247	-0.023	0.022	**0.063**	-0.006	0.326**
TW	-0.002	-0.009	0.000	-0.062	-0.016	0.006	-0.001	**0.249**	0.191

Considering the interrelationship studied and path analysis of various componet characters with seed yield and among themselves, it is clear that pods per plant, 100 grain weight, seeds per pod and number of pods per cluster are important traits for yield improvement of mungbean. The value (0.2995) of the residual effect is high because the experiment was conducted under rainfed and protective irrigation conditions. Similar results were also reported by Rohman et al. (6).

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