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Correlation and Path Analysis Study on some Morphological and Yield Parameters of Mungbean (*Vigna radiata* L. Wilezek)

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Abstract— *Mungbean (Vigna radiata L. Wilezek) germplasm comprising 26 genotypes was evaluated at Instructional Farm Jaguli, Bidhan Chandra Krishi Viswavidyalaya, during summer 2012 in a randomized block design with three replications. Correlation was worked out among plant height, number of branches plant^{-1}, pod length, pod width, number of seeds pod^{-1}, seed diameter, 100 seed weight, number of pods plant^{-1} and seed yield plant^{-1} at both genotypic and phenotypic levels. Significant differences were observed among different genotypes for all the parameters. Seed yield plant^{-1} possessed highly significant correlation with pod length, 100 seed weight and number of pods plant^{-1} and significant correlation with pod width, number of seeds pod^{-1} at both genotypic and phenotypic level. Negative and highly significant correlation of seed yield plant^{-1} with plant height at genotypic level and significant correlation at phenotypic level was also observed. Number of branches plant^{-1} showed negative significant correlation with seed yield plant^{-1}only at genotypic level. Results of path analysis revealed that four characters viz. number of branches plant^{-1}, pod length, 100 seed weight and number of pods plant^{-1} had direct effect on seed yield plant^{-1} while other four characters namely plant height, pod width, number of seeds pod^{-1} and seed diameter incurred negative direct effect on seed yield plant^{-1}. Therefore, characters like number of pods plant^{-1}, 100 seed weight, pod length, pod width, number of seeds pod^{-1} should be taken into consideration for genetic improvement of seed yield plant^{-1} in mungbean. Direct selection involving these characters may provide results of practical value as quantitative parameters are usually controlled by additive genes with some amount of dominant genes.*

1. INTRODUCTION.

Mungbean or greengram (*Vigna radiata* L. Wilezek, 2n=22, Leguminosae) is the third most important annual crop of Asia [1]. High in protein content, broad in adaptation, requires lesser agronomical practices and has high ability to increase soil fertility [26, 49]. It is an important short duration grain legume which can be grown in varying environmental conditions, during all crop seasons *viz.*, kharif, rabi and spring/summer in different parts of the country, as sole or intercrop for grain and green manure.

Correlation studies gives an idea about the contribution of different characters towards seed yield and it reveals the type, nature and magnitude of correlation between yield components with yield and among themselves. Knowledge of inter-relationships existing among yield components is essential when selection for improvement is to be effective. Path analysis identifies the yield components which directly and indirectly influences seed yield. The present study aimed to evaluate the correlation coefficients and path coefficients in order to formulate selection criteria for evolving high yielding genotypes and to estimate the contribution of yield components on seed yield and their association in mungbean.

2. MATERIALS AND METHODS.

The field experiment for the study was conducted at Instructional Farm, Bidhan Chandra Krishi Viswavidyalaya, Jaguli, Nadia, in Kharif season 2012 situated at, latitude of 22^{o}93’ N, longitude of 88^{0}59’ E and altitude of 9.75 (above the mean sea level). The area belongs to typical sub-tropical climate. The soil of the farm was well drained, new alluvial soil with homogeneity in fertility and uniform textural make up. The experimental material for the present study comprised of 26 mungbean genotypes viz., TM-99-50, TM-99-21, WBM-220, SUBLOBATA-2, BASANTI, TARM-1, PDM-84-139 (Samrat), KOPERGAON, TM-99-37, TM-98-50, SUBLOBATA-14, HUM-12, B-1 (Sonali), PUSA VISHAL, PANT MUNG-2, WBM-611-3, WBM-659, K-851, WBM-4131, WBM-314, MALDA-95-13, MIDNAPUR LOCAL, WBM-04-05, PDM-54 (Moti), WBM-6-34-1-1 (Bireshwar) and PS-16 each planted in a randomized block design with three replications. Each genotype was grown in three rows of 2 meter length with row to row and plant to plant spacing of 30cm and 10cm respectively. All the recommended cultural practices were followed up to harvest. Plant height (cm) and number of branches plant^{-1} were recorded in the field. At maturity, data were collected for pod length (cm), pod width (cm), number of seeds pod^{-1}, seed diameter (cm), 100 seed weight (g), number of pods plant^{-1} and seed yield plant^{-1} on five competitive plants randomly selected from each of the three replications. The genotypic correlation between yield and its component traits and among themselves was worked out as per the methods suggested by Johnson *et al* 1955 [18]. Genotypic correlations between yield and its component traits were partitioned into direct and indirect effects following path coefficient analysis as suggested and discussed by Dewey and Lu 1959 [9].

3. RESULT AND DISCUSSION.

Correlation of plant characters and seed yield.

The genotypic and phenotypic correlation coefficients are presented **Table.1** Genotypic correlation coefficient was in general, observed to be higher than that of phenotypic correlation coefficient indicating the existence of strong inherent association for the various traits studied and phenotypic selection may be rewarded. Correlations among the different characters were as follows:

Plant height (cm).

Plant height showed positive and highly significant correlation coefficient with number of branches $plant^{-1}$ at both genotypic and phenotypic levels (0.655 and 0.636) [19]. It also showed highly significant negative correlation coefficients with pod width (-0.593 and -0.500), seed diameter (-0.642 and -0.610), and 100 seed weight (-0.642 and -0.587). Negative significant correlation with pod length (-0.455 and -0.429) and highly significant and significant correlation with seed yield $plant^{-1}$ (-0.428 and -0.401) was also observed Other authors also reported negative correlation between plant height and seed yield $plant^{-1}$ in their study [22, 31, 41]. No significant correlation of plant height was observed with number of seeds pod^{-1} and number of pods $plant^{-1}$. Positive correlation with number of branches was in agreement with the findings of some authors [21, 27, 41]. Negative and significant association of plant height with 100 seed weight was also observed by other authors in their experiments[31, 38, 40, 48].

Number of branches $plant^{-1}$.

No positive and significant correlation was observed for number of branches $plant^{-1}$ with any other character. However, negative and highly significant correlation coefficient with pod width (-0.677 and 0.538), seed diameter (-0.639 and -0.590) was observed at both genotypic and phenotypic levels and 100 seed weight at the genotypic level. Negative significant correlation was also observed with pod length (-0.407), number of pods $plant^{-1}$ (-0.406) and seed yield $plant^{-1}$ (-0.405) for this character at the genotypic level and with 100 seed weight (-0.469) at the phenotypic level. Similar findings were reported by other authors [4, 6, 7, 20, 24]

Pod length (cm).

This character exhibited significant positive correlation with seed yield $plant^{-1}$ (0.772 and 0.667) at both genotypic and phenotypic level. It also showed positive and highly significant correlation coefficients with number of seeds pod^{-1} (0.630 and 0.561) and 100 seed weight (0.704 and 0.658) at both the levels while it had positive and highly significant correlation coefficients with pod width (0.508), seed diameter (0.499) and number of pods $plant^{-1}$ (0.498) at genotypic level only. Positive and high significant correlations were also observed for the character with pod width (0.432), seed diameter (0.451) and number of pods $plant^{-1}$ (0.412) at the phenotypic level only. Negative and significant correlation coefficients were observed with plant height (-0.455 and -0.429) at both genotypic and phenotypic levels and with number of branches $plant^{-1}$ (-0.407) at genotypic level for this trait. Reports a positive association of pod length with number of seeds pod^{-1} and 100 seed weight was also found by others [35, 43]. A negative correlation of pod length with plant height in mungbean was reported by others also [5, 7, 26].

Pod width (cm).

Pod width exhibited positive and highly significant correlation coefficient with seed diameter (0.727 and 0.571) and 100 seed weight (0.791 and 0.644) at both genotypic and phenotypic levels and with pod length (0.508) at the genotypic level and positive and significant correlation with seed yield $plant^{-1}$ at both the levels (0.472 and

Table. 1. Genotypic (G) and Phenotypic (P) correlation among different yield components in mungbean

Sl No.	Characters	Plant height (cm)	Number of branches $plant^{-1}$	Pod length (cm)	Pod width (cm)	Number of seeds pod^{-1}	Seed diameter (cm)	100 seed weight (g)	Number of pods $plant^{-1}$	Seed yield $plant^{-1}$ (g)
1.	Plant height (cm)	G 1.000	0.655**	-0.455*	-0.593**	-0.002	-0.642**	-0.614**	-0.193	-0.428**
		P 1.000	0.636**	-0.429*	-0.500**	-0.006	-0.610**	-0.587**	-0.179	-0.401*
2.	Number of branches $plant^{-1}$	G		-0.407*	-0.677**	0.177	-0.639**	-0.530**	-0.406*	-0.405*
		P		-0.352	-0.538**	0.153	-0.590**	-0.469*	-0.369	-0.368

3.	**Pod length (cm)**	**G**			0.508**	0.630**	0.499**	0.704**	0.498**	0.772**
		P			0.432*	0.561**	0.451*	0.658**	0.412*	0.667**
4.	**Pod width (cm)**	**G**				-0.090	0.727**	0.791**	0.343	0.472*
		P				-0.095	0.571**	0.644**	0.293	0.400*
5.	**Number of seeds pod^{-1}**	**G**					-0.126	0.102	0.324	0.399*
		P					-0.109	0.094	0.281	0.387*
6.	**Seed diameter (cm)**	**G**						0.736**	0.071	0.332
		P						0.674**	0.061	0.294
7.	**100 seed weight (g)**	**G**							0.282	0.682**
		P							0.227	0.644**
8.	**Number of pods plant^{-1}**	**G**								0.821**
		P								0.755**
9.	**Seed yield plant^{-1} (g)**	**G**								1.000
		P								1.000

**** significant at 1% level, * significant at 5% level**

Table 2: Path coefficient (genotypic) analysis showing direct (bold) and indirect effects on yield in mungbean

Sl No.	**Characters**	**Plant height (cm)**	**Number of branches plant^{-1}**	**Pod length (cm)**	**Pod width (cm)**	**Number of seeds pod^{-1}**	**Seed diameter (cm)**	**100 seed weight (g)**	**Number of pods plant^{-1}**	**Seed yield plant^{-1} (g)**
1.	**Plant height (cm)**	**-0.13697**	0.11558	-0.128580	0.19676	0.00032	0.04129	-0.37817	-0.13817	-0.428
2.	**Number of branches plant^{-1}**	-0.08976	**0.17638**	-0.11499	0.22473	-0.02545	0.04111	-0.32634	-0.29077	-0.405
3.	**Pod length (cm)**	0.06234	-0.07179	**0.28253**	-0.16862	-0.09067	-0.03209	0.43317*	0.35665	0.772**
4.	**Pod width (cm)**	0.08122	-0.11945	0.14356	**-0.33184**	0.01289	-0.04676	0.48713**	0.24552	0.472*
5.	**Number of seeds pod^{-1}**	0.00031	0.03120	0.17804	0.02972	**-0.14389**	0.00812	0.06291	0.23219	0.399*
6.	**Seed diameter (cm)**	0.08790	-0.11271	0.14094	-0.24123	0.01816	**-0.06433**	0.45307*	0.05065	0.332

7.	**100 seed weight (g)**	0.08416	-0.09352	0.19885	-0.26265	-0.01471	-0.04736	**0.61546****	0.20214	0.682**
8.	**Number of pods plant^{-1} (g)**	0.02641	-0.07156	0.14060	-0.11368	-0.04662	-0.00455	0.17359	**0.71669****	0.821**

Residual effect = 0.1483998, * * Significant at 1% level and * Significant at 5% level

0.400) and with pod length (0.432) at the phenotypic level. Pod width was found to have significant positive correlation at both the levels with 100 seed weight in one study [19]. Negative and highly significant correlation coefficient with plant height (-0.593 and -0.500) and number of branches plant^{-1} (-0.677 and -0.538) were also observed for this trait.

Seed diameter (cm).

Seed diameter recorded positive and highly significant correlation coefficients with pod width (0.727 and 0.571) and 100 seed weight (0.736 and 0.674) at both genotypic and phenotypic levels and with pod length at the genotypic level. Negative and highly significant correlation coefficient was exhibited by plant height (-0.642 and -0.610) and number of branches plant^{-1} (-0.639 and 0.590) at both the levels for this trait.

100 seed weight (g).

100 seed weight showed highly significant and positive correlation with seed yield plant^{-1} (0.682 and 0.644) at both genotypic and phenotypic level. Significant positive correlation of 100 seed weight with seed yield plant^{-1} were reported by some authors [23, 28]. Significant positive correlation of 100 seed weight with seed yield plant^{-1} was also reported [2, 19]. It also exhibited positive and highly significant correlation coefficients with pod length (0.704 and 0.658), pod width (0.791 and 0.644) and seed diameter (0.736 and 0.674) at both genotypic and phenotypic levels. Similar finding with all the characters was reported [38]**.** Negative and highly significant correlation coefficient of 100 seed weight with plant height (-0.614 and 0.587) was observed at both the levels and with number of branches plant^{-1} at the genotypic level (-0.530) was observed. Negative and significant association of plant height with 100 seed weight supplements the findings of some others [46, 48]. It also showed a negative and high significant correlation with number of branches plant^{-1} (-0.469) at the phenotypic level.

Number of seeds pod^{-1}.

Number of seeds pod^{-1} showed positive and highly significant correlation coefficient with pod length (0.630 and 0.561) at both genotypic and phenotypic levels and high and positive correlation coefficient with seed yield plant^{-1}(0.399 and 0.387). It did not show any other significant correlation with any other characters. Reports on similar findings for this trait was given by others [8, 13, 37, 26].

Number of pods plant^{-1}.

Number of pods plant^{-1} showed positive and highly significant correlation coefficient with seed yield plant^{-1} (0.821 and 0.755) at both the levels and with pod length (0.498) at the genotypic level only. Positive and high significant correlation coefficient with pod length (0.412) at the phenotypic level was also observed for this trait. Positive and significant correlation for number of pods plant^{-1} with seed yield was also observed by other authors [3, 6, 10, 11, 14-16, 19, 26, 32, 34, 44, 45, 47, 49]

Seed yield plant^{-1}.

Seed yield plant^{-1} showed positive and highly significant correlation coefficient with pod length (0.772 and 0.667), 100 seed weight (0.682 and 0.644) and number of pods plant^{-1} (0.821 and 0.755) at both genotypic and phenotypic levels. It showed positive and high significant correlation with pod width(0.472 and 0.400), number of seeds pod^{-1} (0.399 and 0.387) at both genotypic and phenotypic levels. Seed yield was positive and significantly correlated with number of pods plant^{-1}, number of seeds pod^{-1} and 100 seed weight in one study [36]. Highly significant correlation of pod length and number of seeds pod^{-1} with seed yield in 26 mungbean genotypes was also reported by one author [30]. It also showed negative and highly significant correlation with plant height (-0.428) at genotypic level and negative and high significant correlation with the same (-0.401) at phenotypic level and with number of branches plant^{-1} (-0.405 and -0.368) at both the levels. The results are in partial agreement with those of others [14, 36, 45].

Path Coefficient Analysis. (Table 2.)

Residual effect of path coefficient analysis was very low (0.1483998) which indicated that the number of characters chosen for the study were very much appropriate for yield determination in mungbean. Path coefficient analysis revealed that four characters viz. number of branches plant^{-1} (0.17638), pod length (0.28253), 100 seed weight (0.61546) and number of pods plant^{-1} (0.71669) had positive direct effect on grain yield while four characters namely plant height (-0.13697), pod width (-0.33184), number of seeds pod^{-1} (-0.14389) and seed diameter (-0.06433) incurred negative direct effect on seed yield plant^{-1}. Number of pods plant^{-1} imparted the highest positive direct effects on seed yield followed by 100 seed weight, pod length and number of branches plant^{-1}. High direct and significant correlation of number of pods plant-1 towards seed yield plant^{-1} in mungbean was observed by other authors in their study [2, 3, 19, 34, 43]. Pod length, 100 seed weight and number of pods plant^{-1} showed highly significant positive correlation simultaneous with high amount of seed yield plant^{-1}. Therefore, direct selection through these traits would be effective in yield improvement of mungbean. Thus, it can be inferred that selection based on any one of these traits either alone or in combination, will be helpful for improvement of mungbean with respect to seed yield plant^{-1}. Seed yield plant^{-1} was positively correlated with number of pods per plant, pod length, 100 seed weight, pod width and number of seeds pod^{-1}. This was in agreement with the findings of other authors [17, 37].

Correlation coefficient of seed yield plant^{-1} with pod width and number of seeds pod^{-1} were significantly positive but direct effects were negative and positive relationship was manifested by high indirect effect via 100 seed weight and number of pods^{-1} on pod width and number of pods plant^{-1} on number of seeds pod^{-1}. Plant height and number of branches plant^{-1} showed negative correlation with yield though not significant with low magnitude of negative direct effect by plant height and positive direct effect by number of branches plant^{-1}.

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