

## Identification of Germplasm Lines for Stable Morphological Marker Traits and Selection Strategy for High Productivity in Mungbean (*Vigna radiata* L. Wilczek)

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### Abstract

A few mungbean genotypes were identified for stable morphological characters e.g., seed color, seed size, hypocotyl color, leaf size and shape, pod length, pod color, plant habit and bruchid resistance. Such stable morphological marker traits would have direct bearing on DUS testing for varietal identification. Besides, some valuable genotypes were identified for important yield contributing traits. OUM 7, Pant M 2, PMB 9, TM 98—15 were observed to have significantly early flowering than the best early flowering check variety Kamdev. A few entries e.g., AB 2557, K 851, T 7—3, T 7—10, Pusa 172, COGG 902 and TCR 20 recorded even more than 34 pods per plant. Only one local land race, Jharsuguda local D (27.42 pods per plant) bore significantly higher pod number than the best standard check variety Dhauri. These germplasm lines could be of immense value for future breeding program for augmentation of productivity *per se*. However, T 2—1, T 3—12, T 7—1, T 7—3, T 7—7, T 7—10, T 12—2, TM 98—2, RCM 12, Pusa 105, Pusa 172, ML 267, PMB 27, AB 2557 and the wild accession TCR 20 were identified to have significantly higher productivity than LGG 460. A regression equation  $Y = 1.991 + 0.128X_1 - 0.029X_2 + 0.028X_3 - 0.190X_4 - 0.297X_5 + 0.138X_6$  was suggested for selection of high yielding genotypes in a set of large collection of germplasm lines.

**Key words :** Evaluation of germplasm, Morphological markers, Quantitative traits, Regression analysis, Mungbean.

Mungbean is an important short duration legume crop which can fit well in intercropping and crop rotation. It is adapted to wide range of agro-climatic conditions ranging from hill tracts to plains. It is an inexpensive source of easily digestible protein, essential amino acids, vitamins and minerals in vegetarian diet particularly in the developing countries. Protein content of its seeds varies from 17.2 to 29.9% among varieties with an average of 22.4%. Despite several merits, mungbean in Orissa is succumbed to very low productivity (409 kg/ha) as against the national average of 436 kg/ha which is far below than that in neighboring China (1,154 kg/ha). Two-third of the area under mungbean in Orissa is cultivated during winter season, mainly in rice fallow using local cultivars. Local cultivars though suit better to local environments and are comparatively tolerant to biotic and abiotic stresses, but have low yield potential. Therefore, evaluation of available

germplasm is necessary for selection of genotypes for immediate use in cultivation and also identification of parent materials for further genetic improvement. In the present pursuit, the authors report elite germplasm lines of mungbean with regard to stable morphological marker traits and propose a selection strategy to identify genotypes for higher productivity following regression analysis.

### Methods

The experimental materials used in the present investigation comprised 292 *vigna* germplasm lines which included standard ruling varieties, important pre-released cultures, popularly adapted local land races and two accessions of *Vigna sublobata* (progenitor of mungbean). These genotypes were laid out in augmented design with nine blocks and 32 varieties plus four promising standard check varieties of

**Table 1.** Estimates of variability for seed yield and its component traits.

Estimates of variability	DF	PHT	NC	NP/C	NP/P	SY/P
Mean	34.02	21.38	3.14	5.55	17.44	1.99
Range	27.0—59.22	12.06—70.74	1.32—15.67	1.34—7.54	6.67—36.82	0.24—7.67
Phenotypic variance	10.86	39.53	1.72	0.47	44.63	1.15
CV (%)	9.69	29.40	41.79	12.40	38.31	53.89
CD 5% between adjusted value of a test variety and a check variety mean	2.791	4.801	0.574	0.358	5.102	0.570

mungbean (Dhau, Kamdev, Durga and LGG 460) in each block to assess their comparative performance in *rabi* of 2008-09. The crop was raised following recommended package of practices. Observations on various stable morphological descriptors and quantitative traits e.g., seedling vigor ( $X_1$ ), days to 50% flowering ( $X_2$ ), plant height ( $X_3$ ), number of clusters per plant ( $X_4$ ), number of pods per cluster ( $X_5$ ) and number of pods per plant ( $X_6$ ) and seed yield per plant ( $Y$ ) were recorded. Actual values of agronomic data were adjusted as per the standard procedure of augmented design as follows to eliminate block effects from actual data recorded.

Block effect  $r_j$  for each block =  $B_j - M$  where,  $B_j$  = mean of all checks in the  $j$ th block,  $M$  = Grand mean of all checks, Adjusted data = Actual data - block effect.

Estimates of variability and the partial regression co-efficients for yield determining traits were worked out according to the method given by Panse and Sukhatme (1).

## Results and Discussion

The present investigation displayed a large array of variation in morphological and agronomic characteristics. Seed color with shiny lusture particularly

shiny green usually fetch consumers' preference. K 851, MGG 349, ML 682, Phulbani local-B, Makarjhol local-A, Purusattam local, Khadabhanga local-A and samarjhol local exhibited appealing shiny green seed color. Whereas, three local land races, e.g., Kodala local-A, kopergaon local and Paralakhemundi local had shiny yellowish green seed coat color. Shiny seed lusture is usually associated with pulse beetle resistance owing to inconvenience of such store grain pest for oviposition on smooth shiny surface of seeds. BDYR-1, COGG 912, ML 613, Pusha Vishal, SML 668 and local land races e.g., Kodala local-A, Kopergaon local, purusattam local, khadabhanga local -A possessed bold seeds. Samrat, RM 3-11, OUM 52-4, OUM 24, ML 881, M 9—12 gave determinate growth pattern with synchronous flowering period.

Hypocotyl color is usually purple in mungbean. Green hypocotyl color was exhibited in thirty four test entries including two check varieties e.g., Durga and LGG 460. Normally, mungbean bears ovate leaves. However, T 32-2-1 : a mutant of Khurda local, and a wild accession TCR 13 had shown lobed leaves. SML 668 bore characteristic bold pods. Much broader leaves were observed in Pusa 172 and TCR 20 as compared to other test genotypes. Leathery leaf was identified to be specific to Pusa 172 and multifoliate na-

**Table 2.** Regression analysis of yield component traits on seed yield. \*, \*\*—significant at P 0.05 and P 0.01 respectively.

Estimates of regression	a-value	SV (X1)	DF (X2)	PHT (X3)	NC (X4)	NP/C (X5)	NP/P (X6)
Partial regression coefficient (b)	1.991	0.128**	-0.029*	0.028**	-0.190*	-0.297**	0.138**
SE of partial regression coefficient	0.597	0.042	0.014	0.010	0.088	0.090	0.017
t-value of partial regression coefficient		3.047	-2.071	2.800	-2.159	3.300	8.117
Regression equation	Y (Seed yield) = 1.991 + 0.128X <sub>1</sub> - 0.029X <sub>2</sub> + 0.028X <sub>3</sub> - 0.190X <sub>4</sub> - 0.297X <sub>5</sub> + 0.138X <sub>6</sub>						

ture of leaf was restricted to OGG 56. Mungbean usually bear pods without any bent at maturity. But, the wild accession TCR 20 used in this investigation was found to possess prominent bent pods. Brown color pods are usually observed in improved varieties and straw brown in local land races in mungbean. However, K 851, TARM 1, TARM 2, PDM 84—143, Pusa Vishal were observed to have prominently black pods at maturity. Bruchid / pulse beetle (*Callosobruchus chinensis*) resistance is considered as most dreadful store grain insect pest in mungbean. In general, mungbean is susceptible to bruchids. However, in the present set of germplasm, TCR 20 (wild accession) and Banakhandi local-B were identified as resistant to pulse beetle.

Mean, range, phenotypic variance and coefficient of variance of seed yield and its five component traits are presented in Table 1. Wide range of variability was observed in all traits with maximum being in seed yield (0.24—7.67 g) followed by number of clusters per plant (1.32—15.67) and number of pods per plant (6.67—36.82) as also revealed from coefficient of variability i.e., 53.81%, 41.08% and 38.31% respectively. Highest genetic variation of seed yield followed by pods/plant was also observed by Makeen et al. (2). Similar findings were reported by Natarajan et al. (3) and Byregowada et al. (4) in mungbean.

On an average, the mungbean accessions flowered at 34.02 days after sowing and grown to a height of 21.38 cm during *rabi* of 2008-09 and it ranged from 27.0—59.22 days after sowing and 12.06—70.74 cm respectively. Overall productivity of the present set of mungbean germplasm was 1.99 g per plant which resulted from an average 3.14 clusters per plant, 5.55 pods per cluster and 17.44 pods per plant.

Among the standard check varieties, LGG 460 was the highest yielder (3.12 g/plant) and hence could be considered as best standard check variety in terms of productivity. T 2-1, T 3-12, T 7-1, T 7-3, T 7-7, T 7-10, T 12-2, TM 98-2, RCM 12, Pusa 105, Pusa 172, ML 267, PMB 27, AB 2557 and the wild accession TCR 20 had shown significantly higher productivity than LGG 460. One of the standard check variety Kamdev showed early flowering (27 days). OUM 7, Pant M 2, PMB 9, TM 98—15 were observed to have significantly early flowering than even Kamdev. These genotypes had poor yield performance. However, some of the important early flowering genotypes (as early as

Kamdev) with moderately high seed yield have been sorted out were RCM 12, PMB 27, RCM 3, RCM 6 and TM 98-2. In terms of pod number, 31 test entries exhibited significantly higher number of pods/plant as compared to Dhauri (20.67 pods/per plant). Out of these genotypes, a few entries e. g., AB 2557, K 851, T 7-3, T 7-10, Pusa 172, COGG 902 and TCR 20 recorded even more than 34 pods per plant. Among the available 62 local land races included in the study, only one local land race, Jharsuguda local D (27.42 pods per plant) bore significantly higher pod number than the best standard check variety Dhauri. These germplasm lines could be of immense value for future breeding programme for augmentation of productivity *per se*.

Direct selection based on mean performance often led to statistical error and lack of precision. Besides, regression analysis of yield component traits on seed yield could establish a basis of selection based on important yield contributing characters simultaneously. In the present set of test materials, the partial regression coefficients for yield determining traits were worked out (Table 2) with a view to fit the regression equation  $Y(\text{seed yield}) = 1.991 + 0.128X_1 - 0.029X_2 + 0.028X_3 - 0.190X_4 - 0.297X_5 + 0.138X_6$ ; where  $X_i$  – represents independent variables e.g., seedling vigor, days to 50% flowering, plant height, number of clusters per plant, number of pods per cluster and number of pods per plant respectively. Regression coefficients of all the yield contributing characters were found significant indicating that these have definitely predominant influence on seed yield in mungbean. However, seedling vigor, plant height and pods per plant had positive influence on seed yield but other component traits acted negatively. Therefore, selection should be done meticulously in such a way that selection for different characters in positive direction would compensate the yield loss due to other traits that influence negatively.

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