International Journal of Applied Research 2020; 6(6): 395-399

ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2020; 6(6): 395-399
www.allresearchjournal.com
Received: 10-04-2020
Accepted: 23-05-2020

MW Marawar
Department of Agricultural Botany, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

AK Wagh
Department of Agricultural Botany, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

VV Ujjainkar
Department of Agricultural Botany, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Corresponding Author:
MW Marawar
Department of Agricultural Botany, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Correlation and path analysis studies in mungbean

MW Marawar, AK Wagh and VV Ujjainkar

Abstract
Green gram (*Vigna radiata* L.) is an important pulse crop grown in India. The entire success of plant breeding programme of any crop largely depends on the wide range of variability present in that crop. It is the range of genetic variability in respect of important economic characters present in the population upon which is based on the effectiveness of selection. Correlation studies measure only mutual association between two traits and it does not imply the cause and effect of relationship. Path analysis is a standardized partial regression analysis, which further permits the partitioning of correlation coefficient in to components of direct and indirect effects of independent variable on the dependent variable.
The present investigation was carried out with thirty diverse mungbean (*Vigna radiata* L. Wilczek) genotypes for ten characters with three replications in the field of Agricultural Botany, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra state during the *kharif*, 2016-17 for the estimation of genetic variability parameters, correlation coefficient and path coefficient analysis. The higher values of GCV and PCV observed for almost all the characters studied. High estimates of heritability in broad sense were recorded for plant height (0.97), grain yield per plant (0.91), days to 50 percent plant flowering (0.89), 100 seed weight (0.85), plant stand at harvest (0.84), number of pod per plant (0.84), number of seed per pod (0.78), days to maturity (0.29) and number of branches per plant (0.20). High genetic advance observed for plant stand at harvest (67.48) plant height (16.72), days to 50 percent flowering (6.37), number of pod per plant (5.44). The lowest magnitudes of genetic advance were reported for number of branches per plant (0.44), 100 seed weight (0.86), number of days to maturity (1.35), number of seed per pod (2.31), grain yield per plant (4.70) and number of pod per plant (5.44). The yield per plant was highly significant and positively correlated with plant stand at harvest, plant height, number of branches per plant, number of pod per plant, 100 seed weight, number of seed per pod, Path coefficient analysis indicated high direct effect on days to 50% flowering, number of branches per plant, number of pod per plant.

Keywords: Correlation, path analysis, mungbean and correlation coefficient

Introduction
Green gram *(Vigna radiata* L.) is an important pulse crop grown in India. It is also suitable in all agro-ecological situations. Green gram contributes 14 percent in total area and 7 percent in total pulses production in India. It is widely cultivated throughout Asia. It is a protein rich staple food and contain about protein-24.5 percent, fat-1.2 percent, fibre-0.8 percent, minerals-3.5 percent, carbohydrates-59.9 percent, calcium-75mg, phosphorus-405mg, iron-8.5mg and small amount of vitamin-B complex.
It supplies protein requirement of vegetarian population of the country. It is consumed in the form of split pulse as well as whole pulse which is an essential supplement of cereal-based diet. The mung dal Khichadi is recommended to the ill or aged person as it is easily digestible and is a complete diet. It is particularly rich in leucine, phenylalanine, lysine, valine, isoleucine etc.
India is the largest producer of mungbean in the world. It accounts for almost 65 percent area and 54 percent production of the world. The area under green gram in India during year 2014-15 is 3.07 m ha with production of 1.38 mt having productivity 487 kg/ha. While the area under green gram in Maharashtra during year 2015-16 is 3.59 lakh ha with production 0.86 lakh tons, having productivity 239 kg/ha. In Vidharbha region, it is 0.79 lakh ha area with production 0.25 lakh tons having productivity 270 kg/ha. Farmers grow this crop not as a principal crop but as a bonus crop, mixed with other crops on marginal lands and that too without manuring.

The entire success of plant breeding programme of any crop largely depends on the wide range of variability present in that crop. It is the range of genetic variability in respect of important economic characters present in the population upon which is based on the effectiveness of selection. Environment has a profound influence upon the economically important characters, which are quantitatively inherited. Hence, it is difficult to decide upon whether the observed variability is heritable or due to environment and it is therefore, necessary to partition the same into its heritable and non-heritable components. Selection procedure is more difficult in a trait, where heritability is low or is not precisely measurable. Indirect selection in such a situation is more effective and study of correlation among different economic traits are therefore, essential for an effective selection programme because selection for one or more trait results in correlated response for several other traits and sequence of variation will also be influenced. Hence, the knowledge of genotypic and phenotypic correlation between yield and its contributing characters is very essential. Correlation studies measure only mutual association between two traits and it does not imply the cause and effect of relationship. Path analysis is a standardized partial regression analysis, which further permits the partitioning of correlation coefficient in to components of direct and indirect effects of independent variable on the dependent variable.

Material and Method

The experiment was conducted in the field of Agricultural Botany, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra state during the *kharif*, 2016-17. The experimental material comprised of thirty genotypes of mungbean representing different geographic origin. The experiment was laid out in randomized block design with three replications and the crop was raised as per the recommended package of practices. Seeds were sown with row to row spacing of 45 cm and plant to plant spacing of 10 cm. The five competitive plants from each of the replication were tagged and observations were taken from these tagged plants at various stages of the crop plant growth. Data were recorded for ten characters *viz*., days to 50% flowering, days to maturity, plant height (cm), number of primary branches per plant, number of pods per plant, plant stand at harvest, number of seeds per pod, 100-seed weight (g), seed yield per plant (g) and seed yield per plot (g).

Mean values were computed and data were analyzed for analysis of variance as suggested by Panse and Sukhatme (1985) and coefficient of variances as well as heritability (in broad sense) as suggested by Burton (1952), Genotypic and phenotypic correlation coefficients analysis were estimated adopting the procedure suggested by Comstock and Robinson (1952). Path coefficient analysis as suggested by Wright (1921) was used to partition the genotypic correlation coefficients of seed yield into direct and indirect effects.

Result and Discussion

The mean sums of squares due to various sources for different traits are presented in Table 1.

Table 1: Analysis of variance for various characters

Source of variation	Degree of freedom	Mean Sum of Square									
		Days to 50% plants flowering	No. of days to maturity	Plant height (cm)	No. of branches per plant	Plants stand at harvest	No. of pods per plant	No. of seeds per pod	100 seed weight (gm)	Grain yield per plant (gm)	Grain yield per plot (gm)
Replication	2	0.155	16.088	4.192	4.822	1303.4	7.622	0.022	0.032	2.822	15404.42
Treatment	9	973.788**	226.488**	5927.414**	46.055**	117260.4**	760.622**	152.322**	18.713**	510.488**	1273527.956**
Error	58	75.844	199.244	85.473	51.844	13514.6	85.711	25.311	1.987	29.844	150203.577

* Significance at 5% level, **Significance at 1% level

The analysis of variance indicated highly significant differences for all characters among 30 accessions for all the traits indicating presence of wide genetic variation for different characters among the genotypes of mungbean. The genotypic and phenotypic coefficient of variation, heritability and genetic advance as percent over mean for each of the characters are presented in Table 2. Considerable range in variation was observed for all characters. Phenotypic coefficients of variation values were relatively higher than corresponding genotypic coefficient of variation for all traits under study. It indicated the effect of environment in the expression of the traits.

The PCV, which gives the extent of phenotypic variability ranged from 3.24 to 30.47 per cent for various traits. The PCV was high for grain yield per plant (30.47%), number of branches per plant (26.89%), number of pods per plant (22.31%), plant stand at harvest (21.80%).

Table 2: Estimates of genetic parameters in Mungbean

Sr. No.	Characters	Genotypic variance	Phenotypic variance	GCV %	PCV%	Heritability (h^2) (BS) (%)	Genetic Advancement (GA)	GAM (%)
1	Days to 50% plants flowering	10.75	12.06	8.11	8.59	0.89	6.37	15.78
2	No. of days to maturity	1.77	4.89	1.77	3.24	0.29	1.35	1.99
3	No. of branches per plant	0.23	1.12	12.19	26.89	0.20	0.44	11.39
4	Plant height (cm)	67.64	69.11	16.08	16.18	0.97	16.76	32.62
5	Plants stand at harvest	1270.15	1503.16	20.04	21.80	0.84	67.48	37.95
6	No. of pods per plant	8.25	9.72	20.54	22.31	0.84	5.44	38.98
7	No. of seeds per pod	1.60	2.042	10.45	11.78	0.78	2.31	19.09
8	100 seed weight (gm)	0.20	0.23	12.40	13.40	0.85	0.86	23.63
9	Grain yield per plant (gm)	5.69	6.21	29.18	30.47	0.91	4.70	57.57

Genotypic coefficient of variation which gives the extent of genetic variability in the population, ranged from 1.77 to 29.18 per cent. Maximum genotypic coefficient of variation was observed for seed yield per plant (29.18%), number of pods per plant (20.54%), plant stand at harvest (20.04%), and plant height (16.08) indicating large variation in the population for this trait. High phenotypic coefficient of variation and genotypic coefficient of variation were observed for yield per plant followed by number of pods per plant and plant height, which indicate that these traits can be recommended for direct selection. Similar results were reported earlier by Konda *et al.* (2009) [8], Gadakh *et al.* (2013) [3]. Less differences observed between phenotypic and genotypic coefficient of variation in certain cases indicated that these characters were less influenced by the environment.

Highest magnitude of heritability was observed for plant height (0.97%) followed by grain yield per plant (0.91%), days to 50 percent flowering (0.89%), 100 seed weight (0.85%), plant stand at harvest (0.84%), number of pod per plant (0.84%), number of seed per pod (0.78%), number of days to maturity (0.29%), number of branches per plant (0.20%) indicating major role of genotype and ultimately less environmental influence. These results confirm the earlier findings of Bakshi (2006) [1], Reni (2013) [12].

Highest magnitude of genetic advance was observed for plant stand at harvest (67.48), plant height (16.76), days to 50% plant flowering (6.37). A similar result for high genetic advance was observed by Byregowda *et al.* (1997) [2].

Correlation coefficient analysis among Seed yield and its contributing characters are shown in Table 3 & 4.

Table 3: Estimates of genotypic correlation coefficient (r) for different characters in mungbean

Character	Days to 50% plant flowering	No. of days to maturity	Plant stand at harvest	Plant height (cm)	No. of branches per plant	No. of pods per plant	100 seed wt. (gm)	No. of seed per pod	Grain yield per plant (gm)
Days to 50% plants flowering	1	0.937**	0.025	-0.015	-0.047	0.059	-0.028	0.103	0.039
No. of days to maturity		1	-0.243	-0.199	-0.095	-0.110	-0.241	-0.048	-0.100
Plant stand at harvest			1	0.967**	0.968**	0.994**	0.806**	0.827**	0.951**
Plant height				1	0.855**	0.968**	0.745**	0.773**	0.945**
No. of branches per plant					1	0.988**	0.767**	0.706**	0.092
No. of pods per plant						1	0.814**	0.801**	0.987**
100 seed wt. (gm)							1	0.546**	0.823**
No. of seed per Pod								1	0.762**
Grain yield per plant (gm)									1

*Significant at 5% level, **Significant at 1% level

Table 4: Estimates of phenotypic correlation coefficient (r) for different characters in mungbean

Character	Days to 50% plant flowering	No. of days to maturity	Plant stand at harvest	Plant height (cm)	No. of branches per plant	No. of pods per plant	100 seed wt. (g)	No. of seed per pod	Grain yield per plant (g)
Days to 50% plant flowering	1	0.481**	0.073	-0.017	-0.042	0.026	-0.023	0.114	0.038
No. of days to maturity		1	-0.083	-0.104	0.112	-0.049	-0.158	0.006	-0.110
Plant stand at harvest			1	0.884**	0.438**	0.821**	0.686**	0.666**	0.868**
Plant height (cm)				1	0.386**	0.888**	0.676**	0.682**	0.897**
No. of branches per plant					1	0.465**	0.360**	0.280**	0.519**
No. of pods per plant						1	0.706**	0.629**	0.863**
100 seed wt. (g)							1	0.433**	0.732**
No. of seed per pod								1	0.681**
Grain yield per plant (g)									1

*Significant at 5% level, **Significant at 1% level

The grain yield per plant was showed highly significant positive correlation at genotypic and phenotypic level with plant height, plant stand at harvest, number of branches per plant, number of pods per plant, 100 seed weight, number of seed per pod. The strong genotypic correlation may be attributed to the close linkage of genes controlling recessive characters. These characters were also, positively interlinked among themselves. Thus, it indicated the importance of these characters while selection. These findings were supported by Gouda (1977), Govindraj (2001) [4], Parameswarappa (2005) reported the grain yield per plant was showed highly significant positive correlation with plant height, number of branches per plant, number of pods per plant, number of seed per pod. Character plant height is highly significant and positively correlated with seed yield which means mungbean accession with high grain yield should have sufficient plant height therefore this parameter can be used as the selection criteria in mungbean breeding programme. This result was supported by Hassan and Siddique (1995) [5]. Correlation coefficient with yield between number of branches per plant and number of pods per plant was positive and highly significant. This indicates that accession having both more number of branches and number of pod potentially produce higher yield. Similar result was reported by Byregoda *et al.* (1997) [2] showing that genotypes with more number of branches and number of pods may produce higher yield. Number of seed per pod and 100 seed weight showed highly significant and positive correlation with grain yield per plant, which means that more number of seed per pod and high weight of 100 seed potentially produce higher yield. Similar finding was reported by Khan and Ahmed (1989) [16]. Character days to 50% plant flowering showed negative non significant association with number of branches per plant, 100 seed weight, plant height. This indicates that increasing days to 50% flowering accompanished by decreasing these trait.

Similar result was reported by Parameswarappa (2005). Number of days to maturity is negatively non significant with grain yield per plant which means that late maturing accession potentially produced lower yield. This finding was in consonance with the finding of Shrivastava and Singh (2012) [14]. Positive correlation occurs due to changes of genes supplying precursors. On the other hand negative correlation arises due to competitions among traits for common precursors which are restricted supply.

Path coefficient analysis at genotypic level revealed that the characters days to 50 percent plant flowering showed direct positive significant association toward seed yield per plant. Hence it is suggested that more emphasis should be given on days to 50% plant flowering, while executing the selection on for genetic enhancement of seed yield in mungbean. Similar results were reported by Natarajan *et al.* (1999), Patil and Deshmukh (1988), Khan and Ahmed (1989) [16], Singh *et al.* (2009). Character number of days to maturity exhibited negative direct effect on grain yield per plant. Similar results were reported by Natarajan *et al.* (1999). However positive indirect effect exhibited through plant height, number of branches per plant, number of pods per plant, 100 seed weight and number of seed per pod. Plant height showed negative direct effect on grain yield as well as negative indirect effect via number of branches per plant, number of pods per plant, 100 seed weight and number of seed per pod. However positive indirect effect exhibited through days to 50% flowering and number of days to maturity. Similar results were reported by Patil and Deshmukh *et al.* (1988) [10].

Table 5: Path coefficient analysis showing the direct and indirect effects of various selected characters on yield in Mungbean

Characters	Days to 50% plants flowering	No. of days to maturity	Plant height (cm)	No. of branches per plant	No. of pods per plant	100 seed weight (g)	No. of seed per pod	Grain yield per plant (g)
Days to 50% plants flowering	0.103	0.096	-0.001	-0.004	0.006	-0.002	0.010	0.004
No. of days to maturity	-0.141	-0.151	0.030	0.014	0.016	0.036	0.007	-0.100
Plant height (cm)	0.003	0.043	-0.216	-0.184	-0.209	-0.161	-0.167	-0.204
No. of branches per plant	-0.002	-0.004	0.042	0.049	0.048	0.037	0.034	0.053
No. of pods per plant	0.089	-0.164	0.445	0.521	0.123	0.132	0.521	0.056
100 seed weight (g)	0.002	0.019	-0.059	-0.060	-0.064	-0.079	-0.043	-0.065
No. of seed per pod	-0.008	0.003	-0.060	-0.055	-0.062	-0.043	-0.078	-0.059

Residual effect: 0.1359

Character number of branches per plant showed positive direct effect on grain yield per plant. This result is agreement with the finding of Saxena and Sing (2007) [13]. The positive indirect effect on grain yield through plant height, pods per plant, 100 seed weight, number of seed per pod. The positive indirect effect was through days to 50% flowering and days to maturity. The character number of pods per plant exhibited positive direct effect on yield as well as positive indirect effect via days to days to 50% flowering, plant height, number of branches per plant, 100 seed weight and number of seed per pod, whereas negative indirect effect through number of days to maturity. Similar results were reported by Bakshi (2006) [1]. Character 100 seed weight and number of seed per pod showed negative direct contribution to grain yield as well as negative indirect effect through plant height, number of pods per plant. Similar results were reported by Wani (1992) [15], Khan (1988) [6].

Path coefficient analysis indicated the importance of yield contributing characters *viz.*, days to 50 percent flowering, number of branches per plant, number of pods per plant, which showed high positive direct effect as the major yield contributing traits, for enhancing the yield of green gram.

It is evident from the foregoing discussion that the economic character, seed yield per plant showed genetic variability, heritability and genetic advance of high magnitude. The correlation study revealed that the number of seeds per pod and number of pods per plant were important characters for increasing seed yield. Genotypic path coefficient analysis indicated that the predominance of direct effects of number of branches per plant, days to 50% plant flowering.

Conclusions

The mean sum of squares for all the characters studied was found to be significant indicating the variation for the characters under study. The phenotypic coefficient of variation (PCV) was higher than that of genotypic coefficient of variation (GCV) for all the characters under study. High estimates of heritability in broad sense were recorded plant height, grain yield per plant, days to 50% plant flowering, 100 seed weight, plant stand at harvest, number of pod per plant, number of seed per pod, number of days to maturity, number of branches per plant. It shows that genotypic variance for their characters are probably due to high additive genetic effect. Therefore, the selection based on phenotypic performance of these characters would be useful for achieving desired results. Low estimates of heritability coupled with high genetic advance were obtained for plant stand at harvest, plant height, days to 50% flowering and number of pods per plant. It shows that genotypic variance for their characters are probable due to non-additive genetic effect and they can be improved through hybridization. The yield per plant was positively and significantly correlated with plant stand at harvest, plant height, number of branches per plant, number of pod per plant, 100 seed weight, number of seed per pod. Path coefficient analysis indicated the importance of yield contributing characters *viz.*, days to 50 percent flowering, number of branches per plant, number of pods per plant, which showed high positive direct effect as the major yield contributing traits, for enhancing the yield of green gram.

References

1. Bakshi A, Bala S, Dostisder KG. Character association for seed yield components in black gram (*Vigna mungo* (L.) Hepper). Environ. and Ecology 2006;24(3):943-945.
2. Byregowda M, Chandraprakash J, Babu CS, Rudraswamy P. Genetic variability and interrelationship among yield and yield components in green gram. Crop Res 1997;13(15):361-368.

3. Gadakh SS, Dethe AM, Kathale MN. Genetic variability correlation and path analysis studies on yield and its components in mungbean (*Vigna radiata* (L.) WILCZEK). Bioinfolet 2013;10(2A):441-447.
4. Govindaraj P, Subramanaian M. Association analysis in black gram (*Vigna mungo* (L.) Hepper). Madras Agril. J 2001;88(4-6):240-242.
5. Hassan MN, Siddique AR, Malek MA. Correlation studies on mungbean. Bangla. J Agril. Res. 1995;20(2):126-131.
6. Khan IA. Path coefficient analysis of yield attributes in mung bean Legume Res 1988;11(1):41-43.
7. Talila Garamu. Effect of different source and rates of biochar application on the yield and yield components of mungbean on the acidic soil in western Ethiopia. Int. J Res. Agron. 2020;3(1):01-07.
8. Konda CR, Salimath PM, Mishra MN. Genetic variability studies for productivity and its components in blackgram [*Vigna munga* (L.) Hepper]. Legume Res 2009;32(1):59-61.
9. Natarajan C, Thiyagarajan K, Rathnaswamy R. Association and genetic diversity studies in green gram *(Vigna radiata* (L.) Wilczek) Madras Agric. J 1988;75(7-8):238-245.
10. Patil HS, Deshmuk RB. Correlation and path coefficient analylsis in mungbean J. Maharashtra Agric. Univ 1988;13(2):183-185.
11. Parameshwarappa SG, Patil SS, Salimath PM, Parameshwarppa R. Comparison of association and path Analysis over two season in Black gram (*Vigna mungo* (L.) Hepper). Karnataka J. Agric. Sci 2003;4(1-2):1-5.
12. Reni YP, Rao YK, Satish Y, Babu JS. Estimates of genetic parameters and path analysis in black gram (*Vigna mungo* (L.) Hepper). Int. J. of Plant, Animal and Environ. Sci 2013;3(4):231-234.
13. Saxena RR, Singh PK. Correlation and path analysis in mungbean cultivars (*Vigna radiata* (L.) Wilczek). J. of Interacademicia 2007;11(2):143-148.
14. Shrivastava RL, Singh G. Genetic variability, correlation and path analysis in mungbean (*Vigna radiata* (L.) Wilczek) Indian L. J. Sci 2012;2(1):61-65.
15. Wani SA, Zargar GH, Ahanger HU. Path coefficient analysis in mungbean *(Vigna radiata* (L.) Wilczek) Adv. PI Sci. 1992;5(2):554-558.
16. Khan IA, Ahmed R. Relationship of yield and its component characters in mungbean (*Vigna radiata* (L.) Wilczek). Legume Res 1989;12:173-176.