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Study of Correlation and Path Analysis in Greengram [*Vigna radiata* (L.) Wilczek] for Yield and Yield Attributing Traits

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The current study was designed to estimate correlation coefficients and investigate the direct and indirect effects of various yield contributing traits on seed yield in twenty greengram genotypes. The experiment was carried out during *Kharif* 2021 in a randomized block design with three replications. Correlation studies among the characters revealed that seed yield per plant has highly positive and significant association with characters like plant height, days to 50% flowering, days to maturity, number of primary branches, number of clusters per plant, number of pods per plant, no. of seeds per pod, pod length, biological yield per plant, harvest index both at phenotypic and genotypic levels, depicting that these are important yield contributing traits. Path coefficient analysis of various quantitative traits indicated that the number of seeds per pod, biological yield per plant, harvest index and seed index had the positive direct effect on seed yield per plant followed by plant height and number of primary branches exhibited the negative direct effect on seed yield per plant in greengram. Their correlation with seed yield was likewise noteworthy and favourable, demonstrating a real and flawless correlation between these features. Therefore, identifying high-yielding genotypes from a population with substantial segregation would be aided by direct selection for these traits.

Keywords: Correlation; path analysis; greengram; seed yield.

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1. INTRODUCTION

Greengram [*Vigna radiata* (L.) Wilczek], also known as mungbean, is an ancient pulse crop widely cultivated in India. It is a diploid species with the chromosomal number 2n=2x=22, a member of the subfamily Papilionaceae of the Leguminosae family, and its botanical name is *Vigna radiata* (L.) Wilczek. Mungbean is a native of South Asia (India), and its likely ancestor is *Vigna radiatavar*. *sublobata*. It may be produced in a variety of crop rotation strategies due to its short duration, broad adaptability, low water need, and photo insensitivity. Green gram is mostly grown in India, Pakistan, Bangladesh, Sri Lanka, Nepal, and other Southeast Asian nations [1].

Mungbean is one of the essential source of amino acids, including arginine, leucine, lysine, tryptophan, and valine, that is high in vitamin B among other pulses. Green gram sprouts contain vitamin C and E [2]. Greengram is rich in protein (24gm/100gm) which is nearly 2.5 times more than cereals. It is also good source of carbohydrate (60gm/100gm), fat (1gm/100gm), minerals (3gm/100gm) and fiber (1gm/100gm). Mungbean seeds contain about 124 mg Calcium/100 gm, 326 mg Phosphorus/100 gm, 1.3% Fat,7.3 mg Iron/100 gm, 4.1 % Fiber and 334 Kcal Calorific Value. Pulses are the main sources of protein in our country, where the majority of the population is vegetarian, thus they are crucial to daily diet. Correlation estimates between yield and other characteristics are helpful in selecting desired plant types in designing an effective breeding program. Correlation coefficient measure the degree of association, genotypic or phenotypic relationship between two or more characteristics forming the basis for selection. Path coefficients analysis [3] is “an important tool for partitioning the correlation coefficient into direct and indirect effect of variables on dependent variable which can be an added advantage and helps in selection to a greater extent for improvement of yield”.

Keeping in view the above facts the present investigation was undertaken to assess the correlation among the traits and their path coefficient analysis for seed yield and yield attributing traits among the greengram genotypes.

1.1 Objectives

1. To asses genotypic and phenotypic association among yield traits
2. To estimate direct and indirect effects of yield contributing characters on seed yield

2. MATERIALS AND METHODS

The study of correlation and path analysis in greengram for yield and yield attributing traits was carried out under the field condition during *Kharif* 2021 in a randomized block design with three replications at the field experimental center and Seed Testing Laboratory, Department of Genetics and Plant Breeding, Sam Higginbottom Institute of Agriculture, Technology and Sciences Deemed to be University, Allahabad. The experimental area is situated on the left side of Allahabad Rewa road. It is nearly 5 km away from Allahabad city and very near to the river Yamuna. The experimental plot had uniform topography with homogenous fertility and this condition was suitable for the cultivation of greengram. For a plot size of 5x2m, the spacing between rows is 30 cm and the spacing between plants is 10 cm. The recommended packages of practices were followed for raising a healthy crop and all necessary plant protection measures were taken to control the pest and diseases.

2.1 Experimental Material

The experimental material for present study is obtained from the Department of Genetics and Plant Breeding, SHUATS, Prayagraj (Allahabad). The details of experimental material The experimental material consisted of 20 diverse lines of greengram are as follows in Table 1.

The observation were recorded on ten randomly selected individual plant of each genotypes for each replication for the following thirteen characters except days to 50% flowering, days to maturity which were recorded on plot basis. The characters included in the study were plant height (cm), days to 50% flowering, days to fifty percent pod setting, days to maturity, number of primary branches, number of clusters per plant, number of pods per plant, number of seeds per pod, pod length (cm), biological yield per plant (g), harvest index (%), seed index (g) and seed yield per plant (g). The data recorded for these characters were subjected to biometrical and statistical analysis and the results were obtained on above mentioned characters.

The estimation of the correlation coefficient was done using the formula given by Searle [4] and the test of significance was carried out by the

method described by Snedecor and Cochran [5]. "The correlation coefficient was further partitioned into direct and indirect effects with the help of path coefficient analysis as suggested" by Wright [3] and elaborated by Dewey and Lu [6].

The software called "R-Language" was used to perform the analysis mentioned in table 1.

3. RESULTS AND DISCUSSION

Crop improvement program heavily rely on the availability of enough variability and association among various variables, which is a requirement for carrying out a successful selection programme. Being a complicated quantitative property, seed yield depends on a variety of constituent characters. Therefore, knowledge of the association of different components together with their relative contributions has immense value in selection.

3.1 Correlation Analysis

The genotypic and phenotypic correlation coefficients were computed among all characteristics presented in Tables 2, 3 and Figs. 1, 2. In general the genotypic correlation coefficients were comparatively higher than the corresponding phenotypic correlation coefficient. Seed yield per plant (g) was found significant and positively correlated with plant height (0.529, 0.829), days to 50% flowering (0.252, 0.380), days to maturity (0.376, 0.425), number of primary branches (0.377, 0.425), the number of clusters per plant (0.634, 0.651), number of pods per plant (0.529, 0.376), number of seeds per pod (0.327, 0.455), pod length (0.341, 0.446), biological yield per plant (0.901, 0.916), harvest index (0.448, 0.388) at both phenotypic and genotypic level as per values, respectively and with days to fifty percent pod setting (0.420) at genotypic level and showed negative significant correlation with seed index (-0.316) at genotypic level. A similar finding was earlier reported by Kumar et al. [7], Ghimire et al. [8], Muthuswamy et al. [9], Asari et al. [10], Ahmad and Belwal [11]. The number of seeds per pod had positive and significant correlation with pod length (0.579, 0.696), biological yield per plant (0.381, 0.534) and seed yield per plant (0.327, 0.455) at both phenotypic and genotypic level as per values, respectively and the number of clusters per plant was found significant and positively correlated with the number of pods per plant (0.684, 0.762), biological yield per plant (0.593, 0.623) and seed yield per plant (0.634, 0.651) at both phenotypic and genotypic level as per values, respectively. Similar finding were earlier reported by Azam et al. *[12]*, Kumar et al. [7] and Muthuswamy et al. [9].

3.2 Path Analysis

"The correlation coefficient becomes more meaningful when the correlation coefficients are partitioned into components of direct and indirect effects through path analysis, because correlation coefficients indicate only the inter-relationship of the characteristics irrespective of cause and effect" [6]. For path analysis, seed yield was taken as the dependent variable and all other 12 characteristics used for correlation studies were taken as independent variables. The results are presented in Tables 4, 5 and Figs 3, 4.

Each factor influenced the yield by a direct contribution and indirect contribution through other variables with which it was correlated. Among all the characteristics, positive direct effects on seed yield per plant was recorded by number of seeds per pod (0.0089, 0.0149), biological yield per plant (0.9497, 0.8767), harvest index (0.4131, 0.4344) and seed index (0.0042, 0.0018) at both genotypic and phenotypic levels, respectively. On the other hand, negative direct effects on seed yield per plant were recorded by plant height (-0.0305, -0.0012) and the number of primary branches (-0.0088, -0.0142) at both genotypic and phenotypic levels, respectively. Similar findings were reported by Bhutia et al. [13], Ghimire et al. [8], Parihar et al. [14], and Muthuswamy et al. [9].

Number of seeds per pod exerted positive indirect effect *via* plant height (0.0053, 0.0077), days to 50% flowering (0.0020, 0.0021), days to fifty percent pod setting (0.0026, 0.0032), days to maturity (0.0018, 0.0035), number of primary branches (0.0006, 0.0007), number of clusters per plant (0.0020, 0.0025), number of pods per plant (0.0006, 0.0004), pod length (0.0062, 0.0086) and biological yield per plant (0.0047, 0.0057) at both genotypic and phenotypic levels, respectively. Biological yield per plant exerted positive indirect effect *via* plant height (0.7709, 0.4619), days to 50% flowering (0.5458, 0.3339), days to fifty percent pod setting (0.5834, 0.3171), days to maturity (0.5921, 0.4247), number of primary branches (0.3013, 0.2658), number of clusters per plant (0.5914, 0.5195), the number of pods per plant (0.4043, 0.4480), number of seeds per pod (0.5071, 0.3336), and pod length (0.3596, 0.2558) both at genotypic and phenotypic levels, respectively.

Table 1. Genotypes of Greengram with their pedigree

S. No.	Genotypes names	Centre responsible for developing	Pedigree	Year of release
1	PUSA VISHAAL	IARI, New Delhi	Selected from NM92	2002
2	IIPM-99-125	IIPR, Kanpur	PM3 X APM36	2004
3	SML-832	PAU , Ludhiana	SML302 X PUSA BOLD1	2010
4	DGGV-2	UAS, Dharwad	CHINAMUNG X TM-98-50	2014
5	IPMD-604-1-7	IIPR, Kanpur	Germplasm	2016
6	PANT MUNGS-5	GBPUAT, Pantnagar	Selected from VC 6368	2002
7	SML-668	PAU , Ludhiana	Selected from NM94	2002
8	PUSA-9531	IARI, New Delhi	Selected from NM9473	2000
9	OBGG-58	OUAT, Berhampur	Mutant of K857	2002
10	IPM-2-3	IIPR, Kanpur	IPM99-125 X PUSA BOLD2	2009
11	MH-3-18	CCSHAU, Hisar	Germplasm	2016
12	PUSA 0672	IARI, New Delhi	11/395 X ML267	2009
13	HUM-16	BHU,Varanasi	PUSA BOLD-1 X HUM8	2006
14	MH-2-15	CCSHAU, Hisar	PDM116 X GUJRAT-1	2007
15	PUSA-9072	IARI,New Delhi	PUSA-106 X 10-215	1995
16	HUM-1	BHU,Varanasi	BHUMI X PANT U -30	1999
17	MH-421	CCSHAU, Hisar	MUSKAN X BDYR2	2014
18	IPM-409-4	IIPR,Kanpur	PDM2881 X IPM 3-1	2020
19	IPM-312-20	IIPR, Kanpur	IPM-1 X SPS 5	2020
20	PANT MOONG -4	GBPUAT, Pantnagar	T44 X UPU-2	1997

Table 2. Genotypic Correlation Coefficient for Yield and Its Related Traits in 20 Greengram Genotypes

TRAITS	Plant height (cm)	Days to 50% flowering	Days to 50 % pod sett	Days to maturity	No. of Primary Branches	No. of clusters per plant	No. of pods per plant	No. of seeds/pod	Pod length(cm)	Biological yield /plant	Harvest index (%)	Seed Index (g)	Seed yield/ plant
Plant height(cm)	1.000	0.467**	0.498**	0.353*	0.112	0.617**	0.536**	0.598**	0.692**	0.812**	0.196	-0.153	0.829**
Days to 50% flowering		1.000	0.825**	0.874**	0.077	0.387*	0.398*	0.222	0.386*	0.575**	-0.370*	-0.441**	0.380*
Days to 50% pod sett			1.000	0.861**	0.105	0.385*	0.467**	0.292*	0.431**	0.614**	-0.361*	-0.365*	0.420**
Days to maturity				1.000	0.208	0.303*	0.439**	0.202	0.190	0.624**	-0.336*	-0.436**	0.425**
No. of Primary Branches					1.000	0.490**	0.246	0.062	0.242	0.317*	0.339*	0.096	0.425**
No. of clusters per plant						1.000	0.762**	0.228	0.433**	0.623**	0.184	-0.307*	0.651**
No. of pods per plant							1.000	0.073	0.017	0.426**	-0.022	-0.386*	0.376*
No. of seeds/pod								1.000	0.696**	0.534**	-0.102	-0.059	0.455**
Pod length(cm)									1.000	0.379*	0.225	0.181	0.446**
Biological yield/ plant										1.000	-0.017	-0.417**	0.916**
Harvest index (%)											1.000	0.165	0.388*
Seed Index (g)												1.000	-0.316*
Seed yield per plant													1.000

**5%Level of significance; **1%Level of significance*

Table 3. Phenotypic Correlation Coefficient for Yield and Its Related Traits in 20 Greengram Genotypes

TRAITS	Plant height (cm)	Days to 50% flowering	Days to 50 % pod sett	Days to maturity	No. of Primary Branches	No. of clusters per plant	No. of pods per plant	No. of seeds/pod	Pod length	Biological yield /plant	Harvest index (%)	Seed Index (g)	Seed yield/ plant
Plant height(cm)	1.000	0.326*	0.414*	0.274*	0.094	0.209	0.304*	0.517**	0.592**	0.527**	0.125	-0.143	0.529**
Days to 50% flowering		1.000	0.941**	0.619**	0.078	0.232	0.237	0.140	0.271*	0.381*	-0.238	-0.345*	0.252
Days to 50% pod sett			1.000	0.596**	0.111	0.214	0.267*	0.215	0.299*	0.362*	-0.253	-0.294*	0.226
Days to maturity				1.000	0.169	0.252	0.381*	0.235	0.136	0.485**	-0.162	-0.400*	0.376*
No. of Primary Branches					1.000	0.338*	0.221	0.047	0.206	0.303*	0.278*	0.091	0.377*
No. of clusters per plant						1.000	0.684**	0.168	0.201	0.593**	0.242	-0.198	0.634**
No. of pods per plant							1.000	0.030	0.013	0.511**	0.156	-0.314*	0.529**
No. of seeds/pod								1.000	0.579**	0.381*	-0.051	-0.048	0.327*
Pod length(cm)									1.000	0.292*	0.176	0.163	0.341*
Biological yield/ plant										1.000	0.023	-0.346*	0.901**
Harvest index (%)											1.000	0.143	0.448**
Seed Index (g)												1.000	-0.253
Seed yield per plant													1.000

**5%Level of significance; **1%Level of significance*

Table 4. Genotypic Path Coefficient for Yield and Its Related Traits in 20 Greengram Genotypes

	Plant height (cm)	Days to 50% flowering	Days to 50 % pod sett	Days to maturity	No. of Primary Branches	No. of clusters per plant	No. of pods per plant	No. of seeds/pod	Pod length	Biological yield /plant	Harvest index (%)	Seed Index (g)	Seed yield/ plant
Plant height(cm)	**-0.0305**	-0.0143	-0.0152	-0.0108	-0.0034	-0.0188	-0.0164	-0.0183	-0.0211	-0.0248	-0.0060	0.0047	0.829**
Days to 50% flowering	-0.0013	**-0.0028**	-0.0028	-0.0024	-0.0002	-0.0011	-0.0011	-0.0006	-0.0011	-0.0016	0.0010	0.0012	0.380*
Days to 50% pod sett	0.0324	0.0655	**0.0650**	0.0559	0.0068	0.0250	0.0304	0.0190	0.0280	0.0399	-0.0235	-0.0237	0.420**
Days to maturity	-0.0236	-0.0583	-0.0574	**-0.0667**	-0.0138	-0.0202	-0.0293	-0.0135	-0.0127	-0.0416	0.0224	0.0290	0.425**
No. of Primary Branches	-0.0010	-0.0007	-0.0009	-0.0018	**-0.0088**	-0.0043	-0.0022	-0.0005	-0.0021	-0.0028	-0.0030	-0.0008	0.425**
No. of clusters per plant	0.0098	0.0061	0.0061	0.0048	0.0078	**0.0158**	0.0121	0.0036	0.0069	0.0099	0.0029	-0.0049	0.651**
Number of pods per plant	-0.0060	-0.0045	-0.0053	-0.0049	-0.0028	-0.0086	**-0.0113**	-0.0008	-0.0002	-0.0048	0.0002	0.0043	0.376*
No. of seeds/pod	0.0053	0.0020	0.0026	0.0018	0.0006	0.0020	0.0006	**0.0089**	0.0062	0.0047	-0.0009	-0.0005	0.455**
Pod length(cm)	-0.0076	-0.0042	-0.0047	-0.0021	-0.0026	-0.0047	-0.0002	-0.0076	**-0.0109**	-0.0041	-0.0025	-0.0020	0.446**
Biological yield per plant	0.7709	0.5458	0.5834	0.5921	0.3013	0.5914	0.4043	0.5071	0.3596	**0.9497**	-0.0163	-0.3956	0.916**
Harvest index (%)	0.0809	-0.1526	-0.1492	-0.1387	0.1402	0.0759	-0.0092	-0.0420	0.0928	-0.0071	**0.4131**	0.0679	0.388*
Seed Index (g)	-0.0006	-0.0018	-0.0015	-0.0018	0.0004	-0.0013	-0.0016	-0.0002	0.0008	-0.0017	0.0007	**0.0042**	-0.316*
Seed yield per plant (g)	0.829**	0.380*	0.420**	0.425**	0.425**	0.651**	0.376*	0.455**	0.446**	0.916**	0.388*	-0.316*	1.0000
Partial R^2	-0.0253	-0.0011	0.0273	-0.0284	-0.0037	0.0103	-0.0042	0.0040	-0.0049	0.8697	0.1604	-0.0013	

**5%Level of significance **1%Level of significance*

Table 5. Phenotypic Path Coefficient for Yield and Its Related Traits in 20 Greengram Genotypes

	Plant height (cm)	Days to 50% flowering	Days to 50 % pod sett	Days to maturity	No. of Primary Branches	No. of clusters per plant	No. of pods per plant	No. of seeds/pod	Pod length	Biological yield /plant	Harvest index (%)	Seed Index (g)	Seed yield/ plant
Plant height(cm)	**-0.0012**	-0.0004	-0.0005	-0.0003	-0.0001	-0.0003	-0.0004	-0.0006	-0.0007	-0.0006	-0.0002	0.0002	0.529**
Days to 50% flowering	0.0108	**0.0331**	0.0311	0.0205	0.0026	0.0077	0.0078	0.0046	0.0090	0.0126	-0.0079	-0.0114	0.2515
Days to 50% pod sett	-0.0092	-0.0209	**-0.0222**	-0.0132	-0.0025	-0.0047	-0.0059	-0.0048	-0.0066	-0.0080	0.0056	0.0065	0.2255
Days to maturity	0.0027	0.0060	0.0058	**0.0097**	0.0016	0.0024	0.0037	0.0023	0.0013	0.0047	-0.0016	-0.0039	0.376*
No. of Primary Branches	-0.0013	-0.0011	-0.0016	-0.0024	**-0.0142**	-0.0048	-0.0031	-0.0007	-0.0029	-0.0043	-0.0039	-0.0013	0.377*
No. of clusters per plant	-0.0002	-0.0002	-0.0002	-0.0002	-0.0003	**-0.0009**	-0.0006	-0.0001	-0.0002	-0.0005	-0.0002	0.0002	0.634**
Number of pods per plant	0.0035	0.0027	0.0031	0.0044	0.0026	0.0079	**0.0116**	0.0003	0.0001	0.0059	0.0018	-0.0036	0.529**
No. of seeds/pod	0.0077	0.0021	0.0032	0.0035	0.0007	0.0025	0.0004	**0.0149**	0.0086	0.0057	-0.0008	-0.0007	0.327*
Pod length(cm)	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	**0.0002**	0.0001	0.0000	0.0000	0.341*
Biological yield per plant	0.4619	0.3339	0.3171	0.4247	0.2658	0.5195	0.4480	0.3336	0.2558	**0.8767**	0.0198	-0.3030	0.901**
Harvest index (%)	0.0544	-0.1032	-0.1099	-0.0705	0.1209	0.1049	0.0679	-0.0221	0.0765	0.0098	**0.4344**	0.0621	0.448**
Seed Index (g)	-0.0003	-0.0006	-0.0005	-0.0007	0.0002	-0.0004	-0.0006	-0.0001	0.0003	-0.0006	0.0003	**0.0018**	-0.2531
Seed yield per plant (g)	0.529**	0.2515	0.2255	0.376*	0.377*	0.634**	0.529**	0.327*	0.341*	0.901**	0.448**	-0.2531	1.0000
Partial R^2	-0.0006	0.0083	-0.0050	0.0036	-0.0053	-0.0005	0.0061	0.0049	0.0001	0.7901	0.1944	-0.0005	

**5%Level of significance **1%Level of significance*

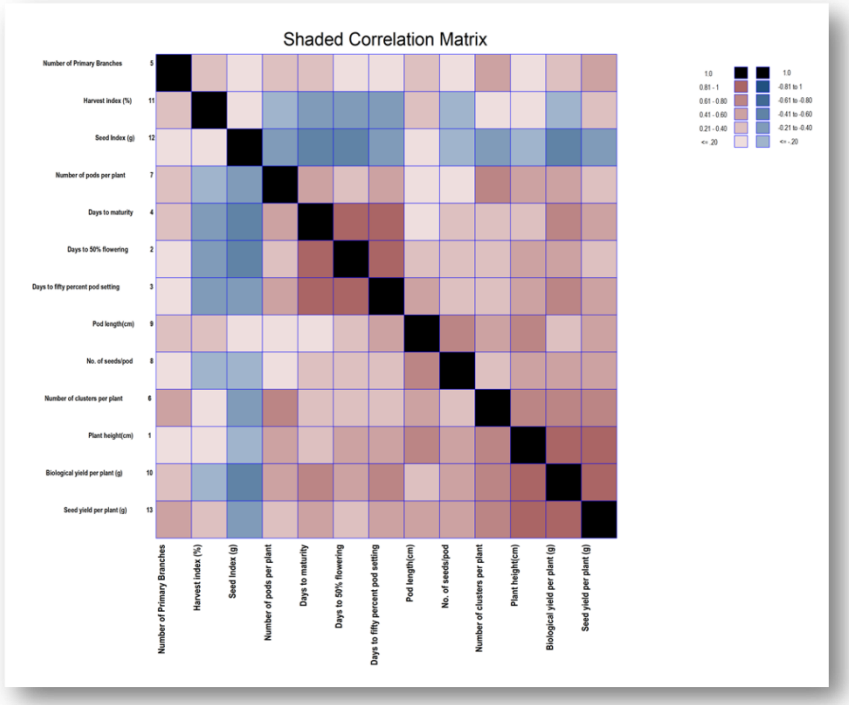

Fig. 1. Genotypic correlation matrix

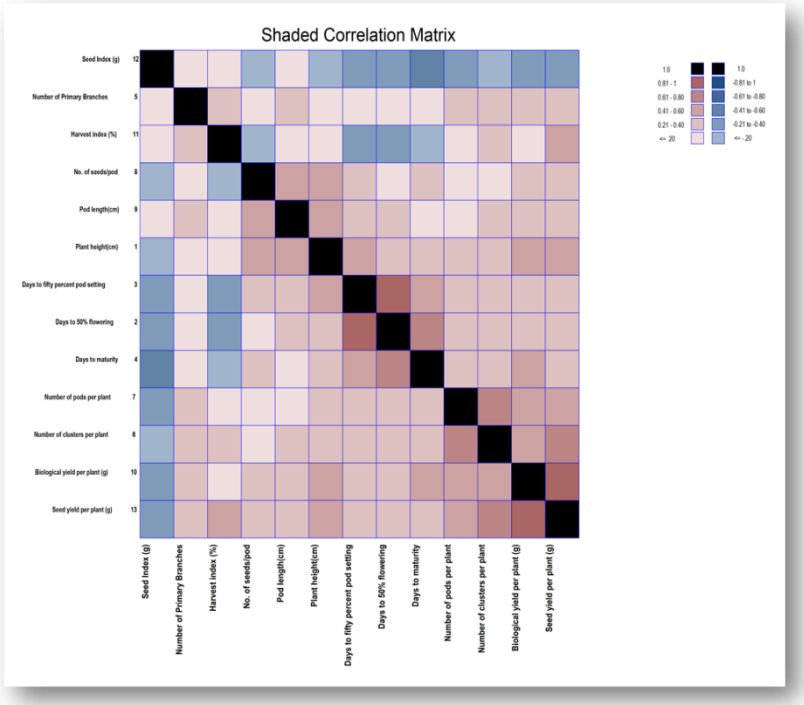

Fig. 2. Phenotypic correlation matrix

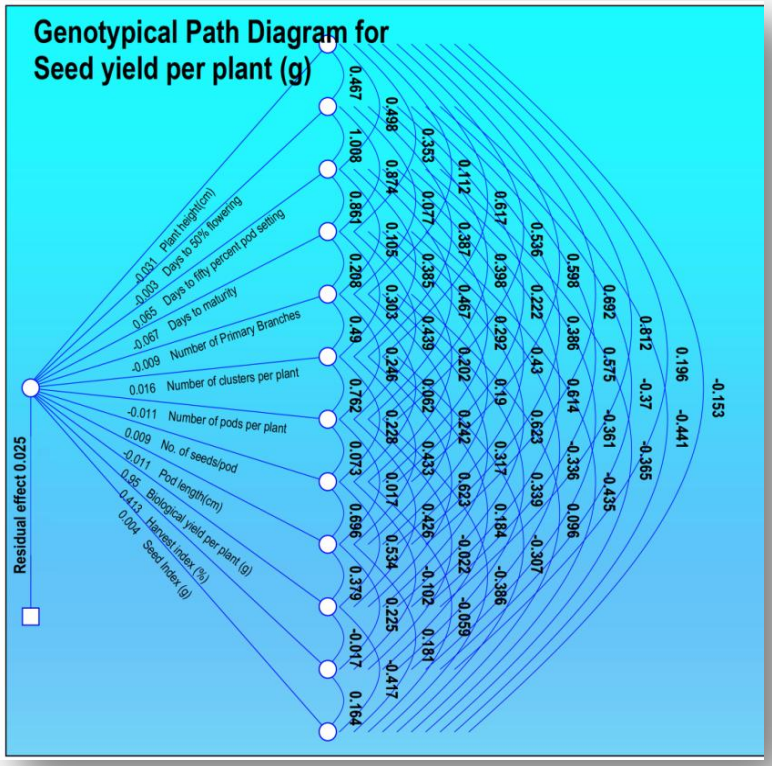

Fig. 3. Genotypic path diagram for seed yield per plant

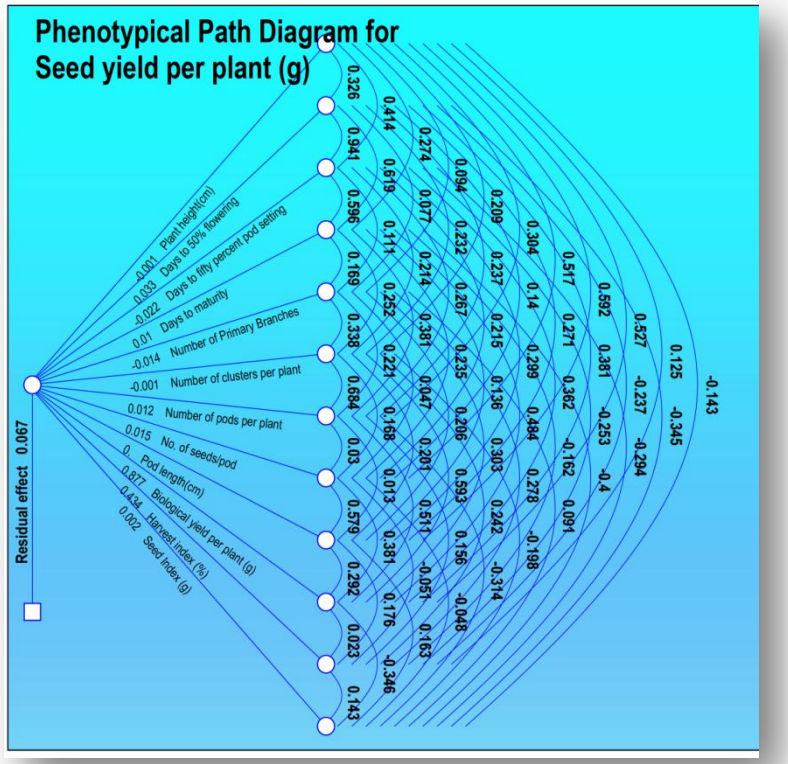

Fig. 4. Phenotypic path diagrams for seed yield per plant

4. CONCLUSION

Based on the findings of the current study, the number of seeds per pod, biological yield per plant, harvest index, and seed index were the main factors that contributed to yield and had a positive and significant relationship with grain yield per plant as well as a significant direct effect on grain yield per plant. Due consideration should be paid to these traits in the selection process in order to improve the yield potential of greengram by separating high-yielding genotypes from highly segregated populations.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Singh C, Singh P, Singh R. Modern Techniques of Raising Field Crops. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi. 2015;386.
2. Engel RH. The importance of legumes as a protein source in Asian diet. Proceeding of first international mungbean symposium, Taiwan. 1978;35-39.
3. Wright S. Correlation and causation. Journal of Agriculture Research. 1921;20: 557-587.
4. Searle SR. The value of indirect selection: I. Mass selection. Biometrics. 1965;21:682-707.
5. Snedecor GW, Cochran WG. Statistical methods. 6thed. Oxford and IBH Pub. Co. New Delhi; 1967.
6. Dewey DR, Lu KH. A correlation and path coefficient analysis of components of crested wheat grass seed production. Agron. J. 1959;51: 515-518.
7. Kumar A, Sharma NK, Kumar R, Sanadya SK, Sahoo S. Correlation and path analysis for seed yield and components traits in mungbean under arid environment. International Journal of Chemical Studies. 2018;6(4):1679-1681.
8. Ghimire SS, Khanal A, Kohar GR, Acharya B, Basnet A, Kandel P, Subedi B, Shrestha J, Dhakal K. Variability and path coefficient analysis for yield attributing traits of mungbean [*Vigna radiata* (L.) Wilczek]. Azarian Journal of Agriculture. 2018;5(1): 7-11.
9. Muthuswamy A, Jamunarani M, Ramakrishnan P. Genetic variability, character association and path analysis studies in mungbean [*Vigna radiate* (L.) Wilczek]. International Journal of Current Microbiology and AppliedSciences. 2019; 8(4):1136-1146.
10. Asari T, Patel BN, Patel R, Patil GB, Solanki, Chirag. Genetic variability, correlation and path coefficient analysis of yield and yield contributing characters in mungbean (*Vigna radiata* (L.) Wilczek). Internatiinal Journal of Chemical Studies. 2019;7(4):383-387.
11. Ahmad S, Belwal V. Study of correlation and path analysis for yield and yield attributing traits in mungbean (*Vigna radiata* (L.) Wilczek). I.J.C.S. 2020;8 (1):2140-2143.
12. Azam MG, Hossain MA, Alam MS, Rahman KS, Hossain M. Genetic variability, heritability and correlation, path analysis in mungbean (*Vigna radiata* (L.) Wilczek). Bangladesh J. Agril. Res. 2018; 43(3):407-416.
13. Bhutia P, Lal M, Thomas N. Studies on genetic variability, correlation and path analysis in green gram [*Vigna radiata* (L.) Wilczek] germplasm. International Journal of Agriculture Science. 2016;8(51):2267-2272.
14. Parihar R, Agrawal AP, Sharma DJ, Madhuri G. Character association and path analysis studies on seed yield and its yield attributing traits in mungbean (*Vigna radiata* (L.) Wilczek). J.P.P. 2018;7(1): 2148-2150.

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