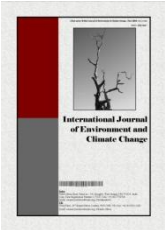

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Study of Genetic Variability, Character Association and Path Analysis in Greengram [*Vigna radiata* (L.) Wilczek]

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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

A set of 21 of greengram were evaluated for studying of "Study of Genetic Variability, Character Association and Path Analysis in Greengram [*Vigna radiata* (L.)Wilczek]". The experiment was conducted in a Randomized Block Design with three replications during the *kharif* season, 2021 in the crop research farm of Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. For all 13 characters, the analysis of variance revealed a significant difference between genotypes. A favourable and very significant link between seed yield per plant and Days to maturity and Harvest Index was found in the current study using both phenotypic and genotypic correlation coefficients. Maximum positive direct effects was depicted by Harvest Index (%), Number of seeds per pod and Plant height (cm) at both phenotypic and genotypic levels. Path analysis further revealed that direct effect of Harvest Index (%), No. of seeds per pod and Plant Height (cm) was of high magnitude. The significant indirect effect through these features also contributed to the high positive relationship of other characters with grain yield per plant (g). This suggested that the above three traits' direct and indirect effects accounted for the majority of the seed yield. As a result, these genotypes may be encouraged for cultivation as well as in next breeding programmes to create better cultivars for sustainable agricultural production.

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Keywords: Greengram; variability; character association; correlation; path coefficient.

1. INTRODUCTION

The third most significant pulse crop in India is greengram, which is grown on around 8% of the nation's total pulse land. Because it provides a less expensive protein source and has a protein content of 24.7%, it is known as "poor man's meat" (Potter and Hotchkiss, 1997). Every 100 g of mungbean seeds contains vitamins, 6.74 mg of iron, 189 mg of magnesium, 367 mg of phosphorus, 124 mg of potassium, and 132 mg of calcium (Haytowitz and Matthews,1986). The excellent digestion and taste of greengram make it a popular green vegetable.

As a self-pollinated species, greengram exhibits significant variation both within and among its related species (Bisht et al., 2005). “The base population serves as a valuable source of base population for providing a wide range of genetic improvement, which is primarily dependent on the level of genetic variability present in the base population. One of the barriers to advancement in greengram production has been cited as the lack of genetic variety for high yield potential” (Ramanujam, 1978).

With India's population continuing to increase and the impoverished sector suffering from malnutrition, there is a growing demand for greengram to be made available to the general public at reasonable pricing. This calls for the creation of high yielding cultivars that can provide both high production and high productivity. The goal of the current study is to determine the optimum genotype that can produce a high yield per unit area.

The pulse improvement programmes highlighted the need to find genotypes for new niches and generate variability for high yield potential. Understanding the genetic makeup of varieties is crucial because gene action that controls yield and its auxiliary features raise yield per unit area.

The level of their genetic variability, heritability, and anticipated genetic advance are of utmost importance when starting breeding efforts to boost yield and the contributing features. The amount of genetic variability in a plant population influences how well selection works. As a result, whether genetic improvement of any character will be successful is determined by the type of diversity present in the character's germplasm. The evaluation aids in determining the relative worth of various genotypes in terms of specific features.

When selecting an appropriate plant type, understanding the relationship between yield and constituent qualities may be beneficial. The correlation must be divided into direct and indirect effects through route analysis in order to determine the actual contribution of each character to the yield. Correlation, in conjunction with path analysis, would thus aid in the establishment of appropriate selection criteria for increasing yield. As a result, the current investigation was carried out to evaluate the variability and establish relationships between the yield and the features that contribute to it in the greengram.

2. MATERIALS AND METHODS

A field experiment was conducted during *Kharif* – 2021, Crop research farm of Department of Genetics and Plant Breeding of Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj which is located at 25° 24' 42" N latitude, 81° 50' 56" E longitude and 98 m altitude above the mean sea level (MSL). To assess the “Study of Genetic Variability, Character association and Path Analysis in Greengram [*Vigna radiata* (L.)Wilczek], the experiment was conducted in Randomized Block Design (RBD) with three replications. The 21 genotypes of greengram were sown on raised bed in July, 2021. The row to row and plant to plant distance was kept at 30×10 cm² spacing. The crop was fertilized with 20 Kg N_2, 40 Kg P_2O5 and 20 Kg K_2O per hectare. The nitrogen was applied in two stages, the first at the time of sowing and the second 25 days later. The entire Phosphorus was used as a base dose. All recommended practises were followed, and plant protection measures were implemented on time to avoid damage from insect pests and diseases. To minimise border effects, observations for these 13 characters were recorded for each genotype in each replication viz., days to 50% flowering, days to 50% pod setting, plant height (cm), number of primary branches per plant, days to maturity, number of clusters per plant, number of pods per plant, pod length, number of seeds per pod, biological yield seed index, harvest index and seed yield per plant from competitive plants that were randomly selected and tagged, excluding border plants. All of the characteristics studied,

with the exception of days to flowering and days to maturity, were recorded on five randomly selected plants per plot. The observations from the entire plot were recorded for days to flowering and days to maturity. Using a physical balance, all weights were recorded in grams. The observations were taken based on the descriptors. The cultivation practices like irrigation, weeding, fertilization and pesticide application etc. were followed on proper times. "The analysis of variance of RBD and their significance for all the characters were worked out as suggested" by Panse and Sukhatme (1967). "The various genetic parameters viz., ECV, GCV, PCV, heritability were calculated by adopting the formulae" given by Johnson et al., (1955). "Genotypic correlation co- efficient was calculated by using the formulae" given by Al-Jibouri et al. (1958).

Chart 1. list of the genotypes used

Sl. No.	Genotypes
1.	MGG – 2
2.	R288 – 8
3.	KM – 2
4.	MGG – 348
5.	VIRAT
6.	VEENA
7.	MGG – 385
8.	MGG – 295
9.	MGG – 371
10.	WGG – 42
11.	MGG – 347
12.	WGG – 37
13.	RM – 12-18
14.	RM – 12-11
15.	ML 131
16.	KM 11-564
17.	K - 851
18.	RM – 12-13
19.	IPM – 2-14
20.	MGG – 351
21.	PUSA VISHAL (CHECK)

Source of the genotypes: Professor Jayashankar Telangana State Agricultural University, Rajendra Nagar, Hyderabad

3. RESULTS AND DISCUSSION

Table 1 shows the variance analysis for the 13 characters under investigation. It demonstrated that there were substantial differences for each of the 21 genotypes under research, showing the presence of extensive genetic variation for many character traits among the genotypes of greengram. All the characters have shown 1% level of significance.

The mean performance of all the characters is presented in Table 2. Among the tested genotypes the higher seed yield per plant were reported by MGG 351, WGG 37.

Table 3 shows the extent of genetic variance for all the traits under investigation. All of the features under examination had greater phenotypic coefficients of variation than genotypic coefficients of variation, showing that both genotype and environment play a role in variance. As a result, the selection of such traits is often inadequate. Lowest GCV and PCV were observed in days to maturity. Similar results are reported by Garg et al., (2017).

High heritability was observed in conjunction with higher genetic advance for all thirteen characters, indicating that the heritability is most likely due to additive gene effects and also that selection may be effective for all characters. The results are in accordance with that of Ahmad et al. (2015), Patel et al. (2014) [1,2] for high GCV and PCV of number of pods per plant and number of clusters per plant. Higher heritability and genetic advance as a percentage mean was observed in number of clusters per plant.

Correlation analysis among the yield and its contributing characters revealed that the genotypic correlation coefficients in most cases were higher than their phenotypic correlation coefficients indicating the association was largely due to genetic reason. At both genotypic and phenotypic levels. Days to maturity, Pod Length, Number of seeds per pod, and Harvest Index all showed statistically significant positive associations.

In the present investigation, Maximum positive direct effects was depicted by Harvest Index (%) , Number of seeds per pod and Plant height (cm) at both phenotypic and genotypic levels. While negative direct effects was depicted by Days to maturity and Seed Index.

The residual component of path analysis indicated that more than 99 % of variability of seed yield was accounted for by these thirteen characters.

Direct positive effect on seed yield through biological yield and harvest index was earlier reported by Gadakh et al. [3] and Choudhary et al. [4]. Direct positive effect on seed yield through number of pods per plant, number of seeds per pod and 100-seed weight was earlier reported by Kapadia et al. [5], Bhutia et al. [6] and Choudhary et al. [4]. Direct positive effect on seed yield through pod length was earlier reported by Jyothsna and Anuradha [7], Kapadia et al. [5], Bhutia et al. [6] and Choudhary et al. [4].

Table 1. Analysis of variance for 13 biometrical traits of Greengram

Sl. No.	Source	Mean sum of squares		
		Replications	Treatments	Error
	Degrees of freedom	2	20	40
1	Days to fifty percent flowering	16.6930	14.559**	5.503
2	Days to fifty percent pod setting	2.3970	21.744**	4.497
3	Plant height (cm)	24.40	81.067**	27.493
4	Number of primary branches per plant	0.1080	0.416**	0.131
5	Days to maturity	33.0060	50.931**	14.349
6	Number ofclusters per plant	0.0490	1.589**	0.2
7	Number of pods perplant	1.5810	10.048**	1.818
8	Pod length (cm)	0.7580	0.573**	0.239
9	Number of seeds per pod	0.3060	0.441**	0.148
10	Biological yield (g)	0.2060	11.586**	2.028
11	Seed Index (g)	00	0.339**	0.048
12	Harvest Index (%)	113.2750	207.897**	42.728
13	Seed yield perplant (g)	1.1630	1.538**	0.529

Table 2. Mean performance of greengram genotypes for 13 quantitative characters of Greengram

Sl. No.	Genotypes	Days to fifty Percent flowering	Days to fifty percent pod settings	Plant height (cm)	Number of primary benches per plant	Days to maturity	Number of clusters per plant|	Number of pods per plant	Pod length (cm)	Number of seeds per pod	Biological yield (g)	Seed index (g)	Harvest Index (%)	Seed yield per plant (g)
1	MGG-2	34.27	39.67	60.17	3.60	82.93	5.32	15.47	7.50	8.00	19.70	3.77	47.70	9.37
2	R288-5	35.93	41.33	53.17	3.33	89.30	5.37	14.47	7.07	7.07	19.83	3.82	42.52	8.43
3	KM-2	36.87	42.67	57.53	3.27	53.13	5.50	14.53	7.73	7.53	20.53	3.73	44.24	9.07
4	MGG-348	33.20	39.33	62.40	2.87	53.20	5.53	11.73	8.00	7.80	15.63	4.12	52.78	9.387
5	Virat	35.47	41.33	71.77	3.67	$1.53	4.40	13.07	8.37	7.47	17.63	4.03	43.59	8.57
6	Veena	35.20	43.33	45.33	3.40	55.00	6.67	15.47	7.33	6.94	15.00	3.75	46.93	8.43
7	MGG-385	35.47	44.00	62.13	3.67	85.13	5.47	13.07	8.00	7.60	15.80	3.78	56.51	8.87
8	MGG-295	38.27	43.67	52.57	2.33	87.93	3.73	10.60	7.40	7.00	16.27	4.00	53.36	9.57
9	MGG-371	39.13	46.33	56.77	3.87	55.60	5.13	14.67	7.63	TAT	16.63	3.74	55.42	9.73
10	WGG-42	40.27	46.00	52.87	3.07	87.53	5.20	15.20	7.73	7.40	19.23	3.93	44.52	S.47
11	MGG-347	40.13	50.00	53.30	3.33	32.07	6.00	16.60	7.30	7.40	19.93	3.54	43.38	8.60
iz	WGG-37	40.27	46.00	59.17	3.13	87.380	6.20	13.47	7.47	7.80	13.10	3.39	57.33	10,23
13	RM 12-158	36.80	42.33	55.30	2.87	79.93	5.67	15.47	8.67	6.40	14.80	3.83	65.38	9.54
14	RM 12-11	34.40	40.33	56.123	3.27	38.387	7.13	17.33	7.50	7.67	15.90	3.70	62.34	9.93
15	ML 131	39.33	45.33	43.90	3.20	86.67	4.93	12.80	S.27	FAT	14.77	3.99	67.60	9.93
16	KM 11-564	39.87	45.00	57.57	2.73	76.33	5.60	15.87	7.87	7.80	18.77	5.10	43.83	8.17

Sl. No.	Genotypes	Days to fifty Percent flowering	Days to fifty percent pod settings	Plant height (cm)	Number of primary benches per plant	Days to maturity	Number of clusters per plant|	Number of pods per plant	Pod length (cm)	Number of seeds per pod	Biological yield (g)	Seed index (g)	Harvest Index (%)	Seed yield per plant (g)
iv	K-851	37.47	43.00	55.47	2.93	78.93	5.20	13.53	7.42	7.47	20.83	4.00	40.31	3.40
18	RM 12-13	36.93	43.00	53.70	3.00	85.27	S.27	14.27	7.40	7.40	20.50	3.74	40.32	8.37
19	IPM -2-14	37.00	43.00	58.43	3.53	51.80	5.20	14.93	7.90	7.40	20.77	3.80	46.12	9.57
20	MGG-351	35.93	41.332	56.723	3.52	79.47	5.67	15.33	7.223	7.40	19.03	2.66	54.42	10.27
21	INDI — 495 (CHECK)	41.00	47.67	63.33	3.59	93.54	6.14	16.20	8.46	8.13	19.72	4.17	57.35	10.11
Mean		37.58	43.56	57.15	3.25	54.40	5.53	14.72	7.73	7.46	15.35	3.89	$1.45	9.21
cv		6.24	4.87	o17	11.17	4.49	3.09	9.16	6.33	5.16	7.76	5.64	12.71	7.90
SsEm		1.35	1.22	3.03	O.21	2.19	0.26	0.738	0.23	0.22	0.32	0.13	3.77	0.42
CD at 5%		3.387	3.50	3.65	0.60	6.25	0.74	2.22	0.31	0.64	2.35	0.36	10.79	1.20
CD at 1%		5.18	4.608	11.58	0.80	5.36	0.99	2.98	1.08	0.85	3.14	0.48	14.43	1.61
Minimum		33.20	39.33	43.33	2.33	76.33	3.73	10.60	7.07	6.40	14.77	3.39	40.31	8.17
Maxi		41.00	50.00	F177	3.87	93.54	7.13	13.47	8.67	8.13	20.83	5.10	67.60	10.27

Table 3. Genetic parameters for 13 quantitative characters of Greengram genotypes

Sl. No.	TRAITS	GCV	PCV	h^2 (Board sence)	Genetic advance 5 %	Gen.Adv as m of Mean 5%
1	Days to fifty percent flowering	4.623	7.768	35.421	2.13	5.668
2	Days to fifty percent pod setting	5.505	7.349	56.112	3.7	8.495
3	Plant height (cm)	7.39	11.777	39.377	5.463	9.553
4	Number of primary branches per plant	9.487	14.653	41.915	0.411	12.652
5	Days to maturity	4.137	6.104	45.942	4.876	5.777
6	Number of clusters per plant	12.301	14.721	69.824	1.171	21.175
7	Number of pods per plant	11.254	14.511	60.147	2.646	17.98
8	Pod length (cm)	4.316	7.664	31.717	0.387	5.007
9	Number of seeds per pod	4.19	6.649	39.709	0.406	5.439
10	Biological yield (g)	9.726	12.443	61.101	2.874	15.661
11	Seed Index (g)	8.018	9.803	66.91	0.525	13.511
12	Harvest Index (%)	14.422	19.22	56.303	11.469	22.292
13.	Seed yield per plant (g)	6.292	10.098	38.832	0.744	8.077

Table 4. Estimation of genotypic correlation coefficient for yield and its related traits in 21 greengram genotypes

TRAITS	Days to fifty percent flowering	Days to fifty cent pod set	Plant height (cm	Number of primary branches per	Days to maturity	Number of clusters per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	Biological yield (g)	Seed Index (g)	Harvest Index (%)	Seed yield per plant
Days to fifty percent flowering	1.0000	0.842**	-0.543**	-0.1513	0.360*	-0.0261	0.434**	0.0397	0.1657	0.0100	0.2084	0.0662	-0.0586
Days to fifty percent pod set		1.0000	-0.494**	-0.0068	0.306*	0.0364	0.381*	0.0893	0.2292	0.0250	0.0366	0.0355	-0.0742
Plant height (cm)			1.0000	0.657**	-0.0828	-0.1940	-0.0953	0.657**	0.623**	0.1757	0.2201	-0.0883	0.0725
Number of primary branches per plant				1.0000	0.272*	0.317*	0.363*	0.0637	0.489**	0.1542	-0.485**	-0.0104	0.2474
Days to maturity					1.0000	0.2392	0.1355	-0.1005	0.1655	-0.1431	-0.413**	0.328*	0.346*
Number of clusters per plant						1.0000	0.933**	-0.268*	0.1885	0.1142	-0.288*	-0.0005	0.0993
Number of pods per plant							1.0000	-0.1518	0.285*	0.2323	-0.321*	-0.0647	0.1266
Pod length (cm)								1.0000	-0.0022	-0.603**	0.499**	0.699**	0.352*
Number of seeds per pod									1.0000	0.481**	0.1666	-0.1172	0.316*
Biological yield (g)										1.0000	0.0123	-0.904**	-0.433**
Seed Index (g)											1.0000	-0.1538	-0.374*
Harvest Index (%)												1.0000	0.797**
Seed yield per plant (g)													1.0000

Table 5. Phenotypic correlation coefficient for yield and its related traits in 21 greengram genotypes

TRAITS	Days to fifty percent flowering	Days to fifty percent pod set	Plant height (cm)	Number primary branches per plant	Days to maturity	Number of clusters per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	Biological yield (g)	Seed Index (g)	Harvest Index (%)	Seed yield per plant (g)
Days to fifty percent flowering	1.0000	0.770**	-0.1419	0.0499	0.1167	-0.0145	0.1190	0.1359	-0.0395	-0.0839	0.0569	0.0442	-0.1294
Days to fifty percent pod set		1.0000	-0.0685	0.1238	0.1175	0.0106	0.2039	0.0375	-0.0477	0.0172	-0.0423	0.0171	-0.0695
Plant height (cm)			1.0000	0.1588	-0.0161	-0.0645	-0.0170	0.1984	0.311*	0.0829	0.0846	-0.0248	0.1041
Number of primary branches per plant				1.0000	0.0190	0.1787	0.2220	0.0528	0.1340	0.0179	-0.251*	0.0260	0.0481
Days to maturity					1.0000	0.1197	0.0117	-0.0046	0.1698	-0.1508	-0.1762	0.296*	0.274*
Number of clusters per plant						1.0000	0.528**	-0.1070	0.1169	0.0612	-0.1492	0.0301	0.1133
Number of pods per plant							1.0000	-0.1632	0.1386	0.1181	-0.1483	0.0040	0.1193
Pod length (cm)								1.0000	0.0544	-0.2425	0.2406	0.279*	0.1290
Number of seeds per pod									1.0000	0.1802	0.255*	-0.0838	0.1561
Biological yield (g)										1.0000	-0.0039	-0.802*****	-0.279*
Seed Index (g)											1.0000	-0.0961	-0.2245
Harvest Index (%)												1.0000	0.730**
Seed yield per plant (g)													1.0000

Table 6. Direct and indirect effects of yield related traits on seed yield in 21 genotypes of greengram at genotypic level

TRAITS	Days to fifty percent flowering	Days to fifty percent pod set	Plant height (cm)	Number primary branches per plant	Days to maturity	Number of clusters per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	Biological yield (g)	Seed Index (g)	Harvest Index (%)	Seed yield per plant (g)
Days to fifty percent flowering	-0.5477	-0.6187	0.2972	0.0828	-0.1973	0.0143	-0.2377	-0.0217	-0.0907	-0.0055	-0.1141	-0.0362	-0.0586
Days to fifty percent pod set	0.7174	0.6350	-0.3138	-0.0043	0.1944	0.0231	0.2419	0.0567	0.1456	0.0159	0.0233	0.0226	-0.0742
Plant height (cm)	-0.1736	-0.1581	0.3199	0.2103	-0.0265	-0.0620	-0.0305	0.2101	0.1993	0.0562	0.0704	-0.0282	0.0725
Number of primary branches per plant	0.1306	0.0059	-0.5677	-0.8636	-0.2348	-0.2741	-0.3135	-0.0550	-0.4223	-0.1332	0.4192	0.0090	0.2474
Days to maturity	-0.0492	-0.0418	0.0113	-0.0372	-0.1367	-0.0327	-0.0185	0.0137	-0.0226	0.0196	0.0565	-0.0448	0.346*
Number of clusters per plant	-0.0076	0.0106	-0.0566	0.0926	0.0698	0.2916	0.2719	-0.0782	0.0550	0.0333	-0.0841	-0.0002	0.0993
Number of pods per plant	-0.1021	-0.0896	0.0224	-0.0854	-0.0319	-0.2195	-0.2353	0.0357	-0.0670	-0.0547	0.0755	0.0152	0.1266
Pod length (cm)	0.0092	0.0208	0.1528	0.0148	-0.0234	-0.0624	-0.0353	0.2327	-0.0005	-0.1403	0.1160	0.1627	0.352*
Number of seeds per pod	0.1281	0.1772	0.4815	0.3780	0.1279	0.1457	0.2202	-0.0017	0.7730	0.3721	0.1288	-0.0906	0.316*
Biological yield (g)	-0.0004	-0.0011	-0.0076	-0.0067	0.0062	-0.0050	-0.0101	0.0263	-0.0210	-0.0435	-0.0005	0.0394	-0.433**
Seed Index (g)	-0.2028	-0.0357	-0.2142	0.4724	0.4019	0.2806	0.3122	-0.4852	-0.1621	-0.0120	-0.9732	0.1497	-0.374*
Harvest Index (%)	0.0396	0.0212	-0.0528	-0.0062	0.1962	-0.0003	-0.0387	0.4182	-0.0701	-0.5408	-0.0920	0.5981	0.797**
Seed yield per plant	-0.0586	-0.0742	0.0725	0.2474	0.346*	0.0993	0.1266	0.352*	0.316*	-0.433**	-0.374*	0.797**	1.0000

Table 7. Direct and indirect effects of yield related traits on seed yield in 21 genotypes of greengram at phenotypic level

Traits	Days to fifty percent flowering	Days to fifty percent pod set	Plant height (cm)	Number primary branches per plant	Days to maturity	Number of clusters per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	Biological yield (g)	Seed Index (g)	Harvest Index (%)	Seed yield per plant (g)
Days to fifty percent flowering	-0.0567	-0.0436	0.0080	-0.0028	-0.0066	0.0008	-0.0067	-0.0077	0.0022	0.0048	-0.0032	-0.0025	-0.1294
Days to fifty percent pod set	-0.0328	-0.0427	0.0029	-0.0053	-0.0050	-0.0005	-0.0087	-0.0016	0.0020	-0.0007	0.0018	-0.0007	-0.0695
Plant height (cm)	-0.0052	-0.0025	0.0367	0.0058	-0.0006	-0.0024	-0.0006	0.0073	0.0114	0.0030	0.0031	-0.0009	0.1041
Number of primary branches per plant	-0.0029	-0.0071	-0.0091	-0.0575	-0.0011	-0.0103	-0.0128	-0.0030	-0.0077	-0.0010	0.0145	-0.0015	0.0481
Days to maturity	-0.0073	-0.0073	0.0010	-0.0012	-0.0622	-0.0074	-0.0007	0.0003	-0.0106	0.0094	0.0110	-0.0184	0.274*
Number of clusters per plant	0.0001	0.0000	0.0002	-0.0007	-0.0005	-0.0038	-0.0020	0.0004	-0.0004	-0.0002	0.0006	-0.0001	0.1133
Number of pods per plant	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.5410	0.0000	0.0000	0.0000	0.0000	0.0000	0.1193
Pod length (cm)	-0.0052	-0.0014	-0.0076	-0.0020	0.0002	0.0041	0.0063	-0.0385	-0.0021	0.0093	-0.0093	-0.0107	0.1290
Number of seeds per pod	-0.0069	-0.0084	0.0547	0.0236	0.0299	0.0206	0.0244	0.0096	0.1760	0.0317	0.0449	-0.0147	0.1561
Biological yield (g)	-0.0653	0.0134	0.0646	0.0140	-0.1174	0.0476	0.0920	-0.1888	0.1403	0.7786	-0.0030	-0.6244	-0.279*
Seed Index (g)	-0.0086	0.0064	-0.0128	0.0380	0.0266	0.0226	0.0224	-0.0364	-0.0386	0.0006	-0.1512	0.0145	-0.2245
Harvest Index (%)	0.0615	0.0237	-0.0345	0.0361	0.4112	0.0418	0.0056	0.3876	-0.1164	-1.1144	-0.1336	0.8540	0.730**

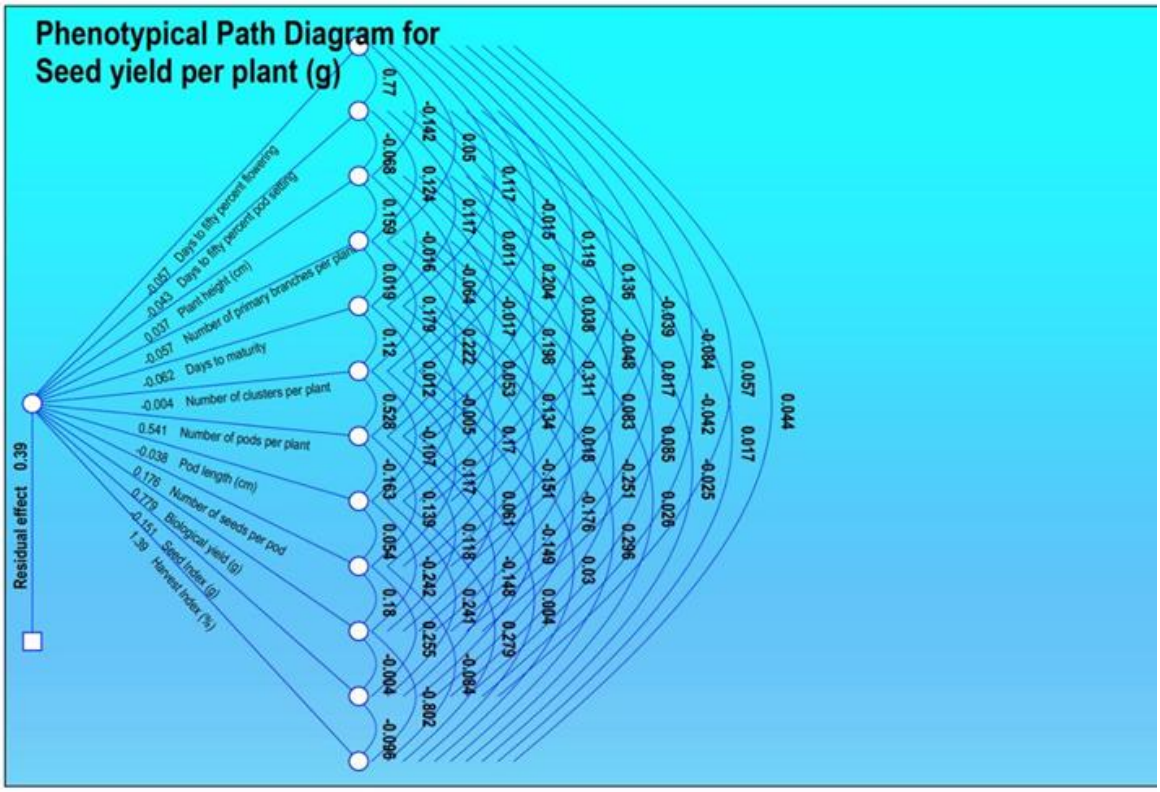

Fig. 1. Phenotypical path diagram for seed yield per plant (g)

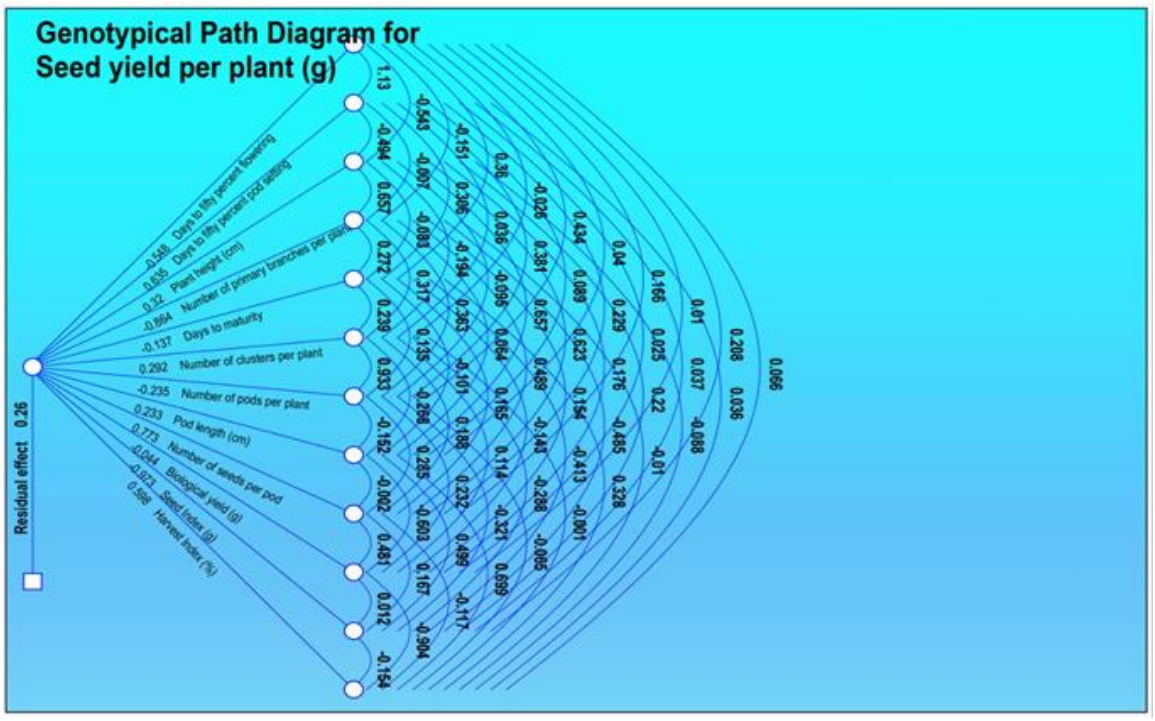

Fig. 2. Genotypical path diagram for seed yield per plant (g)

Direct positive effect on seed yield through days to maturity was earlier reported by Jeberson et al. [8]. In contrast, direct positive effect on seed yield through plant height was earlier reported by Makeen et al. [9], Raturi et al. [2], Kapadia et al. [5] and Choudhary et al. [4]. Path analysis further revealed that direct effect of Harvest Index (%), No. of seeds per pod and Plant Height (cm) was of high magnitude. The high positive association of other characters with grain yield per plant (g) was also due to high indirect effect through these characters. This indicated that grain yield was mainly a product of direct and indirect effects (through each other) of Harvest Index (%), No. of seeds per pod and Plant Height (cm). Path analysis further revealed days to maturity was negatively associated with seed yield per plant (g) because of negative direct effects and indirect effects of Harvest Index (%), No. of seeds per pod and Plant Height (cm). This suggested that the above three traits' direct and indirect effects accounted for the majority of the seed yield [10-12].

4. CONCLUSION

It can be concluded that among the tested genotypes the higher seed yield per plant were reported by MGG 351, WGG 37. From the present investigation, greatest estimates of PCV and GCV were recorded for Harvest Index and Days to maturity. Both at phenotypic and genotypic correlation coefficients revealed that seed yield per plant exhibited positive and highly significant correlation with Days to maturity and Harvest Index. Maximum positive direct effects was depicted by Harvest Index (%) , Number of seeds per pod and Plant height (cm) at both phenotypic and genotypic levels. Therefore, it can be concluded from the present investigation that the characters viz., Harvest Index (%), No. of seeds per pod and Plant Height (cm) had the highest direct positive effect on seed yield per plant. Utmost importance can be given to these characters during selection for yield improvement in greengram.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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