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Research Article

Genetic variability of Agronomic Traits of Gram (*Cicer Arietinum* L.) genotypes

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Abstract

A field experiment was conducted in *rabi* 2014-15 at Research Farm of Agricultural Research Station, Ummedganj, Kota, Agricultural University Kota to assess Genetics variability of Agronomic Traits of Gram (*Cicer Arietinum L.*) genotypes in 60 *desi* chickpea genotypes taking twelve quantitative characters *viz.*, days to 50 per cent flowering, days to maturity, number of primary branches per plant, number of secondary branches per plant, plant height, number of pods per plant, pod length, number of seeds per pod, number of nodules per plant, 100 seed weight, harvest index and seed yield per plant. Analysis of variance revealed sufficient amount of variability present in the genotypes studied. Harvest index recorded maximum phenotypic range of variation followed by 100 seed weight, number of pods per plant, plant height and number of nodules per plant. The high to moderate genotypic coefficient of variation and phenotypic coefficient of variation, was observed for harvest index, plant height, 100 seed weight, number of seeds per pods, seed yield per plant secondary branches per plant and primary branches per plant. High heritability coupled with high genetic advance as per cent of mean was observed for number of nodules per plant, 100 seed weight, pod length, harvest index and seed yield per plant suggesting the existence of sufficient heritable variation and wider scope for effective selection. Seed yield per plant was found to be highly significant and positively correlated with number of pods per plant, secondary branches per plant, harvest index, 100 seed weight, number of pods per plant at both the genotypic and phenotypic levels indicating that these attributes are more influencing the seed yield and therefore, are important for bringing improvement in seed yield. The genotypic and phenotypic path coefficient analysis revealed that biological yield per plant and harvest index exhibited high and positive direct effects on seed yield per plant.

Keywords: Agronomic traits, variability and mean of parameter

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Introduction

Chickpea (*Cicer arietinum* L.) is an annual legume crop. The genus *Cicer* belongs to the sub-family *Papilionaceae* of the family *Leguminoceae* now known as *Fabaceae*. Chickpea popularly known as gram, bengal gram, homes, chhola, garbenzo bean is one of the first grain legumes to be domesticated by humans in old world (Van der Maesen, 1972). India is a leading chickpea growing country accounting for about 65 per cent of the world production. The decreasing per capita availability of pulses (69 g in 1961 to 37 g in 2000) in the country has been a serious concern. A major limitation in the improvement of chickpea is the restricted genetic variability available for most agronomic characters. Availability of sufficient genetic variability is very important in a crop improvement programme.

India is the world's largest producer (18.5 million tons), importer (over 3 million tons) and consumer (22.0 million tons) of pulses (Pulse Con. 2016 Brochure). Over the years, while the country has accumulated a huge surplus of wheat and rice, the pulses remain in short supply. Consequently, the per capita availability of pulses has progressively declined from 65 g a day in 1961 to merely 39.4 g in 2011, whereas, availability of cereals has gone up from 399.7 to 423.5g (Pulse Con. 2016).

The genus consists of 39 known species distributed mainly in central and western Asia, of which two species viz., Cicer arietinum (2n=16) and C. soongaricum (2n=16) are found to be cultivated in India. The origin of the crop is considered to be in Western Asia (Bouhadida et al., 2015), from where it spread in India and other parts of the world. India is a leading chickpea growing country accounting for about 65 per cent of the world production. Other countries include Iran, Iraq, Greece, Turkey, Afghanistan, Pakistan, Morocco, Mexico, Burma and Tanzania.

Nutrition point of view, chickpea seeds contain 17.7 % protein, 0.49 % lysine, 0.11 % methionine (Katiyar, 1982). In addition to this, it also carries 56.6 % carbohydrates, ash, calcium, phosphorus, iron, and vitamin B in considerable amount (Thakur, 1980).

In India, chickpea is an important legume crops and plays an important role to improve soil fertility due to nitrogen fixation by Rhizobium bacteria found in its root nodules. It is capable of thriving in harsh and fragile environments. It has comparative advantage in contributing to crop diversification, rotation and mixed cropping. It is also called low agriculture input due to its nitrogen fixation property and an important source of vegetable protein.

Higher consumption of pulses will help address the scourge of pervasive malnutrition caused by protein deficiency among large sections of the Indian population". We are proud and excited to note that on December 21st 2013, the General Assembly of the United Nations in New York voted to proclaim the International Year of Pulses 2016 (IYOP). Having a UN dedicated year will raise the level of awareness of pulses globally and the important role pulses can play in advancing health and nutrition, food security and environmental sustainability.

Chickpea is used as dal in split form and whole fried or boiled seeds are also eaten. Husk and bits of dal are used as nutritious feed for animals. Green immature chickpea is also used as vegetable and its flour is a major ingredient in snacks and sweets in India and Pakistan. Chickpea plant as such can also be used as green fodder, while straw is an excellent dry fodder for animals.

The basic rationale in any crop improvement programme is the increase in yield potential of the crop. Seed yield is a complex and polygenic trait, and in order to study it properly, different factors affecting the seed yield must be considered and evaluated with regard to their contribution to seed yield. For a particular crop, information on the nature and magnitude of variability present in the population due to genetic and non-genetic causes is an important pre-requisite for commencing any systematic breeding programme.

Availability of sufficient genetic variability is very important in a crop improvement programme. For successful breeding programme, amount of genetic variability present in the experimental material is a basic requirement. Therefore, it is essential for a plant breeder to measure the variability with the help of parameters like phenotypic coefficient of variation, genotypic coefficient of variation, heritability and genetic advance. Hence, these parameters give the information regarding the availability of genetic variability for different characters in available germplasm. Therefore, study of genetic variability of seed yield and its component characters among different varieties provides a strong basis for selection of desirable genotypes for augmentation of yield and other agronomic characters.

Different components of seed yield very often exhibit varying degree of associations with seed yield as well as among themselves. In order to accumulate optimum combination of seed yield contributing characters in a single genotype, it is essential to know the relationships among themselves. Further, the seed yield is influenced by its various components directly and/or indirectly via other traits that create a complex situation before a breeder for making desirable selection. Therefore, path coefficient analysis could provide a more realistic picture of the interrelationship, as it partitions the correlation coefficient in direct and indirect effects of the variables. Thus, character association and path analysis provide the information of yield contributing characters and breeder can practice selection using this information for the isolation of superior accession from gene bank.

Materials and Methods

Sixty genotypes of chickpea were sown during *rabi* 2014-15 in a randomized block design with three replications. Each line was sown in a plot of 4.8 m^2 area with a spacing of 30 cm row to row and 10 cm plant to plant. The genotypes were randomly allotted to the plots in 3 replication. All the recommended agronomical practices along with necessary plant protection measures were followed timely for the successful raising of crop.

Results and Discussion

Days to 50 % Flowering:

Among the genotypes studied, RKG 13- 193 and RKG 13-150 were found to the earliest among all (65.33 days), the genotype which were found to be at par were JG-14, RKG 13-516 and RKG 13-514. Whereas, genotype RKG 13-83 was found to flower late among all (79.67 days), it was found to be at par with RKG 13 –105, RKG 13 – 82, RKG 13 – 166, RKG 12- 130 and RKG 13 – 208. The mean performance for days to 50 % flowering was recorded to be 73.07 days. The GCV and PCV estimates were 3.91 % and 4.04 % respectively, which were estimated to be low for the trait.

Table 1 List of sixty *desi* chickpea genotypes selected for the present investigation on genetic variability and association studies

S.No.	Genotypes	S.No.	Genotypes	S.No.	Genotypes	S.No.	Genotypes
1	RKG 12- 162	**16**	RKG 13 – 401	**31**	RKG 13 – 541	**46**	RKG 13 – 75
2	RKG 12- 130	**17**	RKG 13 – 501	**32**	RKG 26 – 34	**47**	RKG 13 – 205
3	RKG 11 – 157	**18**	RKG 13 – 515	**33**	RKG 13 – 516	**48**	RKG 13 – 82
4	RKG 13 – 460	**19**	RKG 13 – 504	**34**	RKG 13 – 510	**49**	RKG 13 – 61
5	RKG 13 – 454	**20**	RKG 13 – 193	**35**	RKG 13 – 450	**50**	RKG 13 – 111
6	RKG 12 – 309	**21**	RKG 13 – 150	**36**	RKG 13 – 297	**51**	RKG 13 – 22
7	RKG 12 – 298	**22**	RKG 13 – 224	**37**	RKG 11 – 05	**52**	RKG 13 – 211
8	RKG 12 – 286	**23**	RKG 13 – 545	**38**	RKG 27 – 99	**53**	RKG 13 – 83
9	RKG 12 – 172	**24**	RKG 13 – 511	**39**	RKG 13 – 105	**54**	RKG 13 – 84
10	RKG 12 – 296	**25**	RKG 13 – 02	**40**	RKG 13 – 223	**55**	RKG 13 – 54
11	RKG 13 – 105	**26**	RKG 13 – 229	**41**	RKG 13 – 403	**56**	PC - 1 (Check)
12	RKG 12 – 307	**27**	RKG 13 - 110	**42**	RKG 13 – 112	**57**	GNG - 469 (Check)
13	RKG 12 – 158	**28**	RKG 13 – 186	**43**	RKG 13 – 113	**58**	JG - 14 (Check)
14	RKG 13 – 249	**29**	RKG 13 – 166	**44**	RKG 13 – 283	**59**	GNG – 1581 (Check)
15	RKG 13 – 521	**30**	RKG 13 – 208	**45**	RKG 13 – 91	**60**	JG- 2000 - 87 (Check)

Days to maturity

Among the genotypes studied, RKG 13- 110 matured early among all (111.67 days). Whereas, RKG 13-82 and RKG 13-249 matured late (122.33 days) among the genotypes evaluated. None of the genotypes were found to be at par with the early or late maturing genotypes. The mean maturity duration was found to be 116.41 days. The GCV and PCV estimates were 2.48 % and 2.59 % respectively, which were estimated to be low for the trait.

Figure 1 General view of experiment plot

Number of primary branches per plant

Among the genotypes studied, RKG 12- 162 and RKG 13-541 had minimum number of primary branches per plant (1.9), it was found at par with RKG 13-02, RKG 12-296, RKG 12-307. Whereas, genotype RKG 13-223 had maximum number of primary branches per plant (3.1), it was found at par with RKG 13-84, RKG 13-111, RKG 13-

82. The mean for the trait studied was found to be 2.54 number of primary branches per plant. The GCV and PCV estimates were 1.60 % and 2.13 % respectively, which were estimated to be low for the trait.

Number of secondary branches per plant

Among the genotypes studied, RKG 12-307 and RKG 13-521 had minimum number of secondary branches per plant (5.3), it was found at par with RKG 12-286, RKG 12-296, RKG 12-186. Whereas, genotype RKG 13-84 had maximum number of secondary branches per plant (10.3), it was found at par with GNG-469, RKG 13-249, RKG 13-211, RKG 13-83. The mean for the trait studied was found to be 5.3 number of secondary branches per plant. The GCV and PCV estimates were 3.56 % and 5.10 % respectively, which were estimated to be low for the trait, the difference between the GCV and PCV value was high depicting high effect of environment on the trait.

Plant height (cm)

Among the genotypes studied, RKG 13- 157 had the minimum height (29.1 cm), and RKG 13-521 had the maximum height (64.3 cm) which was at par with genotypes RKG 26-34, RKG 13-224, RKG 13-02. The mean performance for plant height was found to be 62.65 cm. The GCV and PCV estimates for the trait were 6.63 % and 7.63 % respectively, which were estimated to be moderately low for the trait.

Number of pods per plant

Among the genotypes studied, RKG 13-61 possessed minimum number of pods per plant (24.7) and it was found at par with RKG 13-186, RKG 13-110, RKG 12-130. Whereas, genotype RKG 13-150 had the maximum number of pods per plant (64.1), it was found to be at par with RKG 13-02, RKG 13-84, RKG 13-224. The mean performance for trait was found to be 40.42 pods per plant. The GCV and PCV estimates were 10.68 % and 15.35 % respectively, which were estimated to be moderately high for the trait and the difference between GCV and PCV value was also high showing high effect of environment on the trait.

Pod length (cm)

Among the genotypes studied, RKG 12-286 had pods with minimum length (1.29 cm), it was found to be at par with RKG 12-158, RKG 12-296, RKG 13-229. Whereas, genotype RKG 13-111 possessed pods with maximum length (2.59 cm), it was found to be at par with RKG 13-403, RKG 13-450, RKG 13-110. The mean performance of the genotypes for pod length was recorded to be 1.87 cm. The GCV and PCV estimates were 3.13 % and 3.14% respectively, which were estimated to be low for the trait.

Number of seeds per pod:

Among the genotypes studied, RKG 12-297 possessed minimum number of seeds per pod (1.3), it was found at par with RKG 12-158, RKG 13-193, RKG 26-34. Whereas, genotype RKG 13-61 possessed maximum number of pods per plant (1.9), followed by RKG 13-22, RKG 13-283, RKG 13-112. The mean performance for number of seed per pod was estimated to be 1.51. The GCV and PCV estimates were 0.63 % and 1.09 % respectively, which were estimated to be very low for the trait.

Number of nodules per plant

Among the genotypes studied nodule count was taken by counting the nodules present on the roots. RKG 13- 460 possessed minimum number of nodules per plant, whereas, genotype RKG 13-515 had maximum number of nodules per plant which was at par with RKG 13-193, RKG 13-91, RKG 13-83. The mean performance for the trait was found to be 9.17 nodules per plant. The GCV and PCV estimates were 10.94 % and 10.99 % respectively, which were estimated to be moderately high for the trait.

100-seed weight (g)

Among the genotypes studied, RKG 12- 297 had minimum 100 seed weight (9.36 g), it was at par with RKG 12-307, RKG 13-205. Whereas, genotype RKG 12-162 had the highest 100 seed weight (27.62), which was at par with RKG

13-110, RKG 13-193, RKG 13-521. The mean of the genotypes studied was found to be 16.42 g for 100 seed weight. The GCV and PCV estimates were 10.33 % and 10.45 % respectively, which were estimated to be moderately high for the trait.

Harvest index (%)

Among the genotypes studied, RKG 13- 208 had the minimum harvest index (17.32 %), which was at par with RKG 13-454, RKG 13-249, RKG 130-515. Whereas, genotype GNG-496 (check variety) had the maximum harvest index (54.6 %) followed by JG-14 (check variety), RKG 13-516, RKG 13-111. The mean performance for the trait was found to be 34.48 %. The GCV and PCV estimates were 14.75 % and 17.15 % respectively, which were estimated to be high for the trait, high difference was also observed among the PCv and GCV values depicting high effect of environmental on the expression of the trait.

Seed yield per plant (g)

Among the genotypes studied, RKG 13-454 had the minimum seed yield per plant (4.39 g), followed by RKG 13-205, RKG 13-208, RKG 13-75. Whereas, genotype RKG 13-11 had the highest seed yield per plant (14.41 g) The mean performance for seed yield per plant was found to be 9.23 g. The GCV and PCV estimates were 6.74 % and 7.63 % respectively, which were estimated to be moderately low for the trait.

Table 2 ANOVA observed for the twelve traits studies in *desi* Chickpea genotypes

Parameters/ Trait	Days to 50% Flowering	Days to Maturity	No of Primary Branches per Plant	No of Secondary Branches per Plant	Plant Height (cm)	No of Pods per Plant	Pod Length (cm)	Seeds per Pod	No of Nodules per Plant	100 Seed Weight (g)	Harvest Index	Seed Yield per Plant (g)
DF	59	59	59	59	59	59	59	59	59	59	59	59
Genotypes MSS	34.29	22.12	0.23	3.96	2745.21	187.47	0.55	0.02	33.01	52.97	251.4	13.77
Error M S	2.34	1.83	0.14	3.08	28.74	147.51	0.002	0.03	0.34	1.24	79.48	3.54
F Calculated	14.59**	12.02**	1.61	1.28	4.80**	1.27	271.45**	0.83	97.03**	42.55**	3.16**	3.88**
Mean	73.07	116.41	2.54	7.71	62.65	40.42	1.87	1.51	9.17	16.42	34.48	9.23
SEM	0.88	0.78	0.22	1.01	3.09	7.01	0.02	0.11	0.33	0.64	5.14	1.08
CV	2.09	1.16	15.62	22.79	8.55	30.04	2.40	12.54	6.35	6.79	25.85	20.38
CD	2.47	2.19	0.61	2.84	8.66	19.63	0.07	0.30	0.33	1.80	14.41	3.04

*Significant at 0.01 and ** Significant at 0.05 probability levels

Table 3 Mean performance of sixty *Desi* chickpea genotypes for twelve traits observed

Sr. No	Genotypes	Days to 50% Flowering	Days to Maturity	No of Primary Branches per Plant	No of Secondary Branches per Plant	Plant Height (cm)	No of Pods per Plant	Pod Length (cm)	Seeds per Pod	No of Nodules per Plant	100 Seed Weight (g)	Harvest Index	Seed Yield per Plant (g)
1	RKG 12- 162	76.33	113.33	1.9	6.7	53.7	33.8	2.40	1.4	5.9	27.92	33.52	9.71
2	RKG 12- 130	78.00	119.00	2.7	8.4	54.0	28.9	2.45	1.5	5.9	12.28	28.17	6.74
3	RKG 11 – 157	74.33	120.33	2.6	7.4	29.1	32.3	1.58	1.5	5.9	12.94	27.50	7.37
4	RKG 13 – 460	74.00	119.00	2.7	7.1	58.7	37.3	1.59	1.7	5.1	19.13	51.51	10.07
5	RKG 13 – 454	75.33	118.33	2.4	7.3	63.6	31.6	2.59	1.5	6.9	13.96	18.76	4.39
6	RKG 12 – 309	73.00	117.00	2.2	6.5	58.5	36.9	1.75	1.5	6.3	12.66	29.17	7.04

7	RKG 12 – 298	71.67	114.67	2.2	7.0	54.8	43.8	1.50	1.5	7.0	12.91	29.11	7.98
8	RKG 12 – 286	74.67	116.67	2.3	5.6	56.7	32.3	1.29	1.5	6.7	13.95	29.74	6.82
9	RKG 12 – 172	75.00	116.00	2.2	7.3	58.6	34.3	1.74	1.5	6.8	18.41	27.60	7.88
10	RKG 12 – 296	71.33	112.33	2.1	5.6	49.6	38.8	1.45	1.6	6.9	11.13	40.73	9.05
11	RKG 13 – 105	78.67	115.67	2.3	6.7	59.6	33.7	2.45	1.6	7.0	11.72	41.64	8.55
12	RKG 12 – 307	75.00	114.00	2.1	5.3	53.5	37.1	1.55	1.3	7.3	10.27	27.22	6.11
13	RKG 12 – 158	74.67	119.67	2.3	7.9	58.3	33.8	1.31	1.3	7.2	23.14	40.79	10.09
14	RKG 13 – 249	73.33	122.33	2.5	9.7	57.7	48.4	1.58	1.4	7.3	18.41	18.99	7.34
15	RKG 13 – 521	74.00	117.00	2.3	5.3	64.3	30.4	2.22	1.5	7.3	24.03	25.66	10.02
16	RKG 13 – 401	74.33	118.33	2.3	8.0	57.3	34.0	1.75	1.4	7.3	12.89	40.53	7.35
17	RKG 13 – 501	72.33	114.33	2.5	6.7	59.3	48.5	2.59	1.5	12.9	11.83	29.27	8.40
18	RKG 13 – 515	69.67	112.67	2.4	8.1	59.5	39.2s	1.59	1.6	20.1	16.68	22.30	12.27
19	RKG 13 – 504	72.33	120.33	2.5	7.7	63.1	36.3	2.45	1.5	8.3	18.53	37.38	10.72
20	RKG 13 – 193	65.33	112.67	2.2	8.1	60.5	47.9	1.58	1.3	19.8	24.13	37.09	11.68
21	RKG 13 – 150	65.33	113.33	2.3	8.9	58.1	64.1	2.41	1.5	7.1	21.79	27.87	9.13
22	RKG 13 – 224	71.00	115.00	2.3	9.3	64.2	53.3	1.50	1.5	9.0	17.58	35.35	10.14
23	RKG 13 – 545	70.67	114.67	2.4	8.9	61.7	45.4	1.74	1.6	6.9	18.34	23.84	7.93
24	RKG 13 – 511	74.33	115.33	2.2	6.7	62.5	38.2	1.59	1.6	6.7	13.26	48.94	12.23
25	RKG 13 – 02	68.00	117.00	2.0	7.6	63.9	55.4	1.59	1.5	6.9	11.81	28.90	8.16
26	RKG 13 – 229	73.00	114.00	2.2	6.5	55.1	37.0	1.45	1.5	7.1	17.46	23.81	7.96
27	RKG 13 - 110	73.67	111.67	2.2	6.3	61.4	28.7	2.59	1.5	12.5	27.08	39.07	9.65
28	RKG 13 – 186	76.00	118.00	2.3	6.2	48.7	26.7	2.41	1.4	10.9	13.18	27.06	7.45
29	RKG 13 – 166	78.00	116.00	2.3	7.7	61.8	30.9	1.59	1.6	8.1	12.09	30.01	8.61
30	RKG 13 – 208	77.67	116.00	2.2	7.9	56.4	43.5	1.74	1.5	7.1	13.99	17.32	5.80
31	RKG 13 – 541	67.00	113.00	1.9	7.5	55.1	46.1	1.50	1.4	6.7	17.50	42.14	10.62
32	RKG 26 – 34	71.33	116.33	2.3	7.0	64.2	37.1	1.58	1.3	8.0	15.53	29.03	8.81
33	RKG 13 – 516	66.33	112.33	2.1	7.4	62.3	37.5	2.45	1.4	7.6	14.14	53.03	13.87
34	RKG 13 – 510	74.00	115.00	2.2	7.9	54.8	43.4	1.58	1.5	10.5	16.21	25.09	7.12
35	RKG 13 – 450	75.00	116.33	2.8	8.1	57.1	38.9	2.59	1.5	6.9	15.92	35.79	10.99
36	RKG 13 – 297	74.67	116.67	2.9	8.2	55.1	41.3	1.45	1.5	13.3	9.36	33.23	7.97
37	RKG 11 – 05	74.00	115.00	2.5	8.5	55.1	44.5	1.75	1.6	13.3	20.58	29.75	9.78
38	RKG 27 – 99	72.33	119.33	2.7	6.7	63.1	45.9	1.74	1.6	13.3	11.76	36.92	11.34
39	RKG 13 – 105	76.67	119.67	2.3	6.5	63.2	31.0	1.58	1.6	7.9	19.03	32.84	6.88
40	RKG 13 – 223	72.00	121.00	3.1	6.9	57.5	40.1	2.45	1.5	9.7	17.54	34.67	8.81
41	RKG 13 – 403	73.33	116.33	2.5	8.0	63.8	37.0	2.59	1.5	8.3	14.04	38.84	9.64
42	RKG 13 – 112	73.00	119.00	2.5	7.4	57.7	45.7	1.75	1.7	7.7	17.65	38.69	9.98
43	RKG 13 – 113	75.67	117.67	2.8	6.5	58.9	50.7	1.50	1.5	13.1	16.83	35.55	9.42

44	RKG 13 – 283	71.00	120.00	2.7	8.3	55.5	38.2	1.75	1.7	8.1	13.86	38.91	9.62
45	RKG 13 – 91	75.00	115.00	2.7	7.6	57.7	44.3	1.58	1.5	16.1	15.54	33.03	8.28
46	RKG 13 – 75	73.00	116.00	2.7	8.4	51.6	44.9	1.74	1.5	7.9	14.85	24.27	6.07
47	RKG 13 – 205	70.67	118.67	2.7	7.3	60.3	32.7	2.45	1.5	13.7	10.58	26.40	5.51
48	RKG 13 – 82	78.33	122.33	3.0	9.3	61.4	42.6	1.58	1.5	8.1	13.80	35.97	10.00
49	RKG 13 – 61	73.33	114.33	2.5	8.8	59.0	24.7	1.50	1.9	13.6	21.02	45.59	9.10
50	RKG 13 – 111	71.67	117.67	3.0	9.3	61.7	50.4	2.59	1.5	7.1	23.72	52.04	14.41
51	RKG 13 – 22	74.67	113.67	2.6	9.3	58.5	36.1	1.45	1.7	7.7	16.84	46.42	10.60
52	RKG 13 – 211	72.67	113.67	2.7	9.5	59.4	41.7	1.75	1.5	7.9	14.16	30.90	7.86
53	RKG 13 – 83	79.67	115.67	2.9	9.3	62.0	49.9	2.45	1.6	14.6	18.58	46.84	11.05
54	RKG 13 – 84	76.33	120.33	3.0	10.3	58.0	54.9	1.50	1.5	7.9	13.93	23.70	8.77
55	RKG 13 – 54	74.67	118.33	2.5	8.0	56.3	52.3	1.58	1.5	13.7	21.21	37.56	12.70
56	PC - 1 (C)	67.00	113.33	2.5	9.0	55.0	41.4	2.45	1.4	9.9	18.00	44.94	12.11
57	GNG - 469 (C)	69.00	114.00	2.3	9.7	62.4	46.3	1.58	1.5	9.7	20.55	54.60	13.21
58	JG - 14 (C)	66.00	113.00	2.7	7.4	63.6	41.8	1.74	1.5	8.1	19.70	53.79	12.09
59	GNG - 1581 (C)	76.67	120.67	2.6	8.5	61.5	35.0	1.75	1.4	8.1	12.44	31.52	8.74
60	JG-2000-87 (C)	68.33	116.00	2.4	7.9	61.5	46.8	2.45	1.5	12.0	17.28	38.39	12.11
Mean		**73.07**	**116.41**	**2.54**	**7.71**	**62.65**	**40.42**	**1.87**	**1.51**	**16.42**	**9.17**	**34.48**	**9.23**

Conclusion

The conclusion drawn by the cluster analysis is that in the studied population, high variability observed between the genotypes in different clusters for different traits. Recombination breeding among genotypes belonging to cluster. The results of path coefficient analysis revealed that for improvement of seed yield in chickpea through selection programme, more emphasis should be given to harvest index, days to 50 % flowering number of seeds per pod and number of pods per plant.

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