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Genetic Character Variability Studies in Desi Chickpea (*Cicer arietinum* L.) Genotypes

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A B S T R A C T

Keeping the importance of the crop and the aspects to be studied, the present investigation entitled "Genetic Character Variability Studies in Desi Chickpea (*Cicer Arietinum L.*) Genotypes)"was conducted in *rabi*2014-15 at the Research Farm of Agricultural Research Station, Ummedganj, Kota, Agricultural University, Kota to assess the 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 and number of seeds per pods, seed yield per plant, secondary branches per plant and primary branches per plant. 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. 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.

Introduction

Chickpea (*Cicer arietinum* L.) is an annual legume crop. The genus *Cicer* belongs to the sub-family *Papilionaceae* of the family *Leguminoceae*, (Bentham and Hooker, 1970) 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). 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.

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. It is cultivated in semi - arid tropics and West Asia North Africa (WANA) region on 11.6 million hectares area worldwide with 8.7 million tons of production (FAOSTAT, 2009).

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, the area under chickpea was 8.74 million hectare with a production of 7.35 million tonnes with productivity of 841 kg/ha during *Rabi* 2009-10 (Singh, 2010).

Four states *viz*., Madhya Pradesh, Uttar Pradesh, Maharashtra and Rajasthan together contribute about 87 % of production from 65 % area. Besides these four states, Gujarat, Andhra Pradesh, Karnataka and Bihar are also the major chickpea growing states in the country. In Gujarat, area under chickpea was 2.50 lakh hectares with total production of 2.28 lakh tonnes and productivity of 913 kg/ha during *Rabi* 2009-10 (Anonymous, 2010).

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 each replication. All the recommended agronomical practices along with necessary plant protection measures were followed timely for the successful raising of crop.

Results and Discussion

The estimates of heritability in broad sense H^2_b for all the characters under study are presented in table 1. Very high estimates of heritability were recorded for pod length (98.98 %), number of nodules per plant (98.98 %), 100 seed weight (97.69 %), days to 50 % flowering (93.45 %), days to maturity (92.12 %) (Table 2).

High to moderate values were recorded for, seed yield per plant (78.05 %), plant height (75.39 %), harvest index (73.90 %). Whereas, moderately low value of heritability were recorded for number of primary branches per plant (56.13 %), number of secondary branches per plant (48.71 %) and number of seed per pod (33.27 %).

Genotypic and phenotypic coefficient of variation

The estimate of genotypic and phenotypic coefficient of variability indicated that the values of phenotypic coefficient of variation were higher than genotypic coefficient of variation, in most of the cases, indicating more influence of environmental factors. The relative magnitude of difference between phenotypic coefficient of variation and genotypic coefficient of variation was low for number of pods per plant, number of seeds per pod, 100 seed weight, number of nodules per plant and days to 50% flowering indicating that these characters were less influenced by the environments. Similar results were also reported by Arora (1991), Wahid and Ahmed (1999), Nimbalkar (2000), Singh (2006) and Borate *et al*., (2010). These findings suggested that selection can be effective on the basis of phenotype along with equal probability of genotypic values.

Correlation coefficients

In the present investigation, most of the character pairs had higher values of genotypic correlations their corresponding phenotypic correlations. Such high amount of genotypic correlations could result due to masking or modifying effect of environmental on the association of characters. This indicates that though there was high degree of association between two variables at genotypic level, its phenotypic expression was deflated by the influence of environment. It was also indicated that there was inherent relationship between the characters studied which is in agreement with the findings of Raval (2001); and Vaghela *et al.,* (2009). On the contrary, the phenotypic correlation coefficients found to be higher than their genotypic correlation coefficients may be due to the non- genetic causes probably environment inflated the value of phenotypic correlation.

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
1	RKG 12- 162	**31**	RKG 13 – 541
2	RKG 12- 130	**32**	RKG 26 – 34
3	RKG 11 – 157	**33**	RKG 13 – 516
4	RKG 13 – 460	**34**	RKG 13 – 510
5	RKG 13 – 454	**35**	RKG 13 – 450
6	RKG 12 – 309	**36**	RKG 13 – 297
7	RKG 12 – 298	**37**	RKG 11 – 05
8	RKG 12 – 286	**38**	RKG 27 – 99
9	RKG 12 – 172	**39**	RKG 13 – 105
10	RKG 12 – 296	**40**	RKG 13 – 223
11	RKG 13 – 105	**41**	RKG 13 – 403
12	RKG 12 – 307	**42**	RKG 13 – 112
13	RKG 12 – 158	**43**	RKG 13 – 113
14	RKG 13 – 249	**44**	RKG 13 – 283
15	RKG 13 – 521	**45**	RKG 13 – 91
16	RKG 13 – 401	**46**	RKG 13 – 75
17	RKG 13 – 501	**47**	RKG 13 – 205
18	RKG 13 – 515	**48**	RKG 13 – 82
19	RKG 13 – 504	**49**	RKG 13 – 61
20	RKG 13 – 193	**50**	RKG 13 – 111
21	RKG 13 – 150	**51**	RKG 13 – 22
22	RKG 13 – 224	**52**	RKG 13 – 211
23	RKG 13 – 545	**53**	RKG 13 – 83
24	RKG 13 – 511	**54**	RKG 13 – 84
25	RKG 13 – 02	**55**	RKG 13 – 54
26	RKG 13 – 229	**56**	PC - 1 (Check)
27	RKG 13 - 110	**57**	GNG - 469 (Check)
28	RKG 13 – 186	**58**	JG - 14 (Check)
29	RKG 13 – 166	**59**	GNG – 1581 (Check)
30	RKG 13 – 208	**60**	JG- 2000 - 87 (Check)

Table.2 Genetic variability, PCV, GCV, heritability, genetic advance and genetic advance (as % of mean) observed for *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)
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
Range	65.3 to 79.7	111.7 to 122.3	1.9 to 3.1	5.3 to 10.3	29.1 to 64.3	24.7 to 64.1	1.3 to 2.6	1.3 to 1.9	5.1 to 20.1	9.4 to 27.9	17.3 to 54.6	4.4 to 14.4
PCV	4.62	2.33	2.13	5.10	7.63	15.35	3.14	1.09	10.99	10.45	17.15	7.63
GCV	4.46	2.23	1.60	3.56	6.63	10.68	3.13	0.63	10.94	10.33	14.75	6.74
H^2_b	93.45	92.12	56.13	48.71	75.39	48.39	99.63	33.27	98.98	97.69	73.90	78.05
GA	6.48	3.10	0.23	0.83	5.30	5.70	0.52	0.05	3.98	4.99	8.98	2.18
GA % Mean	8.87	0.89	3.08	3.60	3.03	4.70	9.20	1.19	14.45	10.13	8.68	7.89

Path coefficient analysis

The path coefficient analysis revealed that harvest index, days to 50 % flowering number of seeds per pod and number of pods per plant exhibited high and positive direct effects on seed yield per plant. All these characters turned out to be the major component of seed yield. Positive moderate direct effect was observed for number of primary branches per plant whereas, negative was observed for days to maturity. High and positive direct effect of harvest index was also reported by Singh (2007), Thakur and Sirohi (2009), and Vaghela *et al.,* (2009). The residual effect was of low magnitude suggesting that the majority of the yield attributes have been included in the path analysis.

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