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RN Arora
Department of Genetics and Plant Breeding, College of Agriculture, CCS Haryana Agricultural University, Hisar, Haryana, India

Krishan Kumar
Department of Genetics and Plant Breeding, College of Agriculture, CCS Haryana Agricultural University, Hisar, Haryana, India

Manav
Department of Genetics and Plant Breeding, College of Agriculture, CCS Haryana Agricultural University, Hisar, Haryana, India

Correspondence
Manav
Department of Genetics and Plant Breeding, College of Agriculture, CCS Haryana Agricultural University, Hisar, Haryana, India

Genetic variability studies for yield contributing traits in *Kabuli* chickpea (*Cicer arietinum* L.)

RN Arora, Krishan Kumar and Manav

Abstract
Fifty genotypes of *kabuli* chickpea were studied for assessment of genetic variability at CCSHAU, Hisar during *Rabi*, 2014-15. All genotypes exhibited wide range of variability for all the characters studied. Maximum variability was recorded for number of pods per plant and minimum for number of days to maturity. There were close agreement between GCV and PCV for number of days to flowering, number of days to maturity and 100-seed weight. Highest heritability was observed for 100-seed weight. Genetic advance as percent of mean was maximum for number of pods per plant. High heritability coupled with high genetic advance was observed in case of number of pods per plant. Thus, it may be concluded that a great amount of variability existed in the present material and it would be desirable to give emphasis on number of pods per plant and 100-seed weight for selection of high yielding genotypes in *kabuli* chickpea.

Keywords: *Kabuli* chickpea, variability, heritability, genetic advance

Introduction
Chickpea (*Cicer arietinum* L.) is the third most vital pulse crop in the world (Padmavathi *et al.* 2013) [14] which is grown in over forty countries which occupies upper position in the territory (Dhingani *et al.* 2013) [6]. It is an important *Rabi* season pulse crop of India and plays an important role to improve soil fertility due to nitrogen fixation by *Rhizobium* bacteria found in its root nodules. The area under chickpea was 9.93 million ha, with production of 9.53 million tons and productivity of 960 kg/ha during 2013-14 (Anonymous, 2014) [2]. Chickpea acquires importance as it contains 22 per cent protein, 63 per cent carbohydrates, 4.5 per cent fat, 8.0 percent crude fibre and 2.7 per cent ash (Miao *et al.* 2009) [12]. Chickpea is low in sodium and fat, high in protein content. It is an excellent source of both soluble and insoluble fibre, complex carbohydrates, vitamins and minerals. The main aim in any crop improvement programme is to increase the yield potential of a crop. Seed yield is a complex and polygenic trait which is affected by many component characters. Hence, knowledge 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. Therefore, it becomes necessary to partition the observed variability into heritable and non-heritable components such as genotypic and phenotypic co-efficients of variation (GCV and PCV), heritability and genetic advance. Keeping this in view, the present study was undertaken to assess and estimate the magnitude and nature of variation among 50 genotypes of *kabuli* chickpea with respect to various yields attributes which could be utilized in the crop improvement programme.

Materials and Methods
The experimental material comprised of 50 genotypes of *kabuli* chickpea collected from various sources and was sown in field research area of Pulses Section, Department of Genetics and Plant breeding, CCSHAU, Hisar during *Rabi*, 2014-15. The experiment was planted in a randomized block design with three replications, keeping row to row distance of 45 cm and plant to plant distance of 10 cm. The observations were recorded on five randomly selected competitive plants for number of days to 50% flowering, days to maturity, number of branches per plant, plant height, number of pods per plant, number of seeds per pod, 100-seed weight and seed yield per plant along with their mean values for statistical analysis. The analysis of variance was done following the method suggested by Panse and Sukhatme (1985) [15]. Genotypic and phenotypic co-efficient of variation (GCV and PCV) were calculated as per the procedure given by Burton and Devane (1953) [4] while heritability in broad sense and expected genetic advance were worked out using the formula of Johnson *et al.* (1955) [9].

Results and Discussion

The analysis of variance with respect to seed yield and its component characters (Table1) clearly indicated that mean sum of squares due to genotypes were highly significant for all the characters studied, thereby, indicating the presence of sufficient genetic variability among various genotypes for all the characters studied. In the present study, the highest genotypic and phenotypic co-efficient of variation was observed for number of pods per plant followed by seed yield per plant, number of branches per plant and 100-seed weight (Table 2) indicating ample scope for genetic improvement of these traits through direct selection. Similar findings were reported by Sial *et al.* (2003) [17], Ali *et al*. (2010) [1], Jeena *et al.* (2005) [8], Durga *et al.* (2007) [7], Lokare *et al.* (2007) [11] and Kumar *et al.* (2012) [10]. Highest heritability was found for 100-seed weight followed by seed yield per plant and number of pods per plant indicated that these characters can be used as the genetic parameters for the improvement and selection of high yielding genotypes in *kabuli* chickpea. These results were in close conformity with the findings of Dasgupta *et al*. (1992) [5]. High genetic advance expressed as percentage of mean was observed for number of pods per plant, 100-seed weight and seed yield per plant as reported by Raval (2001) [16] and Sial *et al.* (2003) [17]. High heritability coupled with high genetic advance was observed in case of number of pods per plant, seed yield per plant and 100-seed weight indicated that these traits were governed by additive gene action and directional selection could be profitably applied on these traits in the genetically diverse material which more or less confirms the earlier reports of Sial *et al*. (2003) [17]. Crop improvement for these traits could be possible through simple selection because of high heritability coupled with high genotypic variation and additive gene effects (Noor *et al*. 2003) [13]. On the other hand, low heritability coupled with low genetic advance was observed for number of seeds pod and number of days to maturity. The results indicate that these traits were greatly influenced by the environment (Arshad *et al*. 2002) [3].

Conclusion

In the present investigation, considering the importance of genetic parameters like GCV, PCV, heritability and genetic advance (% mean) together, it is evident that 100-seed weight and number of pods per plant are the most important traits in *kabuli* chickpea seed yield improvement. Hence, selection for these traits in the segregating generations would be fruitful for further genetic improvement in *kabuli* chickpea.

Table 1: Analysis of variance (mean squares) for 8 characters among 50 genotypes in *kabuli* chickpea

Characters	Mean sum of squares			CV (%)
	Replication	Genotype	Error	
	2	49	98	
Days to 50% flowering	12.62	130.03**	4.49	8.92
Days to maturity	2.45	17.68**	1.79	3.53
Plant height (cm)	46.54	56.26**	10.60	9.76
Number of branches/plant	44.38	7.29**	0.19	8.08
Number of pods/plant	108.52	483.32**	5.52	6.50
Number of seeds/pod	0.026	0.28**	0.01	8.12
100-seed weight (g)	54.484	272.53**	2.61	13.42
Seed yield/plant (g)	32.664	158.05**	7.61	11.73

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

Table 2: Genetic parameters in *kabuli* chickpea for different quantitative characters

Characters	Range	Mean	GCV (%)	PCV (%)	h^2 (%)	GA as % of mean
Days to 50% flowering	98-113.50	104.75	3.48	4.16	36	2.96
Days to maturity	146-157.50	151.86	1.39	2.18	27	1.15
Plant height (cm)	43.4-81.5	59.67	13.88	16.35	39	16.75
Number of branches/plant	2.6-8.20	4.75	29.05	32.38	27	19.15
Number of pods/plant	18-104.5	49.08	38.42	41.98	68	55.27
Number of seeds/pod	1.12-1.84	1.45	9.65	13.78	34	9.78
100-seed weight (g)	10.3-28.38	13.98	24.62	26.07	95	49.32
Seed yield/plant (g)	4.28-21.45	9.08	36.32	40.21	54	46.18

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