ASSESSMENT OF GENETIC VARIABILITY PARAMETERS AND CHARACTER ASSOCIATION IN CHICKPEA (*Cicer arietinum* L.)

Abstract

School of Agriculture, ITM University in Gwalior's Department of Genetics and Plant Breeding performed Rabi season 2021–2022 study on 15 distinct genotypes of chickpeas to better understand their genetic variability. The genotypes were distributed using a Randomized Block Design with three replications. On the plants themselves, data was gathered on their overall height, the number of main and secondary branches they had at 50% flowering, the number of pods and seeds they had at 100 seeds, as well as their grain yields per plant and the total yield per plot. After analysing the data, A statistical study of each character's genotypes revealed a wide range of results. Plant height, number of main and secondary branches, days to 50% flowering, days to maturity, number of pods per plant and 100 seed weight provided the highest GCV and PCV values in the experiment. All of these traits, as well as plant height, secondary branch count, days until 50% of the flowers open, pod count per plant, grain production per plant, and total yield per plot, demonstrated significant heritability and genetic advancement as a percentage of the mean. Research has demonstrated a direct correlation between plant height, seed weight, quantity per pod and the overall yield per plot.

Keywords: Genetic variability; correlation; *Cicer arietinum* L.; heritability, genetic advance, and grain yield.

INTRODUCTION

A member of the Ciceraceae family, Chickpea (*Cicer arietinum* L.), also known as Bengal gram, is a member of the genus Cicer. It is self-pollinating and possesses a diploid (2n=16) genome. Chickpeas are produced in large quantities in countries including India, Australia, Pakistan, Turkey, Myanmar, Ethiopia, Iran, Mexico, and Canada. On an area and production basis, India accounts for 52.5 percent of global chickpea land, 38 percent of the total pulse acreage in the globe, and 50 percent of the overall pulse output (FAOSTAT, 2013). Over 12 million hectares of land are devoted to the cultivation of this essential pulse crop, which produces 9.2 million tonnes of grain each year (Redden and Berger, 2007). Chickpeas are a winter crop, but cold and frost damage the blossoms, preventing them from maturing into seeds or destroying the seeds already within the pod, while they are in bloom. Chickpeas are a very nutrient-dense crop that might serve as a supermolecule-rich addition to diets heavy on cereals. Chickpeas include a plethora of nutrients, including 267 kcal of energy, 23% of protein, 5% of fat, 64% of carbohydrates, and 6% of fibre (6 per cent). Vitamins (particularly B vitamins) and minerals (notably potassium and phosphorus) are also found in chickpeas. Farmers need to apply less nitrogen fertiliser to legume crops than they do to non-legume crops because of the crop's symbiotic nitrogen fixation.

Chickpea output in the nation is quite low, despite its nutritional and economic worth.

Because of the weak genetic composition of the kinds now available, this is a major factor. For plant breeders to be able to choose high-yielding genotypes, genetic diversity is a must in every breeding effort. There is a better probability of obtaining the desired plant species when there is a larger degree of population diversity. A population's heritability and genetic advancement estimates may be used to predict future gains. Selecting genotypes from various genetic subgroups is made easier by heritability estimations. It is possible to create a new population that has a higher quality of life than the previous one because of genetic improvement. The chickpea crop is likely to benefit genetically by selecting features that have a strong positive connection with yield rather than those that have a large negative association with yield.

MATERIALS AND METHODS

A Randomized Block Design (RBD) including three repeated trials using fifteen different chickpea genotypes was used by researchers from the Crop Research Centre, Department of Genetics and Plant Breeding and the School of Agriculture at ITM University Gwalior, M.P., in Rabi 2021-22. After this study, the maximum distance between rows and plants was set at 40 and 15 centimetres. To ensure a successful harvest, all recommended agronomic techniques were implemented in every plot replication. On five randomly selected plants from each genotype in each replication we recorded data on ten different quantitative characteristics, including plant height (cm), the number of primary and secondary branches and pods and seeds per pod, the weight of 100 seeds (g), the number of days until 50% flowering, the number of days until maturity, the grain yield per plant, and the total yield per plot (kg). The average performance value was derived using statistical analysis of the data from each replication. The analysis of variance was computed using the Panse V.G. and Sukhatme P.V. approach (1967). The GCV and PCV were calculated using Burton and De Vane's formulae, which took into account both genetic and phenotypic variation (1953). Heritability and genetic advancement were calculated using methods developed by Mishra and colleagues (1988). An analysis of the correlation between genetic and phenotypic traits was carried out by using the Johnson et al formula. .'s (1955).

RESULTS AND DISCUSSION

This study examined the genetic diversity of fifteen different chickpea genotypes. Analysis of variance data for each character is shown in **Table 1**. The fifteen distinct chickpea genotypes evaluated in this study showed substantial heterogeneity in the gene-specific means for all attributes studied. Additionally, Vaghela MD et al. found comparable outcomes in their study (2019).

To generate attractive genotypes with high yield potential, plant breeders must have

access to a wide range of genetic variations in their germplasm. To achieve self-sufficiency and property in food production, a wide range of genetically distinct types must be established. PCV and GCV coefficients of variation (PCV and GCV) are shown in **Table 2** to analyse the genetic diversity among the various chickpea traits. When comparing PCV with GCV for plant height, the number of main branches and secondary branches, maturity days and pods per plant, as well as total yield per plot, the PCV was shown to be larger than GCV for the relevant parameters. Sanjay Kumar et al., (2019), Jadhav R et al., (2012), and Khan R H et al., (2013) reported comparable findings in previous research (2011).

There was a larger heritability (h^2bs) in terms of plant height, a number of secondary branches, maturity days; the number of pods per plant; 100 seed weight; grain yield per plant; 50 percent flowering days; and total yield per plot (h2bs) When it comes to branching and seed production, **Table 2** reveals that there is a moderate heritability for these traits. Findings of Jain S et al. (2013) and Jain S et al. (2013), Yadav RK (2013), Arshad, et al (1988). Based on heredity alone, the selection of better genotypes may not be sufficient evidence for genetic progress. As a result, using heritability estimates and genetic progress to choose genotypes for future crop breeding improvement will be more successful. There were high genetic advancement values in plant height, number of secondary branches, pod count per plant, grain output per plant, and total yield per plot in the present research. This isn't the first time this has occurred; comparable findings have been found in previous investigations by Arshad *et al*., (2002), Dar S.A *et al*., (2012), and Jadhav RS *et al.*, (2012).

Correlation is a vital instrument in a broad variety of scientific endeavours when it comes to selecting the most attractive personalities. Plant height, the number of seeds per pod, and total yield per plot were found to have a positive correlation with PCV and GCV analysis; however, it had a negative correlation with the number of primary branches per plant; the number of secondary branches per plant; days to 50% flowering; total pods per plant; and the number of ripe seeds per pod. Jain S et al. (2013), Dar SA et al. (2012), and Ali et al. (2011) have all reported on it.

Table 1. Analysis of variance (ANOVA) for ten characters in fifteen genotypes of chickpea (*Cicer arietinum* L.)

S.no	Characters	Mean sum of squares		
		Replication	Genotype	Error

	Degree of freedom	d.f = 2	d.f = 14	d.f = 28
1	Plant height	34.638	17.684**	0.831
2	No of primary branches	1.726	0.687**	0.189
3	No of secondary branches	24.422	11.641**	1.422
4	Days to 50% flowering	114.82	190.946**	1.679
5	No of pods per plant	922.40	505.72**	42.50
6	No of seeds per pod	2.488	0.422**	0.179
7	100 seed weight	34.067	4.133**	0.686
8	Grain yield per plant	19.446	108.213**	0.387
9	Total yield per plot	0.0475	0.270**	0.001
10	Days to maturity	129.06	70.724**	3.305

** = Significant at P = 0.01 level, *** = Significant at P = 0.05 level

Table 2. Mean performance, range, genotypic and phenotypic coefficient of variation (GCV and PCV), heritability (h^2bs), genetic advance, and genetic advance as per cent of the mean for ten characters of Chickpea

S. No	Characters	Range		Grand mean	Coefficient of variation		Heritability (h^2bs %)	GA	GA% Mean
		Max	Min		GCV	PCV			
1	Plant height	29	18	23.14	10.23	10.97	87	4.55	19.68
2	No of the primary branches	5.4	2.5	4.06	10.01	14.65	46	0.57	14.09
3	No of secondary branches	18	8	12.68	14.54	17.31	70	3.19	25.16
4	Days to 50% flowering	99	70	84	9.349	9.473	97	16.14	19
5	No of pods per plant	164	85	107.3	11.53	13.02	78	22.66	21.04
6	No of seeds per pod	3	1	2.04	13.9	24.9	31	0.32	15.99
7	100 Seed weight	23	16	18.53	5.78	7.30	62	1.74	9.43
8	Grain yield per plant	32	9	20.23	29.62	29.78	98	12.28	60.70
9	Total yield per plot	1.6	0.45	1.01	29.64	29.80	98	0.61	60.72
10	Days to maturity	121	100	108.2	4.37	4.68	87	9.11	8.42

Table 3. Genotypic correlation coefficient (above diagonal) and Phenotypic correlation coefficient (below diagonal) among the ten characters in Chickpea (*Cicer arietinum* L.)

Traits	PH	NPB	NSB	D50F	NPP	NSP	100SW	GYPP	TYPP	DM

PH	**1.000**	0.392	0.008	-0.218	0.365	0.126	-0.0904	0.037	0.036	-0.108
NPB	0.204	**1.000**	0.668**	0.420	0.159	0.520*	0.093	-0.160	-0.162	0.247
NSB	**-**0.004	0.257	**1.000**	0.692**	-0.088	-0.435	0.256	-0.334	-0.335	0.800**
D50F	-0.200	0.257	0.587**	**1.000**	-0.069	-0.504	0.456	-0.181	-0.1814	0.526*
NPP	0.288	0.063	0.002	-0.047	**1.000**	-0.290	0.039	-0.0142	-0.014	-0.180
NSP	0.044	0.025	-0.126	-0.284	-0.180	**1.000**	0.1665	0.498	0.497	-0.404
100SW	-0.088	0.0002	0.142	0.363	-0.0168	0.087	**1.000**	0.417	0.419	-0.055
GYPP	0.023	-0.128	-0.276	-0.174	-0.0258	0.282	0.331*	**1.000**	1.000**	-0.565
TYPP	0.023	-0.131	-0.274	-0.174	-0.025	0.279	0.332	1.000**	**1.000**	-0.564*
DM	-0.111	0.235	0.617**	0.485**	-0.1441	-0.199	-0.050	-0.532	-0.531	**1.000**

***, ** =** Significant at P = 0.05 and P = 0.01 levels, respectively

PH= Plant height, NPB= No of primary branches per plant, NSB= No of secondary branches per plant, D50F= Days to 50% Flowering, NPP= No of pods per plant, NSP= No of seeds per pod, 100SW= 100 Seed weight, GYPP= Grain yield per plant, TYPP= Total yield per plot, DM= Days to maturity.

CONCLUSION

In the current research, the analysis of variance showed genetic variants in fifteen chickpea genotypes that supported yield and its corresponding attributes. Genes that consistently function well across conditions may be used to choose enhanced breeding lines for sources of high yield and high quality. The purpose of this investigation was to gather data on how well the product performed. Genes C-126, C-136, C-115, C-1021, C-1022, and C-1014 were shown to be superior to the other genotypes in terms of the characteristics, C-210, C-137, and c-1027. Comparing PCV to the equivalent genotypic coefficient of variation (GCV), it was clear that the characters' features were more strongly influenced by environmental interaction. High heritability and large genetic progress are determined by additive gene activity, which is expressed as a percentage of the mean of important characteristics. Heritability is an indicator of little environmental influence. Following research that linked grain production per plant and its related characteristics to the genotype of chickpeas, the optimal genotype would produce more pods per plant while also having a higher 100 seed weight. In the future, further stress should be applied to the identified features while developing options for increasing Chickpea grain output (Cicer arietinum L.)

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