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Genetic Variability, Heritability, Genetic Advance for Yield and Yield Related Attributes in Chickpea (*Cicer arietinum* L.)

Ayyala Prathyusha, Devarakonda Uday Kiran Kumar, Shama Parveen

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ABSTRACT

The present investigation was carried out with 30 chickpea genotypes to study the genetic variability for yield and yield related traits in chickpea and observed the high significance for all the thirteen characters i.e., germination percentage, days to 50% flowering, days to maturity, plant height, shoot length, root length, seedling length, number of primary branches, number of secondary branches, number of pods per plant, test weight, yield per plant. For the traits number of primary branches, number of secondary branches, number of pods per plant, yield per plant and seedling length genetic variability showed high estimates of phenotypic coefficient of variation and genotypic coefficient of variation with high heritability coupled with genetic advance indicating this these characters exhibited wide variability. The heritability of these traits were due to additive gene effects which makes selection effective. This will help breeders in direct plant selection based on phenotypic expression.

Keywords Genetic variability, Genotypic coefficient of variation, Phenotypic coefficient of variation, Heritability, Genetic advance.

INTRODUCTION

Chickpea (*Cicer arietinum* L.), are several kinds of legume that have been grown for thousands of years and are commonly consumed all over the world. Although they originated in the Middle East and the Mediterranean region, they are now grown across the world, including India, Mexico, and the United States. Chickpea plants are heavily self-pollinated. Having a chromosomal number of 2n=16, chickpeas endure a total of 16 chromosomes in each of its cells. Chickpeas are grown in many economies, with production levels varies according to factors like climate, soil, and demand. Currently, India is globally largest producer of chickpeas, making up about two-thirds of global production.

Chickpeas physical attributes, including size, shape, and nutritional value, are greatly determined by their genetic makeup. Chickpeas are a beneficial addition to any diet while they are an ideal source

Ayyala Prathyusha[1], Devarakonda Uday Kiran Kumar[2], Shama Parveen[3]*

[3] Associate Professor

[1,2,3] Deptt. of Genetics and Plant Breeding, School of Agriculture, ITM University, Gwalior 474001, MP, India

Email: shamaparveen.soag@itmuniversity.ac.in
*Corresponding author

of plant-based protein, fiber, and numerous crucial vitamins and minerals.

One of the most prominent pulse crops is the chickpea. It is the top crop for growing pulses on the Indian subcontinent. India is among the globe's top producer and consumer of chickpeas. The world's largest producer of pulses is India. Chickpea plants are heavily self-pollinated. The two well-known types of chickpeas are the desi type, which has tiny, brown seeds, and the Kabuli variety, which has large, cream-colored seeds, which is grown in around 10% of the total area. Almost 90% of the chickpea crop is grown rain-fed, primarily on marginal lands with drop in soil moisture.

MATERIALS AND METHODS

The present investigation was conducted in *rabi* 2022-23 at Crop Research Center II, Department of Genetics and Plant Breeding, School of Agriculture, ITM University, Gwalior, Madhya Pradesh. Genetics and Plant Breeding, School of Agriculture, ITM University, Gwalior, Madhya Pradesh.

The field trail was conducted during 2022-2023 in Randomized Block Design (RBD) with three replications. The experimented material consisted of 30 genotypes of chickpea. Each genotype was planted in two rows of 49-meter length with 30cm spacing between rows and 10 cm between the plants in a row.

All the agronomical parameters and cultivation practices were followed to grow a successful crop. The observations were recorded from five randomly selected plants for 13 characters of chickpea. The recorded biometric observations were put through an ANOVA analysis of variance (Panse and Sukhatme 1985).

Heritability and genetic advance were calculated by the according to formula suggested by Hanson *et al*. (1956)for each character. To understand the association among the characters genotypic and phenotypic correlation coefficient were worked out by adopting the method described by Burton and Devanc (1952). Analysis of covariance was carried out by taking two characters at a time.

RESULTS AND DISCUSSION

Analysis of variance revealed that the difference among 30 genotypes were highly significant for all the characters. The analysis of variance for different characters was presented in Table 1. Gandam and (2022), Singh *et al.* (2021), Thati and Gabriyal (2021) also found significant variation days to 50% flowering, days to maturity, plant height, number of pods per plant, number of primary branches, number of secondary branches, hundred seed weight.Genotypic Coefficient of variation and phenotypic coefficient of variation.

Genotypic and phenotypic coefficients (Table 2) of variation were estimated by formula suggested by Burton and Devane (1952) for each character. In the present study wide variability was observed in days to 50% flowering, days to maturity, plant height, shoot length, root length, seedling length, no. of pods per plant, test weight, yield per plant. In case of germination percentage, number of primary branches, number of secondary branches and root shoot ratio narrow range of variation was observed.

The high estimates of PCV and GCV were observed for no. of primary branches, no. of secondary branches, no. of pods per plant, yield per plant and seedling length. Moderate for plant height, shoot length, root length and test weight. Low for days to

Table 1. Analysis of variance for13 characters among 30 genotypes of chickpea 2022-2023.

Sl. No.	Character	Replication	Treatment	Error
1	Germination percentage %	1.45	9.41**	0.01
2	Days to flowering	1.2	29.86**	0
3	Days to maturity	1.13	119.63**	0.001
4	Plant height (cm)	1.24	72.32**	0.001
5	Shoot length (cm)	2.54	71.85**	0.124
6	Root length (cm)	1.2	3.97**	0.001
7	Seedling length (cm)	0.52	24.62**	0.14
8	No of primary branches	0.92	0.43**	0.004
9	No of secondary branches	0.98	0.41**	0.002
10	Root shoot ratio	0.93	0.002**	0.001
11	No of pods per plant	1.2	224.64**	0.01
12	Test weight (g)	0.83	21.21**	0.04
13	Yield per plant	1.04	17.7**	0.005

*,** Level of significance at 5% and 1% respectively.

Table 2. Estimation of GCV and PCV for 13 characters.

Sl. No.	Character	Genotypic variation	Phenotypic variation
1	Germination %	1.79	1.8
2	Days to 50% flowering	8.22	8.23
3	Days to maturity	7.26	7.28
4	Plant height (cm)	13.17	13.18
5	Shoot length	14.02	14.06
6	Root length	11.61	11.62
7	Seedling length	31.24	31.51
8	No. of primary branches	25.75	26.14
9	No. of secondary branches	47.44	47.82
10	Root shoot ratio	7.02	17.21
11	No. of pods per plant	47.39	47.4
12	Test weight	17.23	17.26
13	Yield per plant	41.11	41.3

Table 3. Estimation of heritability and genetic advance for 13 characters.

Sl. No.	Character	Heritability (%)	GA	GA% mean
1	Germination %	99.61	3.63	3.69
2	Days to 50% flowering	99.19	6.49	16.95
3	Days to maturity	99.31	13	15
4	Plant height (cm)	98.01	10.1	27.14
5	Shoot length	99.49	10	28.81
6	Root length	99.89	2.37	23.91
7	Seedling length	99.31	5.83	63.82
8	No. of primary branches	97.05	0.76	52.27
9	No. of secondary branches	98.99	0.74	96.94
10	Root shoot ratio	16.67	0	5.91
11	No. of pods per plant	97.96	17.8	97.62
12	Test weight	99.37	5.45	35.33
13	Yield per plant	99.91	5.01	84.44

50% flowering, days to maturity, root shoot ratio, and germination percentage.

Heritability and genetic advance

Heritability (Table 3) above (60%) was recorded for yield per plant, root length, germination percentage, shoot length, test weight, days to maturity, seedling length, days to flowering, number of secondary branches, plant height, number of pods per plant, number of primary branches. Low heritability below (30%) was recorded for root shoot ratio. The similar findings are also displayed by Gautam *et al.*(2021). Yadav *et al.* (2015), Bharadwaj *et al.* (2016) high genetic advance (20%) was recorded for no. of pods per plant, no. of secondary branches, yield per plant, seedling length, no. of primary branches, test weight, shoot length, plant height, and root length.

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