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**Original Research Article**

# Assessment of Genetic Variability and Character Association in Chickpea (*Cicer arietinum* L.) Germplasm for Seed Yield Characters

**Vikas Kumar Bagada* and G. Roopa Lavanya**

Department of Genetics and Plant Breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, 211007 U. P., India
**Corresponding author*

**A B S T R A C T**

The present investigation conducted to evaluate 13 chickpea genotypes for genetic variability and correlation. Analysis of variance revealed highly significant differences among 13 chickpea genotypes for all characters, indicating the existence of high variability. Number of pods per plant showed relatively high GCV and PCV estimates. High estimates of heritability were observed for days to 50% flowering, days to maturity, seed index, biological yield and numbers of pods per plant. High estimates genetic advance as per cent of mean was observed for number of pods per plant, biological yield, seed yield per plant and days to 50% flowering. High heritability coupled with high genetic advance as % of mean observed for number of pods per plant, biological yield and days to 50% flowering. Seed yield per plant at genotypic and phenotypic level was positively significantly correlated with number of primary branches per plant, biological yield and number of pods per plant. These characters can be used as selection indices for chickpea yield improvement.

**Keywords**

Chickpea (*Cicer arietinum* L.), Genetic variability, Heritability, Correlation etc.

## Introduction

Chickpea is the most important and extensively cultivated legume in Asia, which contributes 86.73% of global production from 89.89% area. The world area under chickpea is about 13.10 million ha, with a total production of 10.46 million tonnes, and an average productivity of 960 kg/ha (FAO, 2014).

India stands first in area (9.93 million ha), and production (9.53 million tonnes). The area of chickpea in worldwide is 131.05 lakh hectares and production is 104.66 lakh tonnes. In India area of chickpea is 9.93 million ha, production is 9.53 million tonnes and productivity is 960 kg/ha.

In UP area of chickpea is 5.77 lakh ha, production is 4.75 lakh tonnes and productivity is 824 kg/ha (IIPR, 2013-14).

Based on the importance of the above aspects, an attempt has been made in the present experiment to study the "Evaluation of chickpea genotypes for early duration and seed yield suited to eastern zone of Uttar

Pradesh" was carried with the following objectives

To assess the nature and magnitude of genetic variability for yield and yield related traits in chickpea.

To study association among yield component characters and with seed yield.

## Materials and Methods

The research experiment was carried out during *Rabi* 2015-2016 comprising 13 genotypes of chickpea at the Field Experimentation Center, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad. The genotypes were sown in a randomized block design with three replications. Row length was kept 4m and the spacing between two rows was kept at 30 cm. Five plants from each replication were taken at random at the time of recording the data on various characters. Data of five plants were averaged replication wise and mean data was used for statistical analysis. Recommended package of practices were applied to raise a good crop. The data were recorded on nine characters as following, days to 50% flowering, plant height (cm), number of primary branches per plant, number of pods per plant, days to maturity, biological yield (g), seed index (g), harvest index (%) and seed yield per plant (g). The estimates of PCV and GCV were classified as low, medium and high (Sivasubramanian and Madhavamenon, 1973) (less than 10%=low; 10-20%=moderate; greater than 20%=high). The heritability estimates were categorized as low (0-30%); moderate (31-60%); above high (60%) suggested by Johnson *et al.,* (1955). Genetic advance was estimated and categorized as high (more than 20%); moderate (10-20%); and low (10%) by adopting the method given by Johnson *et al.,* (1955). Correlation coefficient was estimated as per the methods suggested by (AL-Jibouri *et al.,* (1958).

## Results and Discussion

The differences among the chickpea genotypes were significant at 5% level of significance for all the nine traits. The analysis of variance showed that there were considerable inherent genetic differences among genotypes for all the characters under study. The mean squares due to blocks were non-significant for all the characters. This indicates that there is ample scope for selection of genotypes from the present gene pool for yield and its components. The presence of large amount of variability might be due to diverse source of material taken as well as environmental influence affecting the phenotypes. These findings are in accordance with the findings of Dubey and Srivastava (2007), Barshile *et al.,* (2009), Borati *et al.,* (2010) and Kuldeep *et al.,* (2014) who also observed significant variability for yield and its components traits in chickpea. High variances (VG and VP) were recorded for number of pods per plant (228.59 and 269.31). Both PCV and GCV estimates were high for number of pods per plant (31.32% and 28.86%) followed by seed yield per plant (37.01% and 19.76%), number of primary branches per plant (29.87% and 16.32 %), biological yield (24.70% and 23.70%), plant height (16.26% and 11.97 %), days to 50% flowering (10.69% and 10.57%), and seed index (9.95% and 9.71%). Dubey and Srivastava (2007), Barshile *et al.,* (2009), and Kuldeep *et al.,* (2014) registered high genotypic coefficient of variation for number of pods per plant High estimates of heritability (above 60%) in broad sense were recorded for five characters, which ranged from 84.88% (number of pods per plant) to 97.78% (days to 50% flowering) (Table 2).

A perusal of genetic advance for all the quantitative characters under study ranged from 1.25% (number of primary branches per plant) to 28.69% (number of pods per plant). Genetic advance as percent of mean was high for number of pods per plant (54.77) followed by biological yield (46.85), seed yield per plant (21.74) and days to 50% flowering (21.54). Durga *et al.,* (2007) also recorded high genetic advance for days to 50 % flowering.

High heritability was registered for days to 50% flowering, days to maturity, seed index, biological yield and number of pods per plant. Khan *et al.,* (2006), Babbar *et al.,* (2012) and Parameshwarappa *et al.,* (2012) recorded high heritability for days to 50 % flowering. High heritability coupled with moderate genetic advance was registered for number of pods per plant (84.88 and 28.69), suggesting predominance of additive gene action in the expression of these traits.

**Table.1** Analysis of variance for nine different quantitative characters in Chickpea

| SN. | **Characters** | **Mean sum of squares** | | |
|---|---|---|---|---|
| | | **Replications** | **Treatments** | **Error** |
| | | df = 3 | df = 12 | df = 36 |
| 1. | Days to 50 % flowering | 1.897 | 257.631* | 1.939 |
| 2. | Plant height | 89.147 | 152.131* | 33.495 |
| 3. | No. of primary branches per plant | 4.224 | 6.641* | 2.919 |
| 4. | Number of pods per plant | 36.391 | 726.490* | 40.715 |
| 5. | Days to maturity | 0.276 | 82.609* | 0.942 |
| 06. | Seed index | 38.706 | 60.103* | 26.651 |
| 7. | Biological yield | 41.373 | 44.193* | 20.116 |
| 8. | Harvest index | 14.853 | 204.953* | 5.714 |
| 9. | Seed yield per plant | 0.177 | 13.384* | 0.218 |

* Significant at 5% level of significance

**Table.2** Genetic parameters for nine quantitative characters in chickpea

| S. N. | Characters | Vg | Vp | GCV (%) | PCV (%) | $h^2$ (bs) (%) | GA | GA as % of mean |
|---|---|---|---|---|---|---|---|---|
| 1. | Days to 50 % flowering | 85.23 | 87.17 | 10.57 | 10.69 | 97.78 | 18.81 | 21.54 |
| 2. | Plant height | 39.55 | 73.04 | 11.97 | 16.26 | 54.14 | 9.53 | 18.14 |
| 3. | Number of primary branches per plant | 1.24 | 4.16 | 16.32 | 29.87 | 29.83 | 1.25 | 18.36 |
| 4. | Number of pods per plant | 228.59 | 269.31 | 28.86 | 31.32 | 84.88 | 28.69 | 54.77 |
| 5. | Days to maturity | 27.22 | 28.16 | 4.15 | 4.22 | 96.65 | 10.57 | 8.41 |
| 6. | Seed index | 4.39 | 4.61 | 9.71 | 9.95 | 95.28 | 4.21 | 19.52 |
| 7. | Biological yield | 66.41 | 72.13 | 23.70 | 24.70 | 92.08 | 16.11 | 46.85 |
| 8 | Harvest index | 11.15 | 37.80 | 8.00 | 14.74 | 29.50 | 3.74 | 8.95 |
| 9. | Seed yield per plant | 8.03 | 28.14 | 19.76 | 37.01 | 28.52 | 3.12 | 21.74 |

**Table.3** Correlation coefficient between yield and its related traits in chickpea genotypes at genotypic level

| Characters | Plant height | Primary branches per plant | Pods per plant | Days to maturity | Seed index | Biological yield | Harvest index | Seed yield per plant |
|---|---|---|---|---|---|---|---|---|
| Days to 50 % flowering | 0.058 | 0.833** | 0.737** | 0.497** | 0.283* | 0.403** | 0.268 | 0.498** |
| Plant height | 1.00 | -0.035 | -0.238 | 0.114 | 0.500** | 0.102 | 0.530** | 0.219 |
| Primary branches per plant | | 1.00 | 0.995** | 0.185 | 0.332* | 0.996** | 0.284* | 0.999** |
| Pods per plant | | | 1.00 | 0.464** | 0.078 | 0.733** | -0.071 | 0.785** |
| Days to maturity | | | | 1.00 | 0.569** | 0.042 | 0.196 | 0.116 |
| Seed index | | | | | 1.00 | 0.179 | 0.375** | 0.322* |
| Biological yield | | | | | | 1.00 | 0.116 | 0.998** |
| Harvest index | | | | | | | 1.00 | 0.380** |

*and ** significant at 5% and 1% probability

**Table.4** Correlation coefficient between yield and its related traits in chickpea at phenotypic level

| Characters | Plant height | Number of primary branches per plant | Number of pods per plant | Days to maturity | Seed index | Biological yield | Harvest index | Seed yield per plant |
|---|---|---|---|---|---|---|---|---|
| Days to 50 % flowering | 0.063 | 0.443** | 0.676** | 0.474** | 0.282* | 0.372** | 0.117 | 0.267 |
| Plant height | 1.00 | 0.275* | -0.080 | 0.057 | 0.356** | 0.140 | 0.231 | 0.225 |
| No. of primary branches per plant | | 1.00 | 0.477** | 0.033 | 0.136 | 0.514** | 0.204 | 0.312* |
| No. of pods per plant | | | 1.00 | 0.415** | 0.044 | 0.628** | 0.015 | 0.471** |
| Days to maturity | | | | 1.00 | 0.535** | 0.056 | 0.116 | 0.078 |
| Seed index | | | | | 1.00 | 0.152 | 0.152 | 0.117 |
| Biological yield | | | | | | 1.00 | 0.122 | 0.648** |
| Harvest index | | | | | | | 1.00 | 0.455** |

*and** significant at 5% and 1% probability

Seed yield per plant showed positive and significant genotypic association with number of primary branches per plant (0.999**), biological yield per plant (0.998**), number of pods per plant (0.785**), days to 50% flowering (0.498**), harvest index (0.380**) and seed index (0.322*) (Table -3). Similar results were also reported by Ali *et al.,* (2011), Padmavathi *et al.,* (2013) and Kuldeep *et al.,* (2014). Seed yield per plant exhibited significant positive correlation with biological yield per plant (0.648**) followed by number of pods per plant (0.471**), harvest index (0.455**) and primary branches per plant (0.312*) (Table 3).

The results from present study concluded that all thirteen genotypes of Chickpea showed significant genetic variability. High heritability and genetic advance observe for days to 50% flowering, number of pods per plant, biological yield per plant, days to maturity and hence these parameters could be used as for selection. Number of primary branches per plant showed highly significant and positive correlation with seed yield per plant at genotypic level, and biological yield showed highly significant and positive correlation with seed yield per plant at phenotypic level, indicate that these characters can be used as selection parameters for chickpea improvement.

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