Genetic Parameters in Seed Yield Components of Cowpea (Vigna unguiculata (L.) Walp.)

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Abstract

The phenotypic coefficient of variation was found to be higher than the genotypic coefficient of variation for all the traits studied. The highest magnitude of GCV was observed for pod weight followed by number of pod clusters plant\(^{-1}\), seed yield plant\(^{-1}\), 100 seed weight, pod length, number of pods cluster\(^{-1}\) and number of pods plant\(^{-1}\). All the characters considered except number of primary branches plant\(^{-1}\), number of pods plant\(^{-1}\) and seed yield plant\(^{-1}\) recorded high estimates of heritability. High heritability coupled with high genetic advance was observed for days to 50 per cent flowering, length of main stem, number of pod clusters plant\(^{-1}\), number of pods cluster\(^{-1}\), pod weight, pod length, pod girth, number of seeds pod\(^{-1}\), and 100 seed weight.

Keywords
Cowpea, Genetic parameters, Heritability, Genetic advance

Introduction

Cowpea [Vigna unguiculata (L.) Walp] also known black-eyed pea, southern pea etc is a pulse crop rich in proteins, vitamins and minerals and is mainly grown for grain, vegetable and fodder purposes. Low productivity is one of the major constrain in pulse production. Considerable research regarding selection criteria for yield is very essential to increase the productivity of pulses to meet the increasing demands of growing population. Greater the genetic variability, greater the chances for the selection of better genotypes. The genetic parameters like genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) gives an idea about magnitude of variability present in a genetic population. The estimates of genetic parameters like heritability and genetic advance help the plant breeder in selection of elite genotypes from diverse genetic populations. Therefore plant breeding efforts should aim at the manipulation of available genetic diversity in the desired direction through suitable selection criteria. Keeping these aspects in view, the present investigation was undertaken to study genetic variability, heritability, and genetic advance in cowpea genotypes.
Materials and Methods

The experimental crop was raised during the period of April 2016 to July 2016 in a farmer field Kayamkulam in randomized block design with three replication. The experimental field was divided into three blocks of thirty plots each and the treatment was allotted to each block at random. The plot size was 3m². Spacing was 30cm between rows and 10cm between plants in a row. The genotypes were evaluated for following traits viz., days to 50 percent flowering, number of primary branches plant⁻¹, length of main stem (cm), number of pod clusters plant⁻¹, number of pods cluster⁻¹, number of pods plant⁻¹, pod weight (g), pod length (cm), pod girth (mm), number of seeds pod⁻¹, 100 seed weight (g), seed yield plant⁻¹ (g) and crop duration (days).

The data studied on various parameters were subjected to statistical analysis as per methods suggested by Panse and Sukhatme (1967) for analysis of variance, Burton (1952) for variability, Lush (1940) for heritability (Broad Sense) and Johnson et al., (1955) for genetic advance in per cent of mean.

Results and Discussion

Genetic parameters

The various genetic parameters like GCV, PCV, heritability and genetic advance were calculated for different characters for all the thirty genotypes and recorded in the table 1. PCV was greater than GCV for all the characters studied.

Genotypic coefficient of variation (GCV)

Genotypic coefficient of variation (GCV) ranged from 10.33 (crop duration) to 47.73 (pod weight). Highest GCV was observed for pod weight (47.73) followed by number of pod clusters plant⁻¹ (24.99), seed yield plant⁻¹ (24.43), 100 seed weight (24.07), pod length (23.66), number of pods cluster⁻¹ (20.86) and number of pods plant⁻¹ (20.66). Number of primary branches plant⁻¹ (19.46), pod girth (18.75), length of main stem (16.22), days to 50 per cent flowering (15.28), number of seeds pod⁻¹ (12.37) and crop duration (11.67) exhibited moderate level of GCV. None of the characters exhibited low magnitude of GCV.

Phenotypic coefficient of variation

The phenotypic coefficient of variation (PCV) ranged from 11.67 (crop duration) to 52.12 (pod weight). Highest PCV was for pod weight (52.12) followed by seed yield plant⁻¹ (31.72), number of pod clusters plant⁻¹ (31.36), number of pods plant⁻¹ (27.21), number of primary branches plant⁻¹ (26.92), 100 seed weight (24.13), pod length (23.81) and number of pods cluster⁻¹ (21.32). Length of main stem (18.94), pod girth (18.85), days to 50 per cent flowering (16.44) and number of seeds pod⁻¹ (12.84) and crop duration (11.67) exhibited moderate level PCV. None of the characters exhibited low PCV values.

These findings of GCV and PCV values are in close harmony with the result of Manggoel et al., (2012) for 100-seed weight, grain yield, number of pods plant⁻¹ and Thorat et al., (2013) for number of pods plant⁻¹, and number of clusters plant⁻¹ ; Vavilapalli et al., (2013) for pod weight and pod length; Ajayi et al., (2014) for number of pods plant⁻¹, pod length, pod weight (g), number of seeds pod⁻¹, and 100-seed weight; Selvakumar et al., (2015) for yield plant⁻¹, pod length, number of clusters plant⁻¹, number of pods clusters⁻¹ and 100 grain weight; Khandait et al., (2016) for number of pods plant⁻¹, number of pods cluster⁻¹, pod weight and pod length; Rajput (2016) number of pod plant⁻¹, number of pods cluster⁻¹, pod weight and pod length.; and Srinivas et al., (2017) for number of pods plant⁻¹ and number of seeds pod⁻¹.
Table 1: Genetic parameters

| Characters                        | Coefficient of variation | Heritability | Genetic advance (as % of mean) |
|----------------------------------|--------------------------|--------------|--------------------------------|
|                                  | GCV          | PCV          |                                |                                |
| Days to 50% flowering            | 15.28        | 16.44        | 86.45                          | 29.28                          |
| No. of primary branches per plant| 19.46        | 26.92        | 52.26                          | 28.98                          |
| Length of main stem (cm)         | 16.22        | 18.94        | 73.34                          | 28.62                          |
| No. of pod clusters per plant    | 24.99        | 31.36        | 63.5                           | 41.02                          |
| No. of pods per cluster          | 20.86        | 21.32        | 95.73                          | 42.04                          |
| No. of pods per plant            | 20.66        | 27.21        | 57.67                          | 32.33                          |
| Pod weight (g)                   | 47.73        | 52.12        | 83.86                          | 90.05                          |
| Pod length (cm)                  | 23.66        | 23.81        | 98.74                          | 48.44                          |
| Pod girth (mm)                   | 18.75        | 18.85        | 98.94                          | 38.43                          |
| Number of seeds per pod          | 12.37        | 12.84        | 92.83                          | 24.55                          |
| 100 seed weight (g)              | 24.07        | 24.13        | 99.41                          | 49.43                          |
| Seed yield per plant (g)         | 24.43        | 31.72        | 59.30                          | 38.75                          |
| Crop duration (days)             | 10.33        | 11.67        | 78.31                          | 18.83                          |
Phenotypic and genotypic coefficients of variation for thirteen characters in Cowpea

X1  Days to 50% flowering
X2  No. of primary branches per plant
X3  Length of main stem (cm)
X4  No. of pod clusters per plant
X5  No. of pods per cluster
X6  No. of pods per plant
X7  Pod weight (g)
X8  Pod length (cm)
X9  Pod girth (mm)
X10 Number of seeds per pod
X11 100 seed weight (g)
X12 Seed yield per plant (g)
X13 Crop duration (days)
Heritability and Genetic advance for thirteen characters in cowpea
For the characters exhibiting negligible difference between estimates of GCV and PCV, selection will be effective since the environmental influence is low for these characters.

**Heritability and Genetic advance**

Heritability (in broad sense) values for the studied traits ranged from 52.26 % to 99.41 %. The highest heritability was obtained for 100 seed weight (99.41 %) followed by pod girth (98.94 %), pod length (98.74 %), number of pods cluster\(^{-1}\) (95.73 %), number of seeds pod\(^{-1}\) (92.83 %), days to 50 per cent flowering (86.45 %), pod weight (83.86 %), crop duration (78.31 %), length of main stem (73.34 %) and number of pod clusters plant\(^{-1}\) (63.50 %); while moderate heritability was observed for seed yield plant\(^{-1}\) (59.30 %), number of pods plant\(^{-1}\) (57.67 %) and number of primary branches plant\(^{-1}\) (52.26 %).

Similar findings were recorded Adewale et al., (2010) for seeds pod\(^{-1}\), 100 seed weight and pod length; Manggoel et al., (2012) for 100 seed weight, days to 50% flowering, number of seeds pod\(^{-1}\) and pod length; Ajayi et al., (2014) for number of pods plant\(^{-1}\), pod length, pod weight (g), number of seeds pod\(^{-1}\), and 100-seed weight; Khandait et al., (2016) for pod length and pod weight.

Heritability estimates along with genetic advance are normally more helpful in predicting the gain under selection than heritability estimates alone (Singh and Chaudhary, 1985).

Corroborative findings were reported by Suganthi and Murugan (2008) for seed yield plant\(^{-1}\), number of pods plant\(^{-1}\) and number of clusters plant\(^{-1}\); Manggoel et al., (2012) and Khandait et al., (2016) for number of pods plant\(^{-1}\), pod length, number of pods cluster\(^{-1}\), and pod weight.

High heritability coupled with high genetic advance was observed for days to 50 per cent flowering, length of main stem, number of pod clusters plant\(^{-1}\), number of pods cluster\(^{-1}\), seed yield plant\(^{-1}\), pod weight, pod length, pod girth, number of seeds pod\(^{-1}\), and 100 seed weight. It supports findings of Vavilapalli et al., (2013) for pod length, pod girth and pod weight. Kharde et al., (2014) pod length, average pod weight and number of seeds pod\(^{-1}\); Selvakumar et al., (2015) for number of pods clusters\(^{-1}\) and 100 grain weight, Srinivas et al., (2017) for number of pods plant\(^{-1}\) and number of seeds pod\(^{-1}\).

The pod weight exhibited the highest GCV (47.73%) and PCV (52.12%). Heritability was high for all the characters except number of primary branches plant\(^{-1}\), number of pods plant\(^{-1}\) and seed yield plant\(^{-1}\) which possessed moderate heritability.

GA (% mean) was high for all the characters except crop duration. High GCV, PCV, Heritability and Genetic advance was found on the characters number of pod clusters\(^{-1}\), number of pods cluster\(^{-1}\), number of pods plant\(^{-1}\), pod weight, pod length and 100 seed weight. Therefore plant breeding efforts...
should aim at the manipulation of available genetic diversity in the desired direction through these selection criteria.

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