



GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN COWPEA [(*VIGNA UNGUICULATA* (L.) WALP.)]

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Abstract

The present experiment was carried out entitled “Genetic Variability, Heritability, Correlation and Path analysis in Cowpea [(*Vigna unguiculata* (L.) Walp.)]” during *kharif* season of the year 2014- 2015 at Horticulture Research Farm, Department of Horticulture, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya- Vihar, Rae Bareli Road, Lucknow-226025 (U.P.) India. The experiment was laid out in Randomized Block Design with three replications. The experimental materials consisting sixteen genotypes of cowpea *i.e.* Kashi Unnati, Kashi Shyamal, Kashi Gauri, Kashi Kanchan, Kashi Nidhi, IC-559393, IC-259063, IC-559405, IC-202786, IC-559386, IC-202776, IC-242598, EC-9736, EC-1738, EC-30590 and EC-15296. The maximum phenotypic and genotypic variance, genetic advance was observed for average pod yield per plot. The highest of PCV and GCV was recorded in number of primary branches was estimated.

Key words: Genetic variability, PCV, GCV, heritability and genetic advance.

Introduction

Cowpea ($2n=22$) belongs to the family Leguminosae also known as southern pea and black eye pea, is one of the most important vegetables. It is cultivated for its long, green or purplish pods to be cooked as vegetable or for dry seeds used as pulse. Its foliage is also used as fodder or green manure, producing 20-30 cm long pod and elongated kidney shaped, 8-12 mm long seeds. Cowpea is commonly cultivated as a nutritious and highly palatable food source in Asia and throughout the tropics and sub-tropics. Green pod of cowpea contains 85g moisture, 3.0g protein, 1.0 g minerals, 2.0 g fiber, 8.0 g carbohydrates, 72 mg calcium, 59 mg phosphorus, 2.0 mg iron, 0.09 mg riboflavin and 0.07 mg thiamin per 100 g of edible portion. (Anonymous, 2011). Among the different pulses grown in the world, cowpea is grown in 14.13 million hectare with production of 4.51 ('000 MT) and the productivity of 387.45 kg ha⁻¹. In India, the cowpea is grown in an area of about 3.91 million hectare with a production of 2.22 ('000 MT) having a productivity of 564.15 kg seed ha⁻¹ and in Madhya Pradesh its covering area and production is very minor (Shivnanda, 2005). The

development of cultivars with early maturity, acceptable grain quality, resistance to some important diseases and pests has significantly increased the yield and cultivars area (Ehlers and Hall 1997) yield being a complex trait, is influenced by many other important yield contributing characters controlled by polygene and also environment factors. So, in these characters, observed variability is the sum total of hereditary effects of concerned genes plus the influence of the environment. The magnitude of genetic variance denotes how much of the variability of the characters is heritable advance can be achieved. Hence, collection, maintenance and evolution of germplasm for studying genetic variability of economically important traits is one of the basic steps for initiating breeding programme for genetic improvement of cowpea.

Materials and Methods

The present investigation was done at Horticulture Research Farm, Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Vidya- Vihar, Rea Bareli Road, Lucknow during the year 2014-15. Lucknow is characterized by sub-tropical climate with hot, dry summer and cold winter. The soil of

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experimental farm was saline with soil pH 8.2, Electrical conductivity 4.0 and sodium exchangeable percentage 15.0. During the period of experiment, meteorological observations were recorded from Indian Institute of Sugarcane Research, Lucknow. The experiment was laid out in Randomized Block Design. In the present investigation sixteen diverse genotypes of cowpea were used as experimental materials. The 16 genotypes are collected from Indian Institute of Vegetable Research, Varanasi. Genotypes are Kashi Unnati, Kashi Shyamal, Kashi Gauri, Kashi Kanchan, Kashi Nidhi, IC-559393, IC-259063, IC-559405, IC-202786, IC-559386, IC-202776, IC-242598, EC-9736, EC-1738, EC-30590 and EC-15296 used. Observations were recorded like plant height (cm), number of primary branches/plant, number of branches per plant, days to first pod picking, pod length, pod diameter, number of pods per peduncle, pod weight per plant, pod yield per plot, peduncle length (cm), number of peduncle per plant, duration or reproductive phase, number of seeds per plant, number of seeds per pod, 100 seeds weight, vitamin A (IU) and vitamin C (mg/100g) were recorded. The heritable variation was further divided into additive and non additive components and the later function included dominance and interallelic interaction [Fisher *et al.* (1932) and Panse, (1957) and Lush (1945)].

More attribution of the heritable component to the total variation of desirable characters becomes essential. Scientists have given more emphasis to improve the yield of a crop by studying the variability and heritability of yield and yield attributing components (Robinson *et al.*, 1949). (Grafius, 1959, Nikell and Grafius, 1969).

Results and Discussion

The extent of variability present in germplasm of cowpea was measured in terms of range, SEM, phenotypic variance (σ^2_p), phenotypic coefficient of variation (PCV), genotypic (σ^2_G) variance, genotypic coefficient variation (GCV), heritability (broad sense) and genetic advance (GA) (table-1). All the varieties differed significantly with respect of different characters studied.

Mean performance of cowpea germplasm for different characters are showed in table-1 and the coefficient of variation, heritability and genetic gain value are presented in table-1. The phenotypic coefficient of variation (PCV) was higher than their respective genotypic coefficient of variation (GCV) for all the traits under study.

The widest range was recorded for pod yield per plot (3581.00- 3825.00) followed by number of seed per plant (236.97-312.73), pod weight per plant (g) (360.74 -

Table 1: Estimates of variability, heritability and genetic advance as per cent of mean for nineteen characters in cowpea 2014-15.

| S. No. | Character | Range | | Mean | Variance | | PCV (%) | GCV (%) | h ² (%) | Genetic Advance | GA % of mean |
|--------|--------------------------------------|---------|---------|---------|-----------------|----------------|---------|---------|--------------------|-----------------|--------------|
| | | Min. | Max | | Pheno- typic | Geno- typic | | | | | |
| 1. | Plant height(cm) | 27.89 | 32.35 | 30.66 | 2.78 | 1.47 | 5.44 | 3.95 | 0.53 | 1.81 | 5.92 |
| 2. | Number of primary branches per plant | 2.14 | 4.50 | 3.12 | 0.54 | 0.51 | 23.54 | 22.81 | 0.94 | 1.42 | 45.55 |
| 3. | Number of branches per plant | 3.41 | 4.50 | 3.97 | 0.12 | 0.10 | 8.87 | 7.96 | 0.81 | 0.59 | 14.73 |
| 4. | Days to first open flower | 40.76 | 45.98 | 43.40 | 3.73 | 1.12 | 4.45 | 2.44 | 0.30 | 1.19 | 2.75 |
| 5. | Number of pod per plant | 39.33 | 49.41 | 42.91 | 11.72 | 9.17 | 7.98 | 7.06 | 0.78 | 5.51 | 12.85 |
| 6. | Days to first pod picking | 53.25 | 56.78 | 54.54 | 2.29 | 0.32 | 2.77 | 1.04 | 0.14 | 0.44 | 1.02 |
| 7. | Pod length (cm) | 11.30 | 14.87 | 12.99 | 1.49 | 0.97 | 9.39 | 7.60 | 0.65 | 1.65 | 12.67 |
| 8. | Pod diameter (cm) | 5.34 | 6.98 | 6.09 | 0.45 | 0.34 | 10.99 | 9.62 | 0.77 | 1.06 | 17.36 |
| 9. | Number of pods per peduncle | 4.75 | 8.24 | 6.50 | 1.39 | 1.26 | 18.16 | 17.26 | 0.90 | 2.20 | 33.80 |
| 10. | Pod weight per plant (g) | 360.74 | 390.25 | 376.92 | 153.73 | 59.33 | 3.29 | 2.04 | 0.39 | 9.86 | 2.62 |
| 11. | Pod yield per plot (g) | 3581.00 | 3825.00 | 3724.69 | 8411.89 | 3520.91 | 2.46 | 1.59 | 0.42 | 79.08 | 2.12 |
| 12. | Peduncle length (cm) | 4.50 | 9.91 | 7.25 | 1.58 | 1.40 | 17.32 | 16.31 | 0.89 | 2.29 | 31.64 |
| 13. | Number of peduncle per plant | 11.89 | 14.74 | 13.55 | 1.09 | 0.83 | 7.71 | 6.71 | 0.76 | 1.63 | 12.02 |
| 14. | Duration of reproductive phase | 30.15 | 36.78 | 34.08 | 4.47 | 2.85 | 6.21 | 4.95 | 0.64 | 2.77 | 8.14 |
| 15. | Number of seeds per plant | 236.97 | 312.73 | 283.04 | 588.21 | 472.10 | 8.57 | 7.68 | 0.80 | 40.10 | 14.17 |
| 16. | Number of seeds per pod | 11.52 | 16.18 | 13.51 | 1.73 | 1.22 | 9.74 | 8.17 | 0.70 | 1.90 | 14.10 |
| 17. | 100 seeds weight | 4.57 | 5.63 | 5.03 | 0.10 | 0.06 | 6.26 | 5.01 | 0.64 | 0.41 | 8.25 |
| 18. | Vitamin A(IU) | 923.38 | 989.56 | 954.79 | 930.34 | 316.32 | 3.19 | 1.86 | 0.34 | 21.36 | 2.24 |
| 19. | Vitamin C (mg/100g) | 15.29 | 17.89 | 16.57 | 0.90 | 0.52 | 5.74 | 4.37 | 0.58 | 1.13 | 6.85 |

390.25), number of pod per plant (39.33-49.41), plant height (27.89-32.35), days to first open flower (40.76-45.98) and duration of reproductive phases (30.15-36.78).

Phenotypic coefficient of variation was higher for number of primary branches (23.54%) followed by number of pods per peduncle (18.16%), peduncle length (cm) (17.32), pod diameter (cm) (10.99), pod length (cm) (9.39), number of branches per plant (8.87) and number of pod per plant (7.98).

Highest genotypic coefficient of variation was observed in number of primary branched (22.81%) followed by number of pods per peduncle (17.26%), peduncle length (cm) (16.31), pod diameter (cm) (9.62), number of branches per plant (7.96%), number of seed per plant (7.68%) and pod length (cm) (7.60).

Heritability value in broad sense is presented in table-2. The highest heritability was recorded for number of primary branches per plant (0.94%), followed number of pods per peduncle (0.90%), peduncle length (cm) (0.89), number of seeds per plant (0.80%), number of branches per plant (0.81%) number of pods per plant (0.78%), pod diameter (cm) (0.77) and number of seed per pod (0.70%).

The maximum genetic advance (%) was recorded for pod yield per plot (79.08g) followed by number of seeds per plant (40.10), pod weight per plant (g) (9.86), number of pod per plant (5.51%), duration of reproductive phase (2.77%), peduncle length (cm) (2.29) and number of pods per peduncle (2.20%).

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