

CHARACTER ASSOCIATION AND GENETIC DIVERGENCE STUDIES IN COWPEA [*VIGNA UNGUICULATA* (L.) WALP.]

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ABSTRACT

Phenotypic coefficients of variation were invariably higher than their corresponding genotypic coefficients of variation due to environmental influence. The estimates of PCV and GCV indicated the existence of fairly high degree of genetic variability for plant height, number of peduncles and pods per plant, pod weight and pod yield per plant. Higher estimates of heritability coupled with higher genetic advance was recorded for plant height, number of peduncles and pods, and pod yield per plant. Pod yield per plant had significantly positive correlation with number of peduncles and pods per plant, pod length, pod weight and number of seeds per pod. The number of pods per plant exerted the maximum positive direct effect on green pod yield followed by pod weight and pod length. A positive indirect effect of number of pods per plant on pod yield was obtained high via number of branches and peduncles per plant and number of seeds per pod. Forty genotypes were grouped into six clusters and cluster II was observed largest followed by clusters IV, VI and I, respectively. The maximum intra-cluster distance was found in cluster II followed by clusters VI, IV and V, respectively. Similarly, the maximum inter-cluster distance was noticed between cluster II and III followed by III and VI. Considering the cluster means, the minimum days to flower, the longest peduncle, the maximum number of pods per plant, pod length, number of seeds per pod and pod yield per plant was noticed in cluster III. This cluster had next to lowest plant height, moderate number of branches per plant, next to highest number of peduncles per plant and pod weight. Over all cluster I, III and V showed greater potential as a breeding stock by virtue of high mean values of one or more component characters as well as high statistical distance.

**Key words:** Genetic variability, correlation coefficient, path analysis, multivariate clustering, cowpea

INTRODUCTION

Cowpea (*Vigna unguiculata* L. Walp.) is widely grown for pulse, vegetable, green manure and fodder in many parts of the world. In India, cowpea is grown in almost all the regions except high altitude in hilly areas. The *V. unguiculata* ssp. *unguiculata* and *V. unguiculata* ssp. *biflora* types are predominantly cultivated for pulse purpose. However, *V. unguiculata* ssp. *sesquipedalis* (yard long bean) is grown on a small scale for green vegetable purpose in scattered regions particularly in India and South East Asia (Pant *et al.*, 1982). The progress in breeding for the yield and its contributing characters of any crop is polygenetically controlled, environmentally influenced and determined by the magnitude and nature of their genetic variability (Fisher, 1981). Genetic variability, character association and path coefficient are pre-requisite for improvement of any crop for the selection of superior genotypes and improvement of any traits. It is very difficult to judge whether observed variability is heritable or due to environment alone. Moreover, knowledge of heritability is essential for selection based improvement as it indicates the extent of transmissibility of a character in future generations. Knowledge of correlation between yield and its

contributing characters are basic and for most endeavor to find out guide lines for plant selection. Partitioning of total correlation into direct and indirect effect by path coefficient analysis helps in making the selection more effective. D<sup>2</sup> analysis helps the breeder in grouping of genotypes in different clusters and to identify genotypically diverse and desirable genotypes. The knowledge on nature and magnitude of genetic variability existed in cowpea will provide the foundation for designing breeding programme. Keeping this in view, the present investigation was undertaken to assess the genetic diversity of 40 cowpea genotypes.

MATERIALS AND METHODS

The material for present investigation consisted of 40 genotypes of cowpea. The genotypes were evaluated during *kharif* season, 2009 in Randomized Block Design (RBD) with three replications at Indian Institute of Vegetable Research, Varanasi located 82°52' E longitude and 25°10' N latitude. All the 40 genotypes were sown on ridges made 45 cm apart with plant to plant distance of 15 cm. Recommended fertilizer dose and cultural practices including need-based plant protection measures were followed to raise a good crop. Observations were recorded on ten randomly selected

plants for plant height, number of branches and peduncles per plant, peduncle length, days to first flower, number of pods per plant, pod length, pod weight, number of seeds per pod and pod yield per plant in each replication. Genotypic coefficients of variance (GCV), phenotypic coefficients of variance (PCV), heritability in broad sense and genetic advance were worked out as per standard procedure suggested by Johnson *et al.* (1955). Correlation coefficient was worked out as per Al-Jibouri *et al.* (1958) to know the relationship among the yield and its components. Path coefficient was calculated by using the formula given by Dewey and Lu, (1959).  $D^2$  was done to determine the degree of differentiation among  $n(n-1)/2$  pairs of 'n' population and grouping of genotypes into various clusters was carried out by Tocher's method (Rao, 1952).

## RESULTS AND DISCUSSION

### Trait variability analysis

The genotypes differed significantly among themselves for all the characters under study. Estimates of phenotypic coefficient of variation (PCV) were invariably higher than their corresponding genotypic coefficient of variation (GCV) for all the characters indicating a positive effect of environment on the character expression (Table 1). The variances of various characters were compared on the basis of coefficient of variation. Plant height and green pod yield per plant exhibited

comparatively higher estimates of PCV and GCV which indicates that simple selection for green pod yield per plant might be advantageous. Apart from this fairly high degree of genetic variability (PCV and GCV) for number of peduncles and pods per plant, and pod weight which suggest that these characters were least affected by environment. With the help of PCV and GCV alone, it is not possible to determine the amount of variation, which is heritable. Thus, the heritability estimate along with genetic advance is more meaningful. The estimate of heritability in present investigation were of higher magnitude (>95%) for all the characters except days to first flower (71.50%). Higher estimates of heritability coupled with the higher genetic advance were observed for plant height, number of peduncles and pods per plant and pod yield per plant indicated that heritability of these traits is mainly due to additive gene effects and selection may be effective. High heritability accompanied with low genetic advance for number of branches per plant, pod length, pod weight number of seeds per pod indicated in advancement of non-additive gene action and the high heritability is being exhibited due to favorable influence of the environment rather than genotypes. These results were in agreement with the earlier reports of Lal *et al.* (2007) and Vishwa Nath *et al.* (2009).

Table 1: Variability, heritability and expected genetic advance for cowpea genotypes

| Characters                          | Range          | Grand mean | Variability |       | Heritability (%) | Genetic advance | Genetic advance as % of mean |
|-------------------------------------|----------------|------------|-------------|-------|------------------|-----------------|------------------------------|
|                                     |                |            | PCV         | GCV   |                  |                 |                              |
| Plant height (cm)                   | 35.4 - 334.9   | 151.30     | 44.82       | 44.69 | 99.50            | 138.93          | 91.82                        |
| Branches plant <sup>-1</sup> (No.)  | 3.0 - 7.3      | 4.91       | 22.47       | 22.50 | 98.20            | 2.26            | 50.10                        |
| Days to first flower (DAS)          | 34.0 - 65.3    | 46.40      | 17.65       | 14.92 | 71.50            | 12.07           | 26.01                        |
| Peduncle length (cm)                | 19.5 - 35.2    | 27.53      | 14.24       | 13.92 | 95.50            | 7.71            | 28.01                        |
| Peduncles plant <sup>-1</sup> (No.) | 9.2 - 43.6     | 25.71      | 33.88       | 33.73 | 99.10            | 17.79           | 69.19                        |
| Pods plant <sup>-1</sup> (No.)      | 7.2 - 37.4     | 19.32      | 38.18       | 38.05 | 99.30            | 15.09           | 78.11                        |
| Pod length (cm)                     | 11.7 - 21.7    | 16.27      | 16.56       | 16.27 | 96.60            | 5.36            | 32.94                        |
| Pod weight (g)                      | 3.87 - 11.27   | 6.71       | 27.28       | 27.10 | 98.70            | 3.72            | 55.44                        |
| Seeds pod <sup>-1</sup> (No.)       | 4.8 - 15.8     | 12.56      | 18.71       | 18.47 | 97.40            | 4.72            | 37.58                        |
| Pod yield (g plant <sup>-1</sup> )  | 46.75 - 278.67 | 127.14     | 44.02       | 43.88 | 99.40            | 114.56          | 90.11                        |

PCV & GCV – Phenotypic coefficient of variation and genotypic coefficient of variation, respectively

### Trait correlation coefficients

The estimates of genotypic correlation coefficients are essential in evaluating the possibility of simultaneous improvement of many characters or improvement of a single complex trait on the assumption of correlated response to selection. In the present study, the correlation values for different characters are given in Table 2. In general, genotypic correlation was higher than corresponding phenotypic

correlation coefficients, indicating the inherent association among the traits and therefore, the selection based on phenotypic traits could be effective in achieving the genotypic gain for different attributes. Pod yield per plant had significantly positive correlation with number of peduncles and pods per plant, pod length, pod weight and number of seeds per pod. This indicates that green pod yield in cowpea is increased with an increase in aforesaid

characters. The number of peduncles per plant had positive correlation with number of pods per plant, number of seeds per pod and pod yield. The number of pods per plant showed positive correlation with number of seeds per pod and pod yield. Pod length exerted positive correlation with pod weight and pod yield per plant. Similar findings were also reported by Lal *et al.* (2007) and Vishwa Nath *et al.* (2009).

Table 2: Correlation coefficients at genotypic ( $r_g$ ) and phenotypic ( $r_p$ ) levels

| Characters                          | Plant height (cm) | Branches plant <sup>-1</sup> (No.) | Days to first flower (DAS) | Peduncle length (cm) | Peduncles plant <sup>-1</sup> (No.) | Pods plant <sup>-1</sup> (No.) | Pod length (cm) | Pod weight (g) | Seeds pod <sup>-1</sup> (No.) | Pod yield (g plant <sup>-1</sup> ) |
|-------------------------------------|-------------------|------------------------------------|----------------------------|----------------------|-------------------------------------|--------------------------------|-----------------|----------------|-------------------------------|------------------------------------|
| Plant height (cm)                   | ( $r_g$ )         | 0.473**                            | 0.117                      | 0.019                | 0.071                               | -0.051                         | -0.134          | 0.087          | 0.001                         | -0.038                             |
|                                     | ( $r_p$ )         | 0.471**                            | 0.097                      | 0.027                | 0.073                               | -0.047                         | -0.124          | 0.091          | 0.006                         | -0.036                             |
| Branches plant <sup>-1</sup> (No.)  | ( $r_g$ )         |                                    | 0.143                      | 0.223                | 0.225                               | 0.063                          | -0.204          | 0.132          | 0.338*                        | 0.045                              |
|                                     | ( $r_p$ )         |                                    | 0.119                      | 0.226                | 0.231                               | 0.070                          | -0.181          | 0.141          | 0.345*                        | 0.052                              |
| Days to first flower (DAS)          | ( $r_g$ )         |                                    |                            | -0.099               | -0.225                              | -0.426**                       | 0.166           | 0.214          | 0.071                         | -0.310                             |
|                                     | ( $r_p$ )         |                                    |                            | -0.053               | -0.189                              | -0.358*                        | 0.141           | 0.183          | 0.071                         | -0.262                             |
| Peduncle length (cm)                | ( $r_g$ )         |                                    |                            |                      | 0.161                               | 0.061                          | -0.197          | 0.090          | 0.249                         | 0.055                              |
|                                     | ( $r_p$ )         |                                    |                            |                      | 0.161                               | 0.066                          | -0.174          | 0.096          | 0.259                         | 0.059                              |
| Peduncles plant <sup>-1</sup> (No.) | ( $r_g$ )         |                                    |                            |                      |                                     | 0.764**                        | 0.101           | 0.110          | 0.373*                        | 0.702**                            |
|                                     | ( $r_p$ )         |                                    |                            |                      |                                     | 0.762**                        | 0.109           | 0.116          | 0.376*                        | 0.702**                            |
| Pods plant <sup>-1</sup> (No.)      | ( $r_g$ )         |                                    |                            |                      |                                     |                                | 0.004           | -0.158         | 0.423**                       | 0.795**                            |
|                                     | ( $r_p$ )         |                                    |                            |                      |                                     |                                | 0.014           | -0.150         | 0.425**                       | 0.795**                            |
| Pod length (cm)                     | ( $r_g$ )         |                                    |                            |                      |                                     |                                |                 | 0.498**        | 0.165                         | 0.413**                            |
|                                     | ( $r_p$ )         |                                    |                            |                      |                                     |                                |                 | 0.505**        | 0.180                         | 0.413**                            |
| Pod weight (g)                      | ( $r_g$ )         |                                    |                            |                      |                                     |                                |                 |                | 0.063                         | 0.387*                             |
|                                     | ( $r_p$ )         |                                    |                            |                      |                                     |                                |                 |                | 0.073                         | 0.389*                             |
| Seeds pod <sup>-1</sup> (No.)       | ( $r_g$ )         |                                    |                            |                      |                                     |                                |                 |                |                               | 0.373*                             |
|                                     | ( $r_p$ )         |                                    |                            |                      |                                     |                                |                 |                |                               | 0.374*                             |

\* and \*\* - Significant at 5% and 1 % level, respectively

### Direct and indirect effect of component traits on yield

In the present study, the direct and indirect values are given in Table 3. The estimates revealed

that number of pods per plant exerted the maximum positive direct effect (0.902) on green pod yield followed by pod weight (0.439) and pod length (0.224).

Table 3: Direct (diagonal) and indirect effect of yield contributing traits at genotypic (G) and phenotypic (P) levels

| Characters                          |   | Plant height (cm) | Branches plant <sup>-1</sup> (No.) | Days to first flower (DAS) | Peduncle length (cm) | Peduncles plant <sup>-1</sup> (No.) | Pods plant <sup>-1</sup> (No.) | Pod length (cm) | Pod weight (g) | Seeds pod <sup>-1</sup> (No.) | Pod yield (g plant <sup>-1</sup> ) |
|-------------------------------------|---|-------------------|------------------------------------|----------------------------|----------------------|-------------------------------------|--------------------------------|-----------------|----------------|-------------------------------|------------------------------------|
| Plant height (cm)                   | G | <b>0.006</b>      | 0.005                              | -0.008                     | 0.001                | -0.004                              | -0.046                         | -0.030          | 0.038          | 0.001                         | -0.038                             |
|                                     | P | <b>0.002</b>      | -0.002                             | -0.005                     | 0.001                | -0.003                              | -0.042                         | -0.025          | 0.040          | 0.001                         | -0.036                             |
| Branches plant <sup>-1</sup> (No.)  | G | 0.003             | <b>0.010</b>                       | -0.009                     | 0.004                | -0.013                              | 0.057                          | -0.046          | 0.058          | -0.019                        | 0.045                              |
|                                     | P | 0.001             | <b>-0.003</b>                      | -0.006                     | 0.003                | -0.010                              | 0.063                          | -0.037          | 0.062          | -0.020                        | 0.052                              |
| Days to first flower (DAS)          | G | 0.001             | 0.001                              | <b>-0.065</b>              | -0.002               | 0.013                               | -0.384                         | 0.037           | 0.094          | -0.004                        | -0.310                             |
|                                     | P | 0.001             | 0.001                              | <b>-0.054</b>              | -0.001               | 0.008                               | -0.321                         | 0.029           | 0.081          | -0.004                        | -0.262                             |
| Peduncle length (cm)                | G | 0.001             | 0.002                              | 0.007                      | <b>0.019</b>         | -0.009                              | 0.055                          | -0.044          | 0.040          | -0.014                        | 0.055                              |
|                                     | P | 0.001             | -0.001                             | 0.003                      | <b>0.013</b>         | -0.007                              | 0.059                          | -0.035          | 0.042          | -0.015                        | 0.059                              |
| Peduncles plant <sup>-1</sup> (No.) | G | 0.001             | 0.002                              | 0.015                      | 0.003                | <b>-0.058</b>                       | 0.689                          | 0.023           | 0.048          | -0.021                        | 0.702**                            |
|                                     | P | 0.001             | -0.001                             | 0.010                      | 0.002                | <b>-0.045</b>                       | 0.684                          | 0.022           | 0.051          | -0.022                        | 0.702**                            |
| Pods plant <sup>-1</sup> (No.)      | G | 0.001             | 0.001                              | 0.028                      | 0.001                | -0.044                              | <b>0.902</b>                   | 0.001           | -0.069         | -0.024                        | 0.795**                            |
|                                     | P | 0.001             | 0.001                              | 0.019                      | 0.001                | -0.034                              | <b>0.897</b>                   | 0.003           | -0.066         | -0.025                        | 0.795**                            |
| Pod length (cm)                     | G | -0.001            | -0.002                             | -0.011                     | -0.004               | -0.006                              | 0.003                          | <b>0.224</b>    | 0.218          | -0.009                        | 0.413**                            |
|                                     | P | 0.001             | 0.001                              | -0.008                     | -0.002               | -0.005                              | 0.012                          | <b>0.203</b>    | 0.222          | -0.010                        | 0.413**                            |
| Pod weight (g)                      | G | 0.001             | 0.001                              | -0.014                     | 0.002                | -0.006                              | -0.143                         | 0.111           | <b>0.439</b>   | -0.004                        | 0.387*                             |
|                                     | P | 0.001             | 0.001                              | -0.010                     | 0.001                | -0.005                              | -0.135                         | 0.103           | <b>0.439</b>   | -0.004                        | 0.389*                             |
| Seeds pod <sup>-1</sup> (No.)       | G | 0.001             | 0.003                              | -0.005                     | 0.005                | -0.002                              | 0.382                          | 0.037           | 0.028          | <b>-0.056</b>                 | 0.373*                             |
|                                     | P | 0.001             | -0.001                             | -0.004                     | 0.003                | -0.017                              | 0.382                          | 0.037           | 0.032          | <b>-0.058</b>                 | 0.374*                             |

Thus, selection pressure on these traits may lead to an overall increase in pod yield per plant. The number of days taken to first flower showed the maximum negative direct effect on pod yield followed by number of peduncles per plant and number of seeds per pod. Considerable positive indirect effect of number of pods per plant on pod yield was recorded through number of branches and peduncles per plant and number of seeds per pod. A positive indirect effect of pod weight on pod yield was observed through pod length. However, positive indirect effect of pod length on pod yield was exhibited via pod weight and number of seeds per pod. On contrary, days to first flower, number of peduncles per plant and pod length exerted the negative direct effect on pod yield. Despite negative direct effects of number of peduncles per plant (-0.058) and seeds per pod (-0.56) these characters exhibited significantly positive correlation with pod yield. This kind of relationship could be attributed to the high positive indirect effect of number of pods per plant. Path coefficient analysis revealed the importance of characters such as number

of peduncles and pods per plant, pod length and pod weight in selection of superior genotypes for pod yield. Above findings are in conformity with the results of Lovely and Radhadevi (2006) and Vishwa Nath *et al.* (2009).

#### Multiple- traits-based grouping of genotypes

The analysis of plot means estimated for 40 genotypes for each of ten characters indicating the presence of substantial amount of genetic diversity in the population. Forty genotypes were grouped into six clusters by Tocher's method of  $D^2$  depending upon their morphological similarity. The cluster II was the largest having 15 genotypes followed by clusters IV, VI and I with 8, 6 and 5 genotypes, respectively (Table 4). The minimum 3 genotypes were noticed in cluster III and V each. Clustering pattern indicated that majority of genotypes i.e. 34 (85.0%) were genetically close to each other and grouped in 4 clusters, while apparent diversity was mainly noticed due to 6 genotypes (15.0%) distributed over 2 clusters.

Table 4: Composition of different clusters in cowpea

| Clusters | No. of genotypes | Name of genotypes   |
|----------|------------------|---|
| I        | 5 (12.5%)        | ET-116918, IC-202776, IC-202886, C-249144, IC-201097  |
| II       | 15 (37.5%)       | IT-835-911, IT-835-728-13, IT-95K-207-22, IT-03K-1197, IT-86D-719, IT-82E-9, IVU-21, ET-116902, ET-116922, ET-116928, IC-201081, EC-390268, EC-390249, EC-9738, EC-110598 |
| III      | 3 (7.5%)         | 867/05, IC-201095, IC-202717  |
| IV       | 8 (20.0%)        | IT-835-899, ET-116893, ET-116914, ET-116919, ET-116920, IC-9883, EC-390237, EC-19735  |
| V        | 3 (7.5%)         | IC-91458, IC-202826, IC-201098  |
| VI       | 6 (15.0%)        | ET-116932, IC-202779, IC-202865, EC-367718, EC-390210, EC-390215  |

\* Values in parentheses denote the per cent contribution of genotypes in each cluster

The intra cluster value varied from 1.79 to 2.34 (Table 5), the maximum being in cluster II (2.34) followed by clusters VI (2.26), IV (2.08) and V (2.03). The minimum intra cluster distance was observed in cluster III (1.79) followed by cluster I (1.87). The maximum inter-cluster distance was noticed between cluster II and III (4.96) followed by III and VI (4.83), I and VI (4.23), III and IV (4.15), III and V (4.14) and I and IV (4.13), respectively. This indicates that the genotype of these clusters differs much to each other. The magnitude of heterosis largely depends on degree of diversity in the parental lines; the higher distance between two clusters indicates the greater genetic diversity between genotypes. Crosses between genetically diverse parents would manifest more heterosis than the crosses between closely related parents. Hence, genetic divergence seems to be more important tool to

select perspective parents for crop improvement programme. Contrarily, the minimum inter-cluster distance was obtained between cluster II and IV (2.36) followed by II and VI (3.04) and IV and V (3.14), respectively.

Table 5: Intra and inter cluster distance ( $D^2$ ) in cowpea genotypes

| Clusters | I    | II   | III  | IV   | V    | VI   |
|----------|------|------|------|------|------|------|
| I        | 1.87 | 3.44 | 3.44 | 4.13 | 3.91 | 4.23 |
| II       |      | 2.34 | 4.96 | 2.36 | 3.97 | 3.04 |
| III      |      |      | 1.79 | 4.15 | 4.14 | 4.83 |
| IV       |      |      |      | 2.08 | 3.14 | 3.27 |
| V        |      |      |      |      | 2.03 | 3.26 |
| VI       |      |      |      |      |      | 2.26 |

\* Values in bold are the intra cluster distance

Considering the cluster means, the minimum days to flower (41.61), the longest peduncle (32.09

cm), the maximum number of pods per plant (29.98), pod length (19.28), number of seeds per pod (14.63) and pod yield per plant (252.06 g) was noticed in cluster III (Table 6). This cluster had next to lowest plant height (126.79 cm), moderate number of branches per plant (4.82), next to highest number of peduncles per plant (38.26) and pod weight (8.52 g). Contrary to this, the cluster VI having three genotypes was separated by other clusters due to lowest mean values of number of peduncles per plant (20.57), number of pods per plant (11.94) and pod yield per plant (86.76 g). However, cluster II had minimum number of seeds per pod (11.24), next to lowest number of branches per plant (4.59), peduncles per plant (20.75) and pods per plant (17.43), pod length (14.71 cm), pod weight (5.48 g)

and pod yield per plant (95.96 g). The low pod yield per plant in clusters II and VI is mainly due to less number of peduncles and pods per plant, pod length, pod weight and number of seeds per pod. Thus, selection of earliness in flowering, moderate to highest number of peduncles and pods per plant, pod length, pod weight and number of seeds per pod may enhance the pod yield per plant. The cluster V is unique and is separated by cluster III due to tall genotypes (212.41 cm), maximum number of branches per plant (6.20) and days to first flower (55.87), short peduncles (23.27 cm), highest pod weight (8.81 g), and next to highest pod yield per plant (176.95 g). This cluster had next to third highest in number of peduncles (29.83) and pods (20.87) per plant and pod length (18.07 cm).

Table 6: Cluster wise mean for different character in cowpea genotypes

| Clusters | Plant height (cm) | Branches plant <sup>-1</sup> | Days to first flower | Peduncle length (cm) | Peduncles plant <sup>-1</sup> | Pods plant <sup>-1</sup> | Pod length (cm) | Pod weight (g) | Seeds pod <sup>-1</sup> | Pod yield plant <sup>-1</sup> (g) |
|----------|-------------------|------------------------------|----------------------|----------------------|-------------------------------|--------------------------|-----------------|----------------|-------------------------|-----------------------------------|
| I        | 152.98            | 5.76                         | 44.22                | 29.49                | 39.18                         | 29.75                    | 13.39           | 5.43           | 14.09                   | 158.29                            |
| II       | 152.68            | 4.59                         | 42.94                | 26.95                | 20.75                         | 17.43                    | 14.71           | 5.48           | 11.24                   | 95.96                             |
| III      | 126.79            | 4.82                         | 41.61                | 32.09                | 38.26                         | 29.98                    | 19.28           | 8.52           | 14.63                   | 252.06                            |
| IV       | 106.28            | 3.92                         | 47.88                | 24.29                | 24.20                         | 17.32                    | 18.60           | 7.36           | 12.10                   | 130.92                            |
| V        | 212.41            | 6.20                         | 55.87                | 23.27                | 29.83                         | 20.87                    | 18.07           | 8.81           | 12.97                   | 176.95                            |
| VI       | 188.17            | 5.78                         | 52.56                | 31.57                | 20.57                         | 11.94                    | 17.05           | 8.04           | 13.98                   | 86.76                             |
| Mean     | 151.30            | 4.92                         | 46.40                | 27.54                | 25.71                         | 19.33                    | 16.27           | 6.71           | 12.56                   | 127.14                            |

From cluster mean, it is evident that pod yield in cowpea is greatly influenced by different component traits mainly the days to first flower, number of peduncles and pods per plant, pod length and pod weight (Narayanan Kutty *et al.*, 2005; Madhesh and Pandey, 2005). In present investigation the days to first flower, number of peduncles and pods per plant, pod length, pod weight and pod yield per plant exhibited maximum towards genetic divergence. In genetic improvement for pod yield, the choice of parent is important and desirable component characters of yield should be taken into consideration for component breeding to obtain appropriate plant type. Over all cluster I, III and V showed greater potential as a breeding stock by virtue of high mean values of one or more component characters as well as high statistical distance. The crossing among genotypes of these clusters selected for specific component traits may be helpful in

bringing new gene pool and expanding the range of adaptation. Continuous selection in advance generation may lead to develop strains with high cowpea pod yield combining desirable component traits. Intermating at F<sub>2</sub> level among desirable segregants would lead to greater opportunity of variability and selection of desirable plant types.

The conclusion from present study indicated that green pod yield/plant, pod weight, number of pods/plant and number of peduncles are most important characters that should be considered in selection because all these characters had high heritability, moderate genetic advance and also exhibited positive association with each other. On the basis of present experimentation, the advanced breeding lines with the characters necessary for developing stable high yielding lines. These lines may be used in crossing programme to select desirable segregants.

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