Original Research Article

Analysis of Genetic Variability for Quantitative Traits in Chilli Germplasm

P. Pandiyaraj1*, V. Lakshmanan2, D. Saraladevi2 and S. Juliet Hepziba2

1Division of Vegetable Crops, Indian Institute of Horticultural Research, Bengaluru – 560 089, Karnataka, India
2Department of Vegetable Crops, Horticulture College and Research Institute, Periyakulam – 625 601, Tamil Nadu, India

*Corresponding author

A B S T R A C T

Field experiments were conducted at Horticulture College and Research Institute, Tamil Nadu Agricultural University, Periyakulam during August, 2013 to April, 2014. The experiment was conducted in a randomized block design with two replication. Thirty three germplasm seeds are collected from the NBPGR, Regional station, Rajendranagar, Hyderabad. The data were observed from five randomly selected competitive plants from each replication for twelve quantitative traits. Analysis of variance revealed the significance differences among the genotypes. The phenotypic coefficient of variation was higher than genotypic coefficient of variation for all characters indicating the influence of environment on these characters. High phenotypic and genotypic coefficient of variation was observed for all the characters except days to first flowering and number of seeds per pod. High heritability was observed for all character except number of secondary branches per plant, dry pod yield per plant and days to first flowering. High genetic advance as per cent of mean was observed for all character except days to first flowering and number of secondary branches per plant.

Key words: Chilli, Germplasm, Quantitative traits, PCV, GCV, Heritability, GA.

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Introduction

Chilli is an important vegetable as well as spice crop grown in the tropical and subtropical areas of the world. In India chilli is an important commodity used as a vegetable, spice, medicinal herb and ornamental plant. It is also used as an ingredient in industrial products. Crop improvement largely depends on existence of genetic variability. Improvement in any crop is based on the extent of genetic variation present in it and, the degree of improvement depends on magnitude of the available, beneficial genetic variability. The plant breeder has to identify the sources of favourable genes, incorporate them in breeding populations and aim for isolation of productive genotypes and cultivars. Thus, improvement in any crop is based on the extent of genetic variation and the degree of improvement depends upon the magnitude of available beneficial genetic variability.

Since, yield is a complex trait, governed by a large number of component traits, it is imperative to know the interrelationship between yield and its component traits to arrive at an optimal selection index for improvement of yield. Yield is a quantitative
trait that is influenced by a number of yield contributing parameters. The selection of desirable genotypes is usually based on yield and yield components. It is therefore necessary to study the mutual relationship between yield and yield components for efficient utilization of the genetic stock in crop improvement program of chilli. Variability in plants is the first step in understanding how to improve or produce new plants. Heritability is the degree of genetic control associated to some important traits (Addissu, 2012). It indicates how much of the genetic variability has a genetic origin and gives necessary information for the genetic selection process (Falconer, 1981). To improve yield potentials of crops in any breeding programs, it is necessary to obtain adequate information on the magnitude and type of genetic variability and their corresponding heritability. This is because selection of superior genotypes is proportional to the amount of genetic variability present and the extent to which the characters are inherited. Heritability is used to indicate the relative degree to which a character is transmitted from parent to offspring. The magnitude of such estimates also suggests the extent to which improvement is possible through selection (Nechif et al., 2011).

Materials and Methods

The experiment was conducted in a randomized block design with two replication. Thirty three germplasm seeds are collected from the NBPGR, Regional station, Rajendranagar, Hyderabad were sown in the nursery and forty five days old seedlings were transplanted in ridges and furrow, at a spacing of 45 X 45 cm. Three ridges were maintained for each genotype and each replication. Standard horticultural practices (TNAU crop production guide) and plant protection measures were adapted uniformly to all the genotypes. The parameters considered for the study were plant height, number of primary branches per plant, number of secondary branches per plant, days to first flowering, number of pods per plant, pod length, pod girth, mean pod weight, red pod yield per plant, dry pod yield per plant, number of seed per pod, thousand seed weight. Analysis of variance (Panse and Sukhatme, 1967), genotypic and phenotypic coefficient of variation (Burton and Devane, 1953), heritability in broad sense (Hanson et al., 1956) and expected genetic advance (Johnson et al., 1955) were estimated for all the characters. Correlation coefficients for all quality parameters (Al-Jibouri et al., 1958) were also estimated.

Results and Discussion

Analysis of variance showed significant differences among the genotypes for all the twelve quantitative parameters, indicating the sufficient genetic variability to be exploited in breeding programme (Table 1). Similar results were noticed by Vani et al., (2007); Krishnamurthy et al., (2013). The extent of variability with respect to twelve quantitative characters in thirty three germplasm measured in term of mean performance, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability, genetic advance as percent of mean are given in Table 2. The ran of variation was high for red pod yield per plant (101.86-488.26 g) followed by number of pod per plant (47.40-207.70), number of seeds per pod (56.10-99.60), plant height (37.29-100.30 cm), days to first flowering (57.10-77.20 days), dry pod yield per plant (20.72-93.99 g) and number of secondary branches per plant (11.90-24.50).

Relatively low range of variability was recorded in respect to number of primary branches per plant (4.50-8.70), pod length (2.90-10.41 cm), thousand seed weight (2.87-4.96g), pod girth (1.59-4.00cm) and mean pod
weight (0.25-0.92 gm) and these finding are in accordance with Krishna et al., (2007); Chakravorty and Maity (2010).

The phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of variation (GCV) for all the characters (Table 2) and the difference between PCV and GCV was narrow indicating the little influence of environment on the expression of these characters and considerable amount of variation was observed for all the characters. These results are supported by earlier observations of Krishnamurthy et al., (2013); Munshi et al., (2010); Sandeep et al., (2013). The estimates of PCV and GCV were recorded high for red pod yield per plant (38.549 and 38.527 %), dry pod yield per plant (36.03 and 35.73 %), mean pod weight (33.44 and 32.66 %), number of pods per plant (31.99 and 31.930 %) and pod length (30.41 and 30.29 %) indicating higher magnitude of variability for these characters. Similar results were also reported by Singh and Singh (2011) for average dry fruit weight, Cheema et al., (2010); Sharma et al., (2011) for fruit yield per plant, Kumar et al., (2012) for yield per plant and Rajyalakshmi and Vijayapadma (2012) for number of fruits per plant. The estimates of PCV and GCV were moderate for pod girth (21.41 and 18.60), plant height (17.27 and 17.142), number of secondary branches per plant (17.21 and 11.96), thousand seed weight (16.83 and 15.02), number of primary branches per plant (15.81 and 14.95) and number of seeds per pod (12.92 and 12.44). Similar observations were earlier reported by Warshamana et al., (2008) for fruit girth and Nehru et al., (2012) for plant height.

**Table.1** Analysis of variance for quantitative characters in chilli germplasm

| S.No | Characters                          | Replication | Genotypes | Error  |
|------|------------------------------------|-------------|-----------|--------|
| 1.   | Plant height (cm)                   | 90.0009     | 362.762   | 2.693  |
| 2.   | Number of primary branches per plant | 0.0009     | 1.9501    | 0.1081 |
| 3.   | Number of primary braches per plant | 8.4386    | 13.2438   | 4.6189 |
| 4.   | Days to first flowering             | 38.1193    | 35.3076   | 2538.2109 |
| 5.   | Number of pods per plant            | 13.0341    | 2538.2109 | 5.1376 |
| 6.   | Pod length (cm)                     | 0.1266     | 5.5097    | 0.0203 |
| 7.   | Pod girth (cm)                      | 0.0649     | 0.4980    | 0.0696 |
| 8.   | Mean pod weight (gm)                | 0.0046     | 0.0488    | 0.0011 |
| 9.   | Number of seeds per pod             | 34.661     | 239.6563  | 9.0731 |
| 10.  | Thousand seed weight (gm)           | 0.3867     | 0.7582    | 0.0857 |
| 11.  | Red pod yield per plant (gm)        | 2481.678   | 424.748   | 1.7523 |
| 12.  | Dry pod yield per plant (gm)        | 0.2485     | 0.2485    | 0.0219 |
Table 2: Estimation of mean, range, components of variance, heritability and genetic advance for chilli germplasm

| S.No | Characters                           | Range          | Mean | PCV | GCV | Heritability (%) | GA as per cent of mean |
|------|-------------------------------------|----------------|------|-----|-----|-----------------|------------------------|
|      |                                     | Maximum        | Minimum |     |     |                 |                        |
| 1.   | Plant height (cm)                    | 100.3          | 37.29 | 78.27 | 17.27 | 17.142          | 98.5                  | 35.052                |
| 2.   | Number of primary branches per plant| 8.7            | 4.5   | 6.41  | 15.813 | 14.959          | 89.5                  | 29.154                |
| 3.   | Number of secondary branches per plant| 24.5          | 11.9  | 17.35 | 17.217 | 11.964          | 48.2                  | 17.125                |
| 4.   | Days to first flowering              | 77.2           | 57.1  | 64.75 | 7.321  | 5.532           | 57.1                  | 8.611                 |
| 5.   | Number of pods per plant             | 207.7          | 47.4  | 111.45 | 31.995 | 31.93           | 99.6                  | 65.644                |
| 6.   | Pod length (cm)                      | 10.41          | 2.9   | 5.46  | 30.41  | 30.298          | 99.2                  | 62.185                |
| 7.   | Pod girth (cm)                       | 4              | 1.59  | 2.48  | 21.414 | 18.602          | 75.4                  | 33.29                 |
| 8.   | Mean pod weight (gm)                 | 0.92           | 0.25  | 0.47  | 33.446 | 32.667          | 95.4                  | 65.73                 |
| 9.   | Number of seeds per pod              | 99.6           | 56.1  | 86.26 | 12.927 | 12.447          | 92.7                  | 24.688                |
| 10.  | Thousand seed weight (gm)            | 4.96           | 2.87  | 3.85  | 16.833 | 15.027          | 79.6                  | 27.635                |
| 11.  | Red pod yield per plant (gm)         | 488.26         | 101.86 | 232.24 | 15.212 | 15.15           | 99.1                  | 31.081                |
| 12.  | Dry pod yield per plant (gm)         | 93.99          | 20.72 | 60.61 | 33.715 | 24.067          | 50.9                  | 35.392                |
Heritability estimates along with genetic advance would be helpful in predicted the gain under selection than heritability estimates alone. Burton and Devane (1953) suggested that genotypic coefficient of variation together with heritability estimates would give the best picture of the extent of genetic advance expected by selection. In the present investigation, high heritability coupled with high genetic advance observed for characters like red pod yield per plant, dry pod yield per plant, mean pod weight, mean pod weight, number of pods per plant, pod length, plant height, pod girth, number of primary branches per plant, thousand seed weight and number of seeds per fruit revealed the role of additive gene action in the expression of these characters. Thus, these characters could be considered as the reliable indices for selection. Similar results of high heritability and high genetic advance by Jabeen et al., (1998); Bharadwaj et al., (2007) in chilli lend credence to the present findings. On the basis of the present study, it could be concluded that simultaneous selection based on multiple characters having high estimates of heritability and genetic advance could be exercised for improvement through selection.

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