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Analysis of Genetic Variability for Quantitative Traits in Chilli Germplasm

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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.

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 rang 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 braches 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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