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GENETIC VARIABILITY AND AGRONOMIC PERFORMANCE STUDIES IN CHILLI *(Capsicum annum* L.*)*

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ABSTRACT

Eight diverse genotypes of chilli were evaluated an open field study to evaluate the genetic variability, heritability and genetic advance in randomized block design (RBD) with three replications during Kharif, 2015-16. Analysis of variance revealed significant differences among the genotypes for all the characters studied. The higher estimates of genotypic coefficient of variation (GCV) were observed for flowers per branch (21.59%), clusters per plant (19.26%), flower per branch (16.93%) and stem diameter (15.49%). While the higher estimates of phenotypic coefficient of variation (PCV) were found for flowers per branch (26.70%), fruits per branch (24.44%), clusters per plant (24.04%) and stem diameter (19.26%). The higher estimates of broad sense heritability along with genetic advance recorded for flowers per branch (65%), fruits per plant (64%), cluster per plant (64%), stem diameter (65%), plant weight (59%) and days to 50% flowering (50%) indicated the scope for improvement of these characters through selection.

Keywords*:* Chilli, genetic advance, genotypes, heritability, yield and variability

INTRODUCTION

Chilli the important member of the family solanaceae is grown as a tropical and subtropical crop. It is used for both vegetable and spice purposes. It is also as industrial purpose due to extraction of oleoresin. Green fruit of chilli are one of the richest sources of anti-oxidant vitamins such as vitamin A, C and E, which protect the cancer. In India, the major chilli growing states are Andhra Pradesh, Karnataka, Maharashtra, Orissa, Tamil Nadu, Madhya Pradesh and Rajasthan. In India, chilli occupies 0.805 million ha area, annual production 1.492 million tons and productivity of 1.9 metric tons per hectare (NHB, 2014). Chilli is one of the most important vegetable crops valued for its aroma, taste, pungency and flavor. Wide

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ranges of variability reportedly exist in this crop (Nandi, 1992; Munshi and Behera, 2000). The improvement of genotypes is based on the amount of genetic variability present in existing material. The phenotype is often not true indicator of its genotype; the phenotypic variability is the result of the effect of environment and genotype interaction. Hence, attempts have been made to determine the magnitude of heritable and non-heritable components and genetic parameters such as genotypic and phenotypic coefficient of variation, heritability and genetic advance as percentage of mean in some of the quantitative characters of chilli. Genetic variability studies done by several workers *viz.,* PCV were observed to be higher than GCV for all the traits studied (Mishra et al., 2001, Bendale et al., 2006 and Kadwey et al., 2016). PCV were higher for number of fruit, dry fruit yield, seed yield, dry fruit weight in chilli indicated that these characters would respond to selection (Varkey et al., 2005 and Gupta et al., 2009). Highest GCV was observed for number of fruit, dry fruit yield, seed yield per plant, fruit weigh per plant (Rathod et al., 2002, Hosmani and Nandadevi, 2003). Heritability was found to be very high for fruit yield per plant, seed yield per plant, dry fruit weight, days to first picking, fruit length, fruit weight of green chilli, fruit yield per plot, fruit yield per per hectare (Bharadwaj et al., 2007, Wilson and Philip, 2009). Although an estimate of genetic variability is often considered as a pre-requisite for initiating appropriate breeding procedures no previous reports on locally adopted landraces of chilli are available from pantnagar, Uttarakhnad, therefore, the current study was undertaken with the aim of estimating performance of genotypes, genetic variability, heritability and genetic advance in the genotypes of chilli in Tarai region of Uttarakhnad.

MATERIALS AND METHODS

The materials for the study comprised of eight cultivars PC25, PC7, PC2057, PC10, PC1, LCA334, KA2 and PC56 of chilli of which six were GBPUA&T, Pantnagar, one cultivar KA2 from Guntur, Andhra Pradesh and one local cultivar from Uttarakhand LCA 334 developed through pure line selection from indigenous germplasm. The cultivars were raised in a field experiment in randomized block design (RBD) with three replications in the Vegetable Research Station (VRC), college of agriculture, GBPUA&T, Pantnagar, Uttarakhand, during 2015-16. Appropriate agronomic practices were followed to raise a good crop. Various observations were recorded on morphological characters *viz.,* plant weight (g), branches per plant, fruits per plant, fruit weight (g), fruits length (cm), fruit breadth (cm), days to 50% following, flowers per branch, fruits per branch, clusters per plant and stem diameter (cm). The data were recorded from five randomly selected plant at maturity stage from each genotype.The variance components and coefficient of variation were determined according to Burton (1952). The heritability in broad sense and genetic advance as percentage of mean were estimated employing the methods, suggested by Miller et al. (1958) and Jain (1982) respectively.

RESULTS AND DISCUSSION

The mean differences due to genotypes were highly significant for all the characters except fruit breadth (cm) and stem diameter (cm), indicating the presence of genetic diversity in the material (Table 1). Similar results were also reported by Dipendera et al. (2002). The mean performance of the genotypes (Table 3) revealed a wide range of variability for all the traits. The variation was highest for fruit weight (214-279 g), flowers per branch (30.66-63.33), fruits per branch (24.66-51), clusters per plant (22.33-45.66) and fruits per plant (90-119.66) and narrow range of variability was observed for plant weight (73.33-80.33), branches per plant (13.33-17.33), fruit length (07-9.33), fruit breadth (02.43-3.16), days to 50% flowering (42.66-49.33) and stem diameter (01.78-2.83). The similar finding were also reported by Singh et al. 2013 and Kadwey et al., 2016 for fruit yield plant, clusters per plant, number of fruits per plant and fruit weight.

The analysis of variance revealed significant difference among the genotypes for all the characters (Table 1) except fruit breadth (cm) and stem diameter (cm). The existence of high variability for different characters among chilli genotypes has earlier studied by (Kumary and Rajmony, 2004).

Table 1. Analysis of variance for eight genotypes of chilli

Characters	df	Plant weight	Branches/ plant	Fruits/ plant	Fruit weight	Fruit length	Fruit breadth	Days to 50% flowering	Flowers/ branch	Fruits/ branch	Clusters/ plant	Stem diameter
Replication	2	6.94**	1.57*	723.76**	89.76**	1.13*	0.05	17.54**	124.12**	25.12**	0.44	0.24
Genotype	7	111.71**	5.23**	498.85**	1303.52**	2.73**	0.97	13.75**	365.32**	248.54**	157.51**	0.44
Error	14	20.78	1.47	78.23	361.95	0.95	0.67	3.48	54.79	65.94	24.70	0.06

*significant at 5% level and **significant at 1% levels

The genetic parameters *viz.*, genotypic and phenotypic coefficient of variations, heritability in broad sense and genetic advances along with mean and range of different characters are presented in table 2. The wide range especially for fruits per plant, fruit weight, flowers per branch, fruits per branch and clusters per plant indicated the diversity among the chilli genotypes.

Table 2. Components of genetic variation, heritability and genetic advance for different characters in chill

Character	Plant weight	Branches/ plant	Fruits/ plant	Fruit weight	Fruit length	Fruit breadth	Days to 50% flowering	Flowers /branch	Fruits /branch	Clusters / plant	Stem diameter
PC 25	78.33	17.33	90.00	279.00	7.00	2.83	45.00	30.66	24.66	36.66	02.16
PC 7	62.33	16.00	119.66	237.00	8.66	3.16	49.33	37.33	44.00	22.33	02.33
KA 2	78.66	15.33	111.66	255.33	8.00	2.50	44.00	43.66	51.00	31.33	02.83
PC 2057	68.33	15.33	97.33	232.33	8.00	2.63	43.00	44.66	50.66	42.33	01.78
PC 10	73.33	13.33	97.66	214.00	7.33	2.50	43.66	43.66	48.33	45.66	01.86
PC 1	77.33	16.66	94.00	244.33	9.33	2.96	42.66	63.33	53.66	35.00	02.26
LCA 334	80.33	16.00	120.33	219.33	7.00	2.43	45.66	55.33	48.66	32.00	02.26
PC 56	74.66	14.00	120.00	250.66	9.33	2.73	43.66	58.33	47.66	31.00	02.83
Mean	74.16	15.50	106.33	241.56	8.08	2.72	44.62	47.12	46.08	34.54	02.29
S.E.	2.632	0.701	005.10	10.98	0.56	0.14	01.07	04.27	04.68	02.86	00.15
C.D 5%	7.983	2.128	015.48	33.31	1.71	0.45	03.26	12.96	14.22	08.70	00.45

Yield of chilli fruit weight recorded the highest phenotypic and genotypic coefficient of variation followed by fruits per plant and flowers per branch.

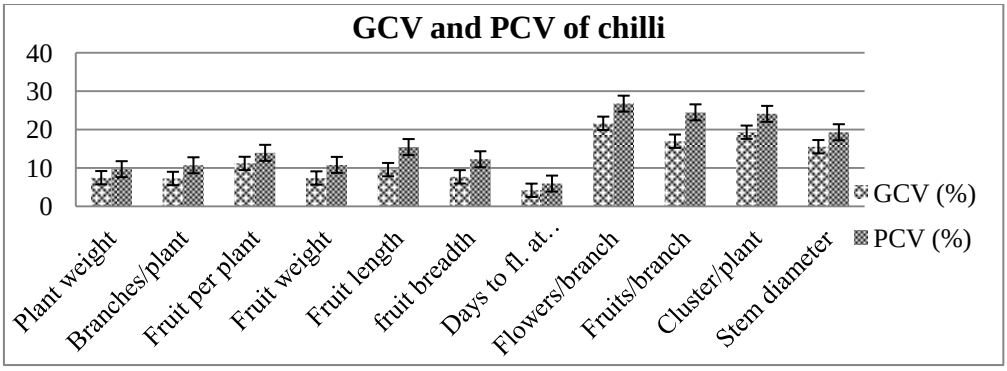

Figure 1. Genotypic and phenotypic coefficient of variability of chilli

This suggested the scope for improvement of these characters through selection. High GCV and PCV for flowers per branch, clusters per plant, fruits per branch, stem diameter and fruits per plant were earlier reported by several workers (Dutta and Das, 2013).

The values were especially high for flowers per branch, clusters per plant, fruits per plant and stem diameter. High heritability for fruits per plant and clusters per plant reported by Gopalakrishnan et al., 1984 supported the present findings. Further, similar to the present results, high heritability for fruit weight, days to 50% flower and fruits per branch was reported by Pandit and Adhikary, (2014). The eminent scientist Johnson et al. (1955) suggested that high heritability combined with high genetic advance is indicative of additive gene action and selection based on these parameters would be more reliable.

In the present investigation, high heritability estimates in conjunction with high genetic advances were observed for number of fruits per plant, flowers per branch, fruit weight, cluster per plant and days to 50% flower. Similar findings were also studied by Choudhary and Samadia, (2004) and Ukkund et al. (2007) who reported high heritability and high genetic advance for fruits per plant and fruit weight.

In view of the high estimates of genotypic coefficient of variation, heritability and genetic advance recorded for fruits per plant, flowers per branch, fruit weight, cluster per plants and days to flower at 50% in the present study, it is concluded that the improvement in these characters can be achieved through selection.

Table 3. Mean performance for the different genotypes of chilli

Characters	Mean	Range	Variance		Coefficient of variance		h^2 (%)	Genetic advance	
			Genotypic	Phenotypic	GCV (%)	PCV (%)	Broad sense	GA %	As (%) Mean
Plant weight	74.16	62.3-80.3	30.31	51.09	7.42	9.64	59.00	21.19	35.09
Branches/plant	15.50	13.3-17.33	1.25	2.73	7.22	10.66	46.00	32.0	22.92
Fruit per plant	106.33	90.0-120.3	140.21	218.4	11.14	13.90	64.00	65.04	53.55
Fruit weight	241.50	214.0-279	313.8	675.8	7.34	10.76	46.00	61.87	63.20
Fruit length	8.08	7.00-9.33	0.59	1.55	9.53	15.40	38.00	52.06	55.70
fruit breadth	2.72	2.43-3.16	0.04	0.11	7.65	12.22	39.00	64.00	52.64
Days to 50% FL	44.62	42.6-49.33	3.42	6.91	4.15	5.89	50.00	43.44	57.71
Flowers/branch	47.12	30.6-63.3	103.5	158.3	21.59	26.70	65.00	51.72	46.09
Fruits/branch	46.08	24.66-53.6	60.87	126.8	16.93	24.44	48.00	52.70	60.96
Cluster/plant	34.54	22.3-45.66	44.27	68.98	19.26	24.04	64.00	40.70	40.74
Stem diameter	2.29	1.78-2.83	0.13	0.20	15.49	19.26	65.00	27.50	32.88

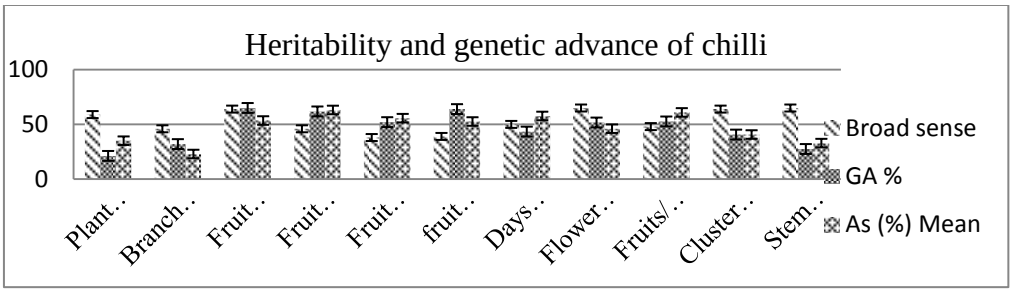

Figure 2. Heritability and genetic advance of chilli genotypes

CONCLUSTION

Analysis of variance revealed the presence of considerable amount of genetic variability for yield and yield attributing characters of chilli genotypes. The genotypes expressed high genotypic and phenotypic coefficient of variation, heritability and genetic advance for fruits per plant, fruit weight, flowers per branch, fruits per branch and clusters per plant, revealed these traits are under the control of additive gene action. This indicated high response to selection for genetic improvement of chilli genotypes under study.

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