Int.J.Curr.Microbiol.App.Sci (2017) *6*(3): 1314-1324

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 3 (2017) pp. 1314-1324**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.603.152

Performance Evaluation and Variability Studies in F_2 Progenies of Hot Pepper (*Capsicum annuum* L. *annuum*)

N. Rohini[1]*, V. Lakshmanan[1], D. Saraladevi[1], A. John Joel[2] and P. Govindarasu[3]

[1]Horticultural College and Research Institute, Tamil Nadu Agricultural University, Periyakulam - 625 604, Tamil Nadu, India
[2]Department of Plant Genetic Resource, Tamil Nadu Agricultural University, Coimbatore- 641 003, Tamil Nadu, India
[3]Department of Plant Genetic Resource, Tamil Nadu Agricultural University, Coimbatore -641 003, Tamil Nadu, India
Corresponding author

Keywords

Hot pepper, F_2 progenies, Evaluation, Variability, Yield.

Article Info

Accepted:
20 February 2017
Available Online:
10 March 2017

A B S T R A C T

The present investigation on mean and variability was conducted on genetically diverse thirty F_2 progenies of chilli. The observation were recorded on the following traits, plant height, branches per plant, days to 50% flowering, fruits per plant, fruit length, fruit girth, individual fresh fruit weight, individual dry pod weight, fresh fruit yield per plant and dry pod yield per plant. Significant difference was observed among the crosses and also within the crosses for all the traits. On the basis of mean performance, progenies K 1 x Pusa Jwala, K 1 x PKM 1, LCA 625 x K 1, Pusa Jwala x PKM 1, K 1 x Arka Lohit Pusa Jwala x K 1 and Arka Lohit x LCA 334 were superior performed for fruit yield per plant, average fresh fruit and dry pod weight, fruits per plant and took less number of days to 50% flowering. Among the thirty progenies studied in F_2 generation, the above said seven cross exhibited high phenotypic coefficient of variation (PCV) and genotypic coefficient of variation for yield and contributing traits indicating that these traits had wide genetic variability and would respond better selection except days to 50% flowering, fruit length and fruit girth. The traits which showed higher mean with moderate to high GCV suggest the presence of genetic variability thereby lending scope for selection

Introduction

Chilli (*Capsicum annuum* L.) is an important vegetable also a high value crop grown common in almost all parts of the world. Chilli has become on essential ingredient in India meals. India is largest producer of 11, 00,452 tonnes of dry chillies from an area of 9, 36,028 ha. Per capita consumption of chilli in the form of dry chilli is estimated 4.2 kg per annum. India is the largest consumer and exporter of this crop. It consumes around 6.2 million tons of chillies, Almost 90% of chilli production is consumed indigenously while only 10 % per cent is exported. In India the major chilli growing states are Andhra Pradesh, Karnataka, Maharashtra, Odissa, Tamil Nadu and West Bengal.

The genus Capsicum is on often cross pollinated and natural cross pollination may go up to 50 per cent depending upon the extent of style exertion, time of dehiscence of anthers, wind direction and insect population (Hosmani, 1993). This accounts for considerable variation in fruit and yield parameters. India has the potentiality to increase the production in order to promote export besides meeting its domestic requirements. However, despite continuous efforts at various levels, the chilli productivity did not gain momentum. This could be attributed to a number of limiting factors of which the prime factor is the lack of superior genotypes for further development of superior high yielding cultivars (or) hybrids. The success of any breeding programme primarily depends on the correct choice of parents. Gilbert (1958) opined that parents with high order of per se performance would be useful in producing better genotypes.

As early as 1889, Galton observed that a part of continuous variation is due to heredity. The study of heritable and non-heritable component of variability has its inception in the finding of Johannson (1909). The degree to which the variability of quantitative and qualitative character is transmitted to the progeny is referred as heritability. The magnitude of variability and its genetic components are the most important aspects of breeding material. Hence, basic understanding of the genetic variability is a prerequisite for the planning of breeding programme. A great deal of information has been generated on genetic variability of various components of chilli. Generally, phenotypic coefficient of variability (PCV) and genotypic coefficient of variability (GCV) are measured to study the variability.

Improvement in yield and quality is the main objective at which plant breeder aims, by altering their genetic architecture. Information on nature and magnitude of variability present in the material and association among the various characters is a pre-requisite for any breeding programme. The success in crop improvement programme depends, chiefly on the availability of genetic variability in the crop. Although variability decreases on self generations, the information on nature and magnitude of variability in later generation of selfing population is important as it indicates association of characters in terms of heritability among themselves and is also pre-requisite for yield improvement. In order to have clear picture of yield components for effective selection programme, there is a need to study for variability in later generation also, as selection pressure can also be applied during these generations.

Planning and execution of breeding programme for the improvement of quantitative attributes depends to a great extent upon the magnitude of genetic variability present in a crop. The genetic and environmental components of variation were discussed in the early century by Johannsen (1909), who attributed the variation in the segregating population to both heritable and non-heritable factors and the variation in the pureline to only environmental factors. East (1916) later confirmed Johannsens work and showed that continuous variation also confirmed to Mendalian genetics. Hence, the study was undertaken with an objective of selecting high yielding types of chilli to determine high mean performance and high variation in quantitative characters contributing to yield characters of chilli.

Materials and Methods

The present study was carried out to identify the high yielding progenies in hot pepper. The genetic materials were comprised of six homozygous inbred viz., Arka Lohit, K 1, LCA 334, LCA 625, PKM 1 and Pusa Jwala. These six parents were maintained as inbreds by selfing for six generations were used as parents and crossed in a full diallel manner, forming a generation of 30 hybrids.

Plant materials

Transplant production

The seeds were treated with *Trichoderma viride* @ 4 g kg^{-1} of seeds, twenty-four hours before sowing and sown in raised beds. The nursery beds were irrigated twice a day using rosecan to facilitate quick germination and good growth of seedlings. The beds were kept moist, but not wet, to avoid dampling -off of seedlings. After seed germination the seedling were treated with 0.3% urea when 10 cm tall for their better growth and were transplanted around 40 -45 days old.

Irrigation to the seedlings was held 3-4 days before transplanting, watering was applied to the nursery bed prior to removal of seedlings for transplanting. Seedlings of six parents were transplanted in the field to produce hybrids. Six parents and these parents were crossed in all possible combination, both direct and reciprocal, to get the maximum number of hybrids during June 2013 to October 2013.

After fruit set, seeds were extracted from fully dried pods, cleaned for raising the progenies of F_1 hybrids. Self seeds of the parents were also obtained during the same season. The selections were made in the F_2 progeny on the basis of single plant fruit yield. The superior single plants were selected. The seeds from the selfed fruits were collected and stored for further evaluation.

Field plot technique

The main field was prepared to a fine tilth and FYM @ 25 t ha^{-1} was applied at the last ploughing. About 2 kg/ha of *Azospirillum* and 2 kg / ha of Phosphobacteria by mixing with 20 kg of FYM. 30:60:30 kg/ ha NPK in the form of urea, single super phosphate and muriate of potash, respectively was applied to the soil at the time of field preparation prior to transplanting. 250 plants each of 30 F_2s, six of parents were planted at a distance of 60 x 45 cm in during November 2014 to April 2015. Additional 30 kg N/ha was given in equal splits on 30, 60 and 90 days after planting. Soil moisture was maintained during the growing season with flood irrigation at 5 days intervals.

Observations were recorded in all the two fifty plants. Data were collected from individual plants of F_2 generation of chilli for ten quantitative traits viz., Plant height, branches per plant, days to 50% flowering, fruits / plant, fruit length, fruit girth (cm), Individual fresh fruit weight (g), individual dry pod weight (g), fresh fruit yield per plant and dry pod yield per plant (g)

Statistical analysis

The mean data of all the F_2 progenies and their parents for each character were tabulated and subjected to analysis of variance (Panse and Sukhatme, 1957). Genotypic and phenotypic coefficient of variance were estimated using following formula

Phenotypic and genotypic coefficients of variation were calculated based on the method advocated by Burton, 1952.

Phenotypic coefficient of variance (PCV) =

$$\frac{\sqrt{Phenotypic\ variance}}{Mean} \ x\ 100$$

Genotypic coefficient of variance (GCV) =

$$\frac{\sqrt{Genotypic\ variance}}{Mean} \ x\ 100$$

The range of following PCV and GCV values were classified as low, moderate and high.

Less than 10 % - Low, 10 - 20 % - Moderate and More than 20 % - High

Results and Discussion

Evaluation of F_2 population for Mean performance and variability

In the segregating generations, selection of superior genotypes is the foremost factor to be considered in the breeding programme. The selection should commence from the F_2 generation. The selection in F_2 involves two principles, *viz*., choice of the desirable crosses and selection of the best progenies within the selected crosses. This strategy will effectively capitalize the transgressive variability available within a cross (Lerner, 1958).

In any breeding programme, the cross or family with the highest mean was relatively effective in identifying the superior segregants (Finkner *et al*., 1973) as it serves to eliminate undesirable crosses (Natarajan, 1992).

The genetic potential of a cross or family is measured not only by mean, but also the extent of genetic variability (Allard, 1960). The existence of genetic variability is essential for exercising selection for improvement of any character. The systematic programme to improve the yield potential of a genotype demands the knowledge on the nature and magnitude of available variability in the population (Supe and Kale, 1992).

Chilli possesses a wider range of variability and had a number of distinct local forms available all over the country. The success of an effective breeding programme depends upon the amount of genetic variability present in the material.

Two criteria, namely mean and variability are not exclusive in deciding the selection of crosses or the families within a cross but they complement each other. Allard (1960) suggested that based on mean and variability, the segregating population may be categorized as high mean and high variability, high mean and low variability, low mean and high variability and low mean and low variability. Selection would be worthwhile in the group of high mean and high variability and if necessary in the groups of high mean and low variability also because, such groups have potentiality to produce more transgressive segregates than other groups. Low mean and high variability are capable of producing more transgressive segregants, but they may be poor in performance. However, in certain characters wherein low mean is desirable, as in days to 50 per cent flowering, this group will be more promising for selection of segregants.

The crosses 91.50 cm), K 1 x LCA 625 (86.90 cm) and PKM 1 x K 1 (86.38 cm) recorded the highest mean for plant height (Table 1). These three crosses also had wider range of mean for this trait. Genotypic and phenotypic co-efficients of variation were observed to be of high magnitude (Table 2). Similar findings were also reported by Nandadevi (2004), Sonia *et al.,* (2006) and Sarkar *et al*., (2009).

The crosses Arka Lohit x LCA 334 (14.60), PKM 1 x LCA 625 (12.18), Pusa Jwala x PKM 1 (11.84), PKM 1 x Pusa Jwala (11.20) and LCA 625 x K 1 (10.20) had the highest mean with wider range for branches per plant (Table 1). On considering the mean along with the variability, above mentioned crosses exhibited higher estimates of these genetic parameters.

In the present study, the genotypic coefficient of variation and phenotypic coefficient of variation were close to each other suggesting minor role of environment on these crosses (Table 2). The results are in accordance with the finding of Manju and Sreelathakumary (2002) and Smitha and Basavaraja (2006).

Table.1 Mean performance of F_2 populations of hot pepper for growth and yield related characters

F_2 progenies	Plant height (cm)		Branches per plant		Days to 50% flowering		Fruits per plant		Fruit length (cm)	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Arka Lohit x K 1	32.76 -78.51	65.81	5.00 -11.00	8.39	67.00-79.00	73.00	69.00-126.00	91.00	5.05-8.65	7.98
Arka Lohit x LCA 334	38.09-98.19	80.69	6.00-20.00	14.60	68.00-80.00	74.00	78.00-192.00	138.00	5.27-9.87	8.67
Arka Lohit x LCA 625	38.70-87.80	72.50	5.00-13.00	8.48	67.00-84.00	76.00	55.00-120.00	95.00	5.87-8.34	7.23
Arka Lohit x PKM 1	35.00-82.10	58.62	5.00-14.00	9.25	68.00-82.00	72.78	48.00-96.00	76.00	6.25-8.69	8.09
Arka Lohit x Pusa Jwala	36.50-87.59	76.36	6.00-15.00	9.40	70.00-84.00	76.00	72.00-138.00	107.50	4.54-6.80	6.05
K 1x Arka Lohit	38.20-98.50	84.50	6.00-16.00	10.10	63.00-74.00	67.40	72.00-196.00	143.83	5.68-9.81	8.49
K 1 x LCA 334	27.41-81.21	60.20	5.00-14.00	9.64	68.00-83.00	75.10	50.00-121.00	80.30	5.06-8.10	7.36
K 1 x LCA 625	35.14-98.50	86.90	6.00-18.00	10.54	63.00-74.00	69.00	58.00-164.00	126.80	5.24-9.25	8.85
K 1 x PKM 1	30.37-85.40	63.45	5.00-14.00	8.97	62.00-72.00	67.74	69.00-197.00	153.60	5.58-10.93	9.24
K1 x Pusa Jwala	30.15-88.64	71.58	5.00-15.00	9.80	63.00-75.00	69.16	64.00-198.00	158.38	5.00-9.18	8.69
LCA 334 x Arka Lohit	39.50-89.48	83.50	4.00-9.00	6.50	71.00-84.00	78.22	35.00-92.00	65.00	5.24-7.85	7.21
LCA 334 x K1	26.50-82.70	74.28	5.00-11.00	8.40	70.00-83.00	76.14	41.00-104.00	76.00	5.66-8.84	7.93
LCA 334 x LCA 625	29.85-68.39	53.13	5.00-12.00	8.57	71.00-85.00	77.96	56.00-116.00	86.27	5.62-8.65	7.85
LCA 334 x PKM 1	30.00-85.36	76.90	4.00-12.00	7.90	71.00-85.00	77.16	35.00-108.00	65.00	5.21-8.59	7.53
LCA 334 x Pusa Jwala	36.57-86.87	75.10	5.00-9.00	7.40	70.00-83.00	76.62	36.00-108.00	84.00	4.00-7.32	5.80
LCA 625 x Arka Lohit	42.69-93.57	72.50	8.00-16.00	11.30	68.00-82.00	73.12	48.00-125.00	108.00	5.00-8.65	7.57
LCA 625 x K 1	31.97-87.28	76.50	5.00-16.00	10.20	65.00-78.00	71.00	68.00-198.00	158.30	5.92-9.78	8.64
LCA 625 x LCA 334	28.54-75.67	57.36	6.00-13.00	8.20	73.00-83.00	79.00	49.00-137.00	100.00	5.28-8.85	8.04
LCA 625 x PKM 1	29.45-86.71	73.50	6.00-15.00	9.12	67.00-79.00	73.84	55.00-158.00	115.00	6.35-9.65	8.84
LCA 625 x Pusa Jwala	34.15-92.18	80.65	6.00-15.00	9.80	68.00-80.00	73.44	55.00-140.00	104.00	5.18-8.20	7.23
PKM 1 x Arka Lohit	37.28-93.56	83.20	6.00-12.00	8.42	70.00-84.00	75.56	65.00-145.00	108.50	5.98-8.85	7.58
PKM 1 x K1	34.67-96.09	86.38	4.00-15.00	11.50	65.00-76.00	71.30	72.00-170.00	132.00	6.00-9.85	9.10
PKM 1x LCA 335	33.82-87.17	78.47	5.00-11.00	8.37	70.00-84.00	76.06	47.00-120.00	98.00	5.98-8.65	7.80
PKM 1 x LCA 625	32.89-94.86	81.65	5.00-18.00	12.18	67.00-77.00	70.56	82.00-193.00	148.00	6.58-9.68	8.59
PKM 1x Pusa Jwala	39.58-86.00	75.60	5.00-16.00	11.20	65.00-76.00	72.04	58.00-158.00	107.00	5.00-8.85	8.00
Pusa Jwala x Arka Lohit	24.08-69.04	54.00	6.00-11.00	9.34	67.00-79.00	73.24	75.00-139.00	148.00	5.12-8.25	6.85
Pusa Jwala x K 1	38.68-102.63	91.50	5.00-13.00	8.70	66.00-78.00	71.60	73.00-191.00	138.00	6.54-11.39	9.23
Pusa Jwala x LCA 334	28.50-72.62	65.28	4.00-9.00	7.88	71.00-84.00	75.54	45.00-105.00	78.00	3.90-7.95	5.82
Pusa Jwala x LCA 625	27.93-81.50	72.68	5.00-14.00	9.56	69.00-80.00	74.40	62.00-148.00	95.00	5.26-8.95	7.83
Pusa Jwala x PKM 1	38.91-93.05	81.35	5.00-17.00	11.84	68.00-77.00	71.96	78.00-198.00	153.00	6.25-11.52	9.35

Table 1. Contd...

F_2 progenies	Fruit girth (cm)		Fresh fruit weight (g)		Dry pod weight (g)		Fresh fruit yield /plant (g)		Dry pod yield / plant (g)	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Arka Lohit x K 1	2.20-3.56	2.90	2.49-3.91	3.34	0.58-0.92	0.79	125.00-463.68	298.72	25.00-83.25	65.60
Arka Lohit x LCA 334	2.39-4.29	3.75	2.87-4.43	3.65	0.49-1.01	0.89	198.20-872.45	500.35	25.68-158.04	120.87
Arka Lohit x LCA 625	2.45-3.60	3.04	2.00-3.30	2.58	0.60-0.88	0.81	125.80-388.21	250.13	29.38-88.82	76.87
Arka Lohit x PKM 1	2.64-4.10	3.41	2.54-3.74	3.25	0.58-0.81	0.69	160.00-390.47	245.68	30.25-87.33	54.04
Arka Lohit x Pusa Jwala	2.58-3.36	3.01	1.78-3.07	2.47	0.45-0.72	0.63	137.40-384.56	264.20	29.58-79.50	67.00
K 1 x Arka Lohit	2.57-4.69	3.95	2.35-4.90	4.15	0.58-1.19	0.89	385.71-891.95	595.61	38.62-169.18	125.49
K 1 x LCA 334	2.15-3.69	3.00	1.75-3.35	2.52	0.51-0.86	0.75	98.50-354.00	200.30	18.39-74.70	57.07
K 1 x LCA 625	2.69-3.90	3.47	2.32-4.85	4.09	0.59-1.01	0.88	196.86-685.73	515.70	33.97-143.89	108.62
K 1x PKM 1	2.78-4.05	3.59	2.39-4.90	4.16	0.52-1.00	0.85	215.50-857.18	680.50	43.83-184.38	135.48
K 1 x Pusa Jwala	2.98-4.15	3.68	2.96-4.58	3.91	0.48-1.02	0.86	237.46-809.58	570.00	56.82-172.37	124.52
LCA 334 x Arka Lohit	2.59-3.60	3.13	2.81-3.74	3.41	0.50-0.85	0.72	85.00-305.20	220.06	16.44-59.82	45.71
LCA 334 x K 1	2.31-3.81	3.20	1.58-3.15	2.48	0.38-0.78	0.65	94.79-320.13	187.62	18.35-70.02	48.45
LCA 334 x LCA 625	2.15-3.69	3.12	2.14-3.69	2.81	0.40-0.79	0.67	90.20-330.51	241.58	17.41-70.25	56.20
LCA 334 x PKM 1	2.01-3.36	2.84	2.06-3.69	3.00	0.42-0.78	0.67	81.30-284.57	193.83	16.44-66.38	42.62
LCA 334 x Pusa Jwala	2.00-3.29	2.76	1.85-3.52	2.90	0.38-0.65	0.51	114.19-336.48	242.90	16.44-69.50	41.02
LCA 625 x Arka Lohit	2.15-3.45	2.80	2.24-3.95	3.37	0.45-0.88	0.78	182.24-524.00	383.47	27.41-99.86	78.34
LCA 625 x K 1	2.95-4.15	3.47	2.48-4.52	3.75	0.40-1.05	0.89	253.60-868.50	592.38	54.74-173.53	131.73
LCA 625 x LCA 334	2.65-3.87	3.31	1.49-3.20	2.45	0.42-0.75	0.65	116.89-444.38	280.00	20.10-77.25	65.15
LCA 625 x PKM 1	2.00-3.70	3.10	2.10-4.15	3.50	0.42-0.86	0.76	185.61-553.72	402.38	32.50-98.00	78.95
LCA 625 x Pusa Jwala	2.15-3.54	3.05	1.95-3.21	2.58	0.49-0.81	0.70	148.63-394.62	251.57	21.92-80.35	62.05
PKM 1 x Arka Lohit	2.14-3.52	2.84	1.93-3.53	2.98	0.36-0.69	0.58	175.32-538.98	321.68	28.42-69.36	52.82
PKM 1 x K1	3.00-4.21	3.62	3.00-4.58	3.85	0.49-0.98	0.82	189.57-664.38	507.00	29.23-110.00	90.17
PKM 1x LCA 335	1.86-2.97	2.54	1.75-3.21	2.51	0.34-0.69	0.59	161.69-398.00	245.30	22.84-68.95	48.18
PKM 1 x LCA 625	2.35-3.98	3.52	2.45-4.51	3.80	0.48-0.94	0.80	298.61-838.57	560.76	35.63-137.33	109.51
PKM 1x Pusa Jwala	2.65-3.92	3.40	3.09-4.68	3.96	0.46-0.95	0.80	234.25-597.58	387.28	24.66-93.59	73.88
Pusa Jwala x Arka Lohit	1.59-3.04	2.51	1.54-2.84	2.35	0.42-0.72	0.63	215.07-409.50	347.10	23.75-81.13	74.27
Pusa Jwala x K 1	2.36-4.65	3.92	2.53-4.98	4.10	0.52-1.07	0.90	272.22-824.36	565.00	37.35-150.82	111.15
Pusa Jwala x LCA 334	1.56-2.85	2.37	1.51-2.95	2.10	0.33-0.61	0.50	89.05-295.20	152.49	14.62-45.33	33.96
Pusa Jwala x LCA 625	2.00-3.02	2.87	1.89-3.85	3.00	0.48-0.85	0.71	113.51-492.66	285.00	22.84-83.23	66.55
Pusa Jwala x PKM 1	2.91-4.36	3.63	2.48-4.75	4.08	0.51-1.08	0.90	253.60-849.53	623.80	55.49-166.50	128.12

Table.2 Variability for different growth and yield related characters in F_2 generation of hot pepper

Crosses	Plant height		Branches/plant		Days to 50% flowering		Fruits/ plant		Fruit length	
	PCV	GCV	PCV	GCV	PCV	GCV	PCV	GCV	PCV	GCV
Arka Lohit x K 1	15.39	12.14	20.57	16.93	5.53	4.95	20.74	15.46	10.37	8.20
Arka Lohit x LCA 334	20.31	17.95	26.57	24.41	6.42	6.18	25.56	24.22	14.55	13.43
Arka Lohit x LCA 625	15.40	11.57	13.18	9.65	6.27	5.64	20.23	16.50	9.24	8.12
Arka Lohit x PKM 1	17.25	12.34	16.57	12.79	5.95	5.33	18.76	13.59	8.87	6.36
Arka Lohit x Pusa Jwala	17.78	12.74	17.42	12.94	5.64	4.88	19.14	16.05	9.80	7.15
K 1x Arka Lohit	18.61	16.20	30.80	28.75	7.22	7.03	25.88	24.73	9.42	8.70
K 1 x LCA 334	16.33	12.54	21.28	14.56	5.87	5.36	23.44	17.45	10.20	7.79
K 1 x LCA 625	16.14	12.83	33.21	29.85	5.93	5.78	23.89	22.06	9.14	8.68
K 1x PKM 1	19.21	15.97	32.75	29.73	5.86	5.65	23.70	20.27	13.79	13.34
K 1 x Pusa Jwala	20.70	17.88	34.92	31.38	5.01	4.79	24.96	21.55	12.38	11.44
LCA 334x Arka Lohit	19.27	15.58	21.48	14.60	5.79	5.06	20.54	14.11	10.04	7.70
LCA 334x K 1	16.08	13.24	18.37	12.08	5.48	5.04	19.31	15.01	11.22	8.52
LCA 334 x LCA 625	17.82	13.45	18.78	13.76	5.86	5.58	13.54	10.58	10.09	8.47
LCA 334 x PKM 1	16.95	12.65	22.22	14.98	4.83	4.50	19.23	12.41	13.06	10.04
LCA 334 x Pusa Jwala	16.84	13.07	27.30	22.33	4.35	4.09	18.27	14.60	10.42	8.09
LCA 625 x Arka Lohit	20.91	15.91	20.20	15.83	4.38	4.08	21.47	19.31	10.76	9.13
LCA 625 x K 1	19.32	16.47	33.78	30.25	5.20	4.95	22.27	20.05	11.37	10.73
LCA 625 x LCA 334	17.29	12.77	20.47	15.07	3.52	3.20	21.87	17.69	10.49	8.77
LCA 625 x PKM 1	15.43	12.87	22.34	15.89	5.69	5.24	24.38	20.33	8.48	6.68
LCA 625 x Pusa Jwala	15.01	11.72	23.38	20.41	4.23	3.84	23.92	20.92	10.18	7.24
PKM 1 x Arka Lohit	20.39	17.34	28.30	18.51	5.45	5.06	20.86	18.13	9.17	7.00
PKM 1 x K 1	14.81	13.37	25.08	18.79	4.27	3.94	23.55	21.61	11.69	10.30
PKM 1x LCA 335	20.50	14.71	18.32	12.59	5.15	4.49	19.35	14.84	8.55	7.25
PKM 1 x LCA 625	16.80	14.79	30.39	26.54	4.09	3.77	21.70	20.04	8.65	7.57
PKM 1x Pusa Jwala	16.05	11.97	31.42	27.37	4.40	4.11	23.45	20.57	11.14	9.14
Pusa Jwala x Arka Lohit	17.53	13.45	19.48	16.17	4.35	3.75	10.37	6.97	10.61	7.61
Pusa Jwala x K 1	20.23	18.43	26.29	23.70	4.79	4.50	26.72	24.09	14.14	13.05
Pusa Jwala x LCA 334	14.75	10.87	18.74	13.61	4.65	4.11	18.55	14.22	11.08	7.88
Pusa Jwala x LCA 625	18.61	14.00	23.81	17.50	4.11	3.73	22.54	19.24	11.06	9.02
Pusa Jwala x PKM 1	22.01	18.45	32.80	29.10	3.01	2.68	20.82	19.45	16.00	14.68

Table 2. Contd.,

Crosses	Fruit girth		Individual fresh fruit weight		Individual dry pod weight		Fresh fruit yield/ plant		Dry pod yield / plant	
	PCV	GCV	PCV	GCV	PCV	GCV	PCV	GCV	PCV	GCV
Arka Lohit x K 1	10.79	8.72	9.49	8.01	11.65	10.18	23.96	18.75	23.39	17.99
Arka Lohit x LCA 334	10.78	10.38	18.74	17.82	13.87	13.41	27.53	23.97	25.74	22.40
Arka Lohit x LCA 625	10.26	6.83	10.64	8.06	9.51	6.10	14.77	9.59	14.44	10.65
Arka Lohit x PKM 1	10.61	7.51	8.92	6.39	9.09	6.38	14.31	10.84	18.37	13.51
Arka Lohit x Pusa Jwala	10.56	6.56	12.04	9.37	9.44	6.22	20.88	16.86	16.70	11.13
K 1x Arka Lohit	14.56	14.04	20.68	20.13	11.89	11.35	22.89	20.49	26.85	23.90
K 1 x LCA 334	13.97	11.08	14.75	11.37	10.94	7.09	20.58	17.58	17.39	12.79
K 1 x LCA 625	10.56	9.83	20.64	20.05	14.28	13.82	24.36	21.74	26.94	23.61
K 1x PKM 1	9.41	8.91	21.54	20.99	16.41	15.55	23.77	22.27	31.77	28.75
K 1 x Pusa Jwala	11.58	10.14	21.43	20.60	16.70	15.87	25.57	23.79	29.06	25.25
LCA 334x Arka Lohit	9.83	7.13	10.15	7.41	11.70	8.67	16.12	11.13	24.54	17.03
LCA 334 x K1	11.83	10.14	13.65	10.02	12.55	11.57	27.17	20.92	29.86	21.93
LCA 334 x LCA 625	10.33	9.05	14.43	11.40	11.51	9.38	23.47	15.80	24.03	16.50
LCA 334 x PKM 1	12.56	8.80	10.79	6.91	11.85	7.77	18.14	10.62	20.36	11.84
LCA 334 x Pusa Jwala	10.83	9.19	13.26	10.94	14.80	10.00	18.48	13.10	22.55	19.09
LCA 625 x Arka Lohit	12.46	10.45	13.94	12.99	12.19	9.96	13.51	10.62	14.34	10.68
LCA 625 x K 1	11.39	10.60	13.22	12.73	19.40	19.07	30.66	28.66	22.73	20.92
LCA 625 x LCA 334	9.59	7.98	14.58	10.93	14.96	13.29	28.23	22.11	25.70	19.21
LCA 625 x PKM 1	13.18	11.67	16.27	15.29	16.27	15.17	18.91	15.36	17.85	12.85
LCA 625 x Pusa Jwala	10.36	7.76	13.73	11.25	12.65	10.92	19.30	14.85	18.34	11.77
PKM 1 x Arka Lohit	12.40	9.90	14.65	13.70	14.87	10.95	20.29	14.43	18.56	12.55
PKM 1 x K 1	9.23	7.89	20.98	20.43	16.67	16.22	18.17	15.71	24.38	21.03
PKM 1x LCA 335	13.00	8.81	13.07	8.25	14.83	8.06	14.69	9.41	20.36	11.87
PKM 1 x LCA 625	13.11	12.32	21.36	20.44	18.19	17.75	23.18	20.86	26.35	22.21
PKM 1x Pusa Jwala	10.79	9.14	21.46	20.17	17.95	17.51	25.02	21.12	24.75	20.61
Pusa Jwala x Arka Lohit	12.50	8.56	13.07	9.81	11.93	7.36	10.49	6.90	11.45	8.19
Pusa Jwala x K 1	14.24	13.65	21.00	20.22	16.28	15.90	22.15	19.47	23.36	20.23
Pusa Jwala x LCA 334	11.99	7.41	12.49	8.77	14.08	7.63	10.06	6.89	9.43	5.69
Pusa Jwala x LCA 625	10.44	5.82	15.44	14.24	14.64	13.22	32.44	27.59	15.95	11.88
Pusa Jwala x PKM 1	11.82	11.13	20.80	20.21	18.66	18.33	27.15	25.35	25.80	22.86

In respect of days to 50 per cent flowering, the crosses K 1 x Arka Lohit (67.40 days), K 1 x PKM 1 (67.74 days), K 1 x LCA 625 (69 days), K 1 x Pusa Jwala (69.16 days) and PKM 1 x LCA 625 (70.56 days) had low mean (Table 1). Low mean is considered for earliness. Low genotypic co-efficient of variation combined with low phenotypic co-efficient of variation exhibited in all the crosses of F_2 generation (Table 2) is in accordance with Shirshat *et al.*, (2007) and Sharma *et al*., (2010).

For fruits per plant, the crosses K 1 x Pusa Jwala (158.38), LCA 625 x K 1 (158.30), K 1 x PKM 1 (153.60), Pusa Jwala x PKM 1 (153.00) and PKM 1 x LCA 625 (148.00) expressed highest mean value with high variability (Tables 1 and 2), suggesting greater genotypic and phenotypic variability among the segregating generations and responsiveness of the attribute for making further improvement through selection. These results are in agreement with the findings of Shirshat *et al.*, (2007), Bhojaraja Naik (2009), Chattopadhyay *et al.*, (2011), Datta and Das (2013) and Pandit and Adhikary (2014).

The crosses Pusa Jwala x PKM 1 (9.35 cm), K 1 x PKM 1 (9.24 cm), Pusa Jwala x K 1 (9.23 cm), Arka Lohit x LCA 334 (8.67 cm) and K 1 x Arka Lohit (8.49 cm) showed the highest mean value and wider range for fruit length with high variability (Tables 1 and 2). High mean and high variability were also recorded by Smitha (2005), Shirshat *et al*., (2007), Chattopadhyay *et al.*, (2011) and Pandit and Adhikary (2014).

In respect of fruit girth, high mean is considered. The crosses K 1 x Arka Lohit (3.95 cm), Pusa Jwala x K 1 (3.92 cm), Arka Lohit x LCA 334 (3.75 cm), K 1 x Pusa Jwala (3.68 cm) and Pusa Jwala x PKM 1 (3.63 cm) had the highest mean value for fruit girth (Table 1) and these crosses exhibited moderate variability (Table 2). It is clear that for high fruit girth these crosses offer considerable scope for selection. The present results are in conformity with findings of Sonia *et al.,* (2006) and Chattopadhyay *et al*., (2011).

The higher mean and higher estimates of genotypic and phenotypic co-efficients of variation were observed for individual fresh fruit weight in the crosses, K 1 x PKM, K 1 x Arka Lohit, Pusa Jwala x PKM 1, Pusa Jwala x K 1 and K 1x Pusa Jwala indicating that the variability existed in these traits and this was due to the presence of genetic constitution. The presence of highest number of better recombinants in the population would have resulted in higher genetic variability. These results are in accordance with the findings of Sonia *et al.,* (2007), Bhojaraja Naik (2009) and Sarkar *et al.*, (2009).

The crosses Pusa Jwala x PKM 1 (0.90 g), Pusa Jwala x K 1 (0.90 g), LCA 625 x K 1 (0.89 g), K 1 x Arka Lohit (0.89 g) and Arka Lohit x LCA 334 (0.89 g) showed the highest mean (Table 1) and moderate variability (Table 2) for individual dry pod weight. The above said crosses become good source for selection of desirable recombinants for more number of fruits per plant. Similar results were earlier reported by Giritammannavar (1995) and Pandit and Adhikary (2014).

In the case of fresh fruit yield per plant and dry pod yield per plant, the crosses K 1 x PKM 1 (680.50 and 135.48 g), Pusa Jwala x PKM 1 (623.80 and 128.12 g), K 1 x Arka Lohit (595.61 and 125.49 g), LCA 625 x K 1 (592.38 and 131.73 g) and K 1 x Pusa Jwala (570.00 and 124.52 g) had the highest mean with wider range (Table 1). Genotypic and phenotypic coefficients of variation were high (Table 2). A greater possibility of exercising selection is emphasized because of the high mean, variability and wider range exhibited by the aforesaid crosses. The high mean and variability indicated better scope for selection. These findings are in accordance with Varkey *et al.*, (2005), Bhojaraja Naik (2009), Chattopadhyay *et al*., (2011) and Pandit and Adhikary (2014).

The mean performance and variability of 30 F_2 progenies revealed that yield contributing characters *viz.*, number of fruits per plant, fruit length, fruit girth, individual fresh fruit weight and individual dry pod weight were observed in P_2 x P_5 (K 1 x PKM 1), P_4 x P_2 (LCA 625 x K 1), P_2 x P_6 (K 1 x Pusa Jwala), P_6 x P_5 (Pusa Jwala x PKM 1) and P_2 x P_1 (K 1 x Arka Lohit). The hybrids P_1 x P_3 (Arka Lohit x LCA 334) and P_6 x P_2 (Pusa Jwala x K 1) recorded better values for plant height, fruit length, branch number and individual dry pod weight. Here, the phenotypic coefficient of variation (PCV) for all the characters were higher than the genotypic coefficient of variation (GCV) indicating the influence of environmental effect. The traits which showed higher mean with moderate to high GCV suggest the presence of genetic variability thereby lending scope for selection.

References

Allard, W. 1960. Principles of Plant Breeding, John Wiley and Son. Inc., New York. Chapter. 19: 224-233.

Bhojaraja Naik, K. 2009. Variability studies in segregating populations of sweet pepper (*Capsicum annuum* (L.) var. *grossum* Sendt.). M.Sc. Thesis, Department of Genetics and Plant breeding, College of Agriculture, University of agricultural sciences, Dharwad.

Burton, G.W. 1952. Quantitative inheritance in grasses, *Proceedings of 6th Int. Grassland Congress,* 1: 277-283.

Chattopadhyay, A., Sharangi, Nuka Dai and Subrata Dutta. 2011. Diversity of genetic resources and genetic association analyses of green and dry chillies of eastern India. *Chilean J. Agri. Res.,* 71(3): 350-356.

Datta, S. and Das, L. 2013. Characterization and genetic variability analysis in *Capsicum annuum* L. germplasm. *SAARC J. Agri*., 11(1): 91-103.

East, E.M. 1916. Studies on size inheritance in Nictiana. *Genet.*, 1: 164-176.

Finkner, V.G., Ponelirt C.G. and Davis, D.L. 1973. Heritability of rachis node number of *avena sativa* L. *Crop Sci*., 13(1): 84-85.

Gilbert, N.E. 1958. Diallel cross in plant breeding. *Heredity*, 12: 477-492.

Giritammannavar, V.A. 1995. Studies on genetic variability and purification of Byadagi chilli (*Capsicum annuum* L.) genotypes. M.Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad.

Hosmani, M.M. 1993. Chilli crop (*Capsicum annuum*). Bharat Photo Offset Works. Dharwad.

Johannsen, W. 1909. Elements of variation in crop plants. Gustan Fisher, p. 20.

Lerner, I.M. 1958. The genetic basis of selection. John Wiley and Sons Inc.

Manju, P.R. and Sreelathakumary, I. 2002. Genetic variability, heritability and genetic advance in hot chilli *(Capsicum chinense*). *J. Trop. Agri.,* 40: 4-6.

Nandadevi. 2004. Genetic studies in bell pepper (*Capsicum annuum* L. var. *grossum*). Ph.D. Thesis, Univ. Agric. Sci., Dharwad.

Natarajan, S. 1992. Genetic variability and heritability in F_2 generation of intervarietal crosses of tomato under moisture stress. *South Indian Hort.,* 39(1): 27-31.

Pandit, M.K. and Adhikary, S. 2014. Variability and heritability estimates in some reproductive characters and yield in chilli (*Capsicum annuum* L.). *Int. J.*

Plant Soil Sci., 3(7): 845-853.

Panse, V.G. and Sukhatme, P.V. 1957. Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi. pp. 97.

Sarkar, S., Murmu, D., Chattopadhyay, A. and Hazra, P. 2009. Genetic variability, correlation and path analysis of some morphological characters in chilli. *J. Crop and Weed*, 5(1):157-161.

Sharma, V.K., Semwal, C.S. and Uniyal, S.P. 2010. Genetic variability and character association analysis in bell pepper (*Capsicum annuum L.) J. Hort. and Forestry*, 2(3): 058-065.

Shirshat, S.S., Giritammannavar, V.A. and Patil, S.J. 2007. Analysis of genetic variability for quantitative traits in chilli. *Karnataka J. Agric. Sci.*, 20(1): 29-32.

Smitha, R.P. 2005. Variability, character association and genetic divergence studies in chilli (*Capsicum annuum* L.). M.Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad.

Smitha, R.P. and Basavaraja, N. 2006. Variability and correlation studies in chilli (*Capsicum annuum* L.). *Karnataka J. Agric. Sci.*, 19(4): 888-891.

Sonia, S., A.K. Bindal and A. Sharma. 2006. Genetic variability, heritability and genetic advance of various polygenic traits in capsicum (*Capsicum annuum* L.). *Sci. Hort*., 10: 201-207.

Sonia, S., Anil, B., Akhilesh, S. and Chaudhary, D.R. 2007. Genetic architecture and trait relationship in bell pepper under sub temperate conditions of north western Himalayas. *Indian J. Hort*., 64(2): 169-174.

Supe, V.S. and Kale, P.B. 1992. Correlation and path analysis in tomato. *J. Maharashtra Agric. Univ*., 17(2): 331-333.

Varkey, J., Saiyed, M.P., Patel, J.S. and Patel, D.B. 2005. Genetic variability and heritability in chilli. *J. Maharashtra Agric. Univ*., 30(3): 346-347.

How to cite this article:

Rohini, N., V. Lakshmanan, D. Saraladevi, A. John Joel and Govindarasu, P. 2017. Performance Evaluation and Variability Studies in F2 Progenies of Hot Pepper (*Capsicum annuum* L. *annuum*). *Int.J.Curr.Microbiol.App.Sci.* 6(3): 1314-1324.
doi: https://doi.org/10.20546/ijcmas.2017.603.152