International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(4): 2460-2463

Received: 25-05-2020
Accepted: 27-06-2020

TG Harish Kumar
Department of Vegetable Science, College of Horticulture, University of Horticultural Sciences, Bagalkot, Karnataka, India

HB Patil
Department of Vegetable Science, College of Horticulture, University of Horticultural Sciences, Bagalkot, Karnataka, India

Jayashree
Department of Vegetable Science, College of Horticulture, University of Horticultural Sciences, Bagalkot, Karnataka, India

DC Manjunath Gowda
Department of Vegetable Science, College of Horticulture, University of Horticultural Sciences, Bagalkot, Karnataka, India

Corresponding Author:
TG Harish Kumar
Department of Vegetable Science, College of Horticulture, University of Horticultural Sciences, Bagalkot, Karnataka, India

Genetic variability studies in green chilli (*Capsicum annuum* L.)

TG Harish Kumar, HB Patil, Jayashree and DC Manjunath Gowda

DOI: https://doi.org/10.22271/chemi.2020.v8.i4ab.10004

Abstract
Genetic variability, heritability and genetic advance as percent of mean for 19 characters were assessed by field evalution observed for all the characters considered for the study. The analysis of variance indicated presence of significant variability among the genotypes for all the characters. Higher GCV and PCV values indicated presence of substantial genetic variability and less environmental influence for Chlorophyll, Ascorbic acid (mg/100g), Capsaicin (SHU), Fruit yield per plant (g), Fruit yield per ha and Number of fruits per plant. High heritability coupled with high genetic advance as per cent mean were noticed for Stalk to fruit ratio, Number of fruits per plant, Average dry fruit weight (g), Fruit yield per plant(g), Fruit yield per ha, Chlorophyll, Ascorbic acid (mg/100g) and Capsaicin (SHU) suggesting presence of additive gene action for inheritance of these yield attributes. Hence, simple selection would be effective for improvement of these traits.

Keywords: Genetic variability studies, green chilli, *Capsicum annuum* L.

Introduction
Green chilli is the one among the best to bring spicy taste to the food. A spice without which Indian cuisine would be incomplete. Green chillies are used with or without the stalks, whole or chopped, with seeds or deseeded. They are used fresh, pickled or in sauces. It is an indispensable crop used as essential ingredient in a variety of cuisines to annex tang and taste to the food by providing colour and flavour. It possess high nutritive value and an excellent source of vitamin C and A along with minerals like folate, potassium, thiamine, molybdenum and manganese. Antioxidant properties in chilli is due to ß-carotinoids and vitamin A and C (Simonne *et al.*, 1997) [10]. Nonetheless in India, chilli is an important commercial crop, cultivated for vegetable, spice, and value added product. Chilli has been acknowledged for extreme hotness or pungency due to presence of capsaicinoids in which predominant forms are capsaicin (8- methyl-N-vanillyl-6-enamide) and dihydrocapsaicin making upto 80-90 per cent (Hoffman *et al.*, 1983) [7]. The capsaicinoids have pharmaceutical applications namely, antioxidant, anti-obesity treatments, anti-arthritic, analgesic, antimicrobial and anticancerous properties (Prasad *et al.*, 2005). Besides this, the colour exhibited in Capsicum is due to group of carotenoids of capsanthin, capsorubin, cryptoxanthine, zeaxanthine and others. The extracted colours of chilli are used in the food processing industries extensively to wide range of food products (Govindarajan, 1986) [5].
Yield is an intricate quantitative character governed by large number of genes and magnanimously influenced by environmental factors. The advancement of breeding in a population primarily determined by the nature, magnitude and interaction of genotypic and environmental variations. The probability of getting superior genotype is high if in the population variability is largely due to genetic cause. But it is difficult to predict what amount of variability is heritable and *vise versa*. At that time, partitioning of observed variability required into heritable and non- heritable components with the help of suitable genetic parameters such as phenotypic and genotypic coefficient of variation, heritability and genetic advance. Hence knowledge about different component characters inter-relationship and intra-relationship is important for devising selection criterion for yield.

Material and Methods

The investigation was carried out on "Evaluation of advanced lines of chilli (*Capsicum annuum* L.) for green chilli yield and yield attributing characters" during the *kharif* season of 2016-2017 at Horticulture Research and Extension Station, Haveri (Devihosur). which comes under the Zone-3 of region-2 among the agro climatic zones of Karnataka has benefits of both South-West and North-East monsoons. The average rainfall of South-West monsoon is 360 mm, distributed over a period of four months (June to September) with 25 rainy days. The average rainfall of North-East monsoon is 136 mm with 8 rainy days. During the experimental period, the meteorological data were recorded at the meteorological observatory of Horticulture Research and Extension Station, Haveri (Devihosur). The experiment comprised 37 genotypes advanced lines of chilli collected from HREC Devihosur. Thirty eight days old seedlings were transplanted to the experimental plot the experimental plot was ploughed and brought to fine tilth and were applied farm yard manures (FYM) and recommended dose of fertilizers (NPK). Seedlings were transplanted at spacing of 60 cm × 60 cm in two replications. Observations were recorded from five randomly selected plants in each experimental plot for growth, yield and quality parameters. The estimates of genotypic and phenotypic coefficient of variation were calculated according to Burton and Devane (1953), heritability in broad sense (Falconer, 1981) [4] and expected genetic advance as per the procedure of Johnson *et al.* (1955).

Results and Discussion

A wide variation in the mean performance of parents was observed for all the characters under study. The analysis of variance showed that all the varieties/strains slightly differed for all the nineteen economic characters.

Table 1: Analysis of variance for various characters in Chilli (mean sum of squares)

Sl. No.	Character /Source	Mean sum of squares	
		Genotype d.f=37	Error d.f=36
1	Plant height 90 days	133.31***	45.58
2	Plant height 120 days	137.75***	41.72
3	Plant Spread @ 90 days	96.48*	54.21
4	Plant Spread @ 120 days	68.82*	36.99
5	Days to 1st flowering	11.99*	5.98
6	Days to 50% flowering	8.83*	4.08
7	Number of primary branches	0.45**	0.20
8	Number of secondary branches	2.23*	1.19
9	Stalk length	0.28*	0.137
10	Stalk to fruit ratio	0.000032***	0.000001
11	Fruit length(cm)	3.27***	0.82
12	Fruit diameter(mm)	0.059***	0.010
13	Number of fruits per plant	3342.34***	101.29
14	Average dry fruit weight(g)	2.29***	0.16
15	Fruit yield per plant (g)	80020.64***	17249.72
16	Fruit yield per plot ha	52.83***	4.88
17	Ascorbic acid (mg/100g)	17815.58***	23.45
18	Capsaicin (SHU)	0.051***	0.000187
19	Chlorophyll	0.23***	0.000579

d.f = Degrees of freedom

Table 2: Estimates of mean, range, components of variance, heritability, and genetic advance for growth, yield and quality parameters in chilli

Sl.no	Character		Grand Mean	Range		GCV (%)	PCV (%)	h2 (%) (BS)	GA	GAM (%)
				Min.	Max.					
1	Plant height (cm)	90 DAT	68.53	43.54	82.35	9.66	13.79	49.00	9.55	13.94
		120 DAT	70.31	45.27	84.46	9.85	13.47	53.05	10.44	14.84
2	Plant spread(cm)	90 DAT	46.30	30.35	58.13	9.92	18.74	28.00	5.01	10.83
		120 DAT	47.74	34.25	58.50	8.35	15.23	30.01	4.50	9.44
3	Primary branches		2.85	2.40	4.40	12.55	20.12	38.09	0.46	16.14
4	Secondary branches		6.74	4.90	9.60	10.66	19.39	30.04	0.82	12.15
5	Days to 1st flowering		27.09	22.50	31.50	6.40	11.06	33.50	2.06	7.62
6	Days to 50% flowering		44.66	42.00	50.00	3.45	5.69	36.70	1.92	4.30
7	Fruit length(cm)		8.35	6.54	12.61	13.23	17.13	59.70	1.76	21.06
8	Fruit diameter(mm)		1.13	0.91	1.59	13.71	16.50	69.00	0.26	23.47
9	Stalk length		2.48	1.80	3.45	11.00	0.21	0.35	0.33	13.28
10	Stalk to fruit ratio		0.00	0.00	0.02	50.29	0.00	98.00	0.00	100.21
11	Number of fruits per plant		109.29	38.46	223.16	36.83	37.96	94.10	80.45	73.61
12	Average dry fruit weight(g)		5.50	4.00	7.85	18.74	20.18	86.20	1.97	35.86
13	Fruit yield per plant(g)		547.23	159.92	939.30	32.37	40.30	64.50	293.17	53.57
14	Fruit yield per ha		14.16	4.18	24.50	34.57	37.93	83.00	9.19	64.91
15	Chlorophyll		0.51	0.23	2.09	66.64	66.80	99.00	0.70	175.50
16	Ascorbic acid(mg/100g)		154.85	47.09	390.91	60.91	60.99	99.00	194.04	165.59
17	Capsaicin(SHU)		0.17	0.08	1.05	89.77	90.10	99.00	0.32	184.26

PV = Phenotypic variance GA= Expected genetic advance PCV =Phenotypic coefficient of variation GAM = Genetic advance as percentage over mean GV = Genotypic variance GCV = Genotypic coefficient of variation h2 = Heritability (broad sense)

The estimate of genetic parameter *viz.*, phenotypic and genotypic coefficient of variation along with heritability in broad sense and genetic advance as percentage of mean for different characters are given in (Table 2). A wide variation in the mean performance of parents was observed for all the characters under study. The extent of variability with respect to various characters in different genotypes measured in terms of range, general mean, genotypic coefficient of variation, phenotypic coefficient of variation along with heritability and expected genetic advance as per cent of mean (Table 2).

Plant height (cm) 90 DAT showed maximum range of variability from 43.54 to 82.35 with a mean of 68.53 followed by plant height 120 DAT from 45.27 to 84.46 along with a grand mean of 70.31, Plant spread(cm) 90 DAT from30.35 to 58.13 along with a grand mean of 46.30, Plant spread(cm) 120 DAT from 34.25 to 58.50 along with a grand mean of 47.74, Number of primary branches per plant from 2.40 to 4.40 along with a grand mean of 2.85, Number of secondary branches per plant from 4.90 to 9.60 along with a grand mean of 6.74, Days to 1st flowering from 22.50 to 31.50 along with a grand mean of 27.09, Days to 50% flowering from 42.00 to 50.00 along with a grand mean 44.66, Fruit length(cm) 6.54 to 12.61 from along with a grand mean of 8.35, Fruit diameter(mm) from 0.91 to 1.59 along with a grand mean of 1.13, Stalk length from 1.80 to 3.45. along with a grand mean of 2.48, Number of fruits per plant from 38.46 to 223.16 along with a grand mean of109.29, Average dry fruit weight (g) from 4.00 to 7.85 along with a grand mean of 5.50 159.92 and 939.30, Fruit yield per ha 4.18 to 24.50 along with a grand mean of 14.16 and Chlorophyll (g) from 0.23 to 2.09 along with a grand mean of 0.51. Ascorbic acid (mg/100g) from 47.09 to 390.9 along with a grand mean of 154.85. Capsaicin (SHU) from 0.08 to 1.05 along with a grand mean of 0.17. The magnitude of phenotypic coefficient of variability was higher than that of genotypic coefficient of variability for all the characters indicating that effect of environment on their genetic expression.

Maximum phenotypic coefficient of variation was obtained for Chlorophyll (66.80), Ascorbic acid (mg/100g) (60.99), Capsaicin (SHU) (90.10), Fruit yield per plant (g) (40.30), Number of fruits per plant (37.96), Fruit yield per ha(37.93) and moderate to low for remaining traits. The maximum amount of genotypic coefficient of variation was observed for Capsaicin(SHU) 89.77, Chlorophyll (66.64), Ascorbic acid(mg/100g) (60.91), Stalk to fruit ratio (50.29), Number of fruits per plant (36.83), Fruit yield per ha (34.57), Fruit yield per plant(g) 32.37 and minimum coefficient of genotypic variance was observed for Plant height (cm) 90 DAT and 120 DAT, Plant spread(cm)90 DAT and 120 DAT, Primary branches Secondary branches, Days to 1st flowering, Days to 50% flowering, Fruit length(cm), Fruit diameter(mm), Stalk length. This variation indicated the possibility of obtaining very high selection response with respect to these traits. These results indicated that higher magnitude of genotypic coefficient of variation for the above traits offer a better opportunity for improvement through selection. Similar findings were reported by Acharya *et al.* [1] Das and Choudhary [3] and Devi *et al.* [4].

The genotypic coefficient of variation provides help to measure the genetic variability in a character and accordingly, it is not possible to partition existing heritable variation in population based solely on this estimate. According to this the maximum heritability was observed for Chlorophyll 99%, Ascorbic acid(mg/100g) 99%, Capsaicin(SHU)99%, Stalk to fruit ratio 98%, Number of fruits per plant 94%, Average dry fruit weight (g) 86.20%,, Fruit yield per ha 83.00 whereas the lowest heritability was hovered by Stalk length 0.21, Plant spread (cm) 90 DAT 28.00. These findings are in accordance with the observations made by Tembhurne *et al.* [10], Mishra, *et al.* [7] and Sreelathakumary *et al.* [9]. High heritability in broad sense indicated that large proportion of phenotypic variance was attributable to the genotypic variance and were less influenced by environment.

Hence, selection can bring worthwhile improvement in these traits. Genetic advance is still a more useful estimate because heritability value by itself does have much significance as it fails to account for the magnitude of absolute variability. It is therefore, necessary to utilize heritability in conjunction with selection differential which would then indicate the expected genetic gain resulting from selection. Capsaicin (SHU) had maximum value (184.26), succeeded by Chlorophyll 175.50, Ascorbic acid(mg/100g) 165.59 The consequence of heritability coupled with genetic advance pointed out that two attributes, Fruit diameter(mm) and Average dry fruit weight (g) observed with high heritability as well as moderate genetic gain (Table 2). Rest the characters exhibited high or moderate heritability with low genetic gain. When the traits exhibit high heritability with moderate to low genetic advance as percent of mean these can be improved though multiple crosses. The results of present investigation are also in agreement with the findings reported by Ukkund *et al.* [11], Gupta *et al.* [5] and Vani *et al* [12]. High estimates of heritability along with high genetic advance provide good scope for further improvement in advance generation if characters subject mass progeny or family selection.

References

1. Acharya P, Sengupta S, Mukherjee S. Genetic variability in pepper (*Capsicum annuum*). Envir. Ecol. 2007; 25(4):808-812.
2. Das S, Choudhary DN. Genetic variability in summer chilli (*Capsicum annuum* L.). J Appl. Biol., 1999; 9(1):810.
3. Devi DS, Arumugam R, Devi S. Genetic variability in summer chilli (*Capsicum annuum* L.). J Appl. Biol., 1999; 9(1):810.
4. Falconer DS. Introduction to Quantitative Genetics, 2nd edition, Longman Group Ltd., Longman House, Harrow, England, 1981, 350.
5. Govindarajan VS. Capsicum production, technology, chemistry and quality. Part III. Chemistry of the color, aroma and pungency stimuli. Crit. Rev. Food Sci. Nutr., 1986; 24:245-355
6. Gupta AM, Singh D, Kumar A. Genetic variability, genetic advance and correlation in chilli (*Capsicum annuum* L.). Indian J Agric. Sci. 2009; 79(3):221-223.
7. Hoffman PG, Lego MC, Galetto WG. Separation and quantitation of red pepper major heat principles by reverse-phase high pressure liquid chromatography. J. Agril. Food Chem., 1983; 31:1326-1330.
8. Mishra AC, Singh RV, Ram HH. Path coefficient analysis in sweet pepper (*Capsicum annuum* L.) genotypes under mid hills of Uttaranchal. Veg Sci., 2002; 29(1):71-74.
9. Prasad NBC, Shrivastava R, Ravishankar GA. Capsaicin: a promising multifaceted drug from Capsicum spp. Evidence-Based Integrative Medicine, 2005; 2:147-166.
10. Simonne AH, Simonne EH, Eitenmiller RR, Mills HA, Green NR. Ascorbic acid and pro-vitamin A contents in

unusually colored bell peppers (*Capsicum annuum* L.). J. Food Compo. Anal. 1997; 10:299-311.
11. Sreelathakumary I, Rajamony L. Variability, heritability and correlation studies in chilli (*Capsicum annuum* L.) under shade. Indian J. Hortic. Sci. 2002; 59(1):77-83.
12. Tembhurne BV, Revanappa R, Kuchanyr PH. Varietal performance, genetic variability and correlation studies in chilli (*Capsicum annuum* L.). Karnataka J Agric. Sci., 2008; 21(4):541-543.
13. Ukkund KC, Madalageri MB, Patil MP, Mulage R, Kotikal YK. Variability studies in green chilli (*Capsicum annuum* L.). Karnataka J Agric. Sci. 2007; 20(1):102-104.
14. Vani SK, Sridevi O, Salimath PM. Studies on genetic variability correlation and path analysis in chilli (*Capsicum annuum* L.). Ann. Biol. 2007; 23(2):117-121.