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Genetic divergence in chilli (*Capsicum annuum* L.) for green yield and its contributing traits under mid hill conditions of Himachal Pradesh

Madhu Sharma and Yudhvir Singh
Department of Vegetable Science and Floriculture
CSK Himachal Pradesh Krishi Vishvavidyalaya Palampur-176062, India.

Abstract

Genetic variability and genetic advance was studied in thirty chilli genotypes for two consecutive *kharif* seasons of 2005 and 2006.Genotypes differed significantly for all the characters studied. High phenotypic and genotypic coefficient of variability was observed for marketable yield per plant, average fruit weight, fruit girth, number of marketable fruits per plant, fruit length and primary branches per plant. Maximum heritability was recorded for secondary branches per plant followed by fruit girth, primary branches per plant and marketable yield per plant. Marketable green yield per plant exhibited highest genetic advance.

Key words: Chilli, variability, heritability, genetic advance, yield.

Introduction

Chilli is the most common and remunerative spice crop of Indian subcontinent. It forms an indispensable adjunct in every house of the tropical world. Though the area and production of chilli crop are increasing annually yet its average yield remains quite low due to various constraints such as non-availability of suitable cultivars/ hybrids, biotic and abiotic stresses, genetic drift in cultivars and development of new pathogenic races. Thus, for enhancing the productivity there is a pressing demand to develop high yielding varieties/hybrids enriched with good quality attributes through genetic restructuring of the chilli germplasm.

In this regard, an understanding of the magnitude and kind of variability existing in the germpool for yield and its attributes is essentially important. Heritability examines the extent of heritable portion of variability, while study of genetic advance predicts the possible gain through selection. The present investigation was undertaken with the aim to study nature and magnitude of genetic variability available for different characters in thirty chilli genotypes under mid hill conditions of Himachal Pradesh.

Material and Methods

Thirty chilli strains were grown in randomized block design with three replications for two consecutive Kharif seasons of 2005 and 2006 at the research farm of Vegetable Science and Floriculture, CSKHPKV, Palampur. Normal agronomical and plant protection measures were adopted for proper raising of the crop. Randomly selected five plants were studied in each treatment for yield and its component characters as days to 50% flowering, days to first fruit picking, primary branches per plant, secondary branches per plant, fruit length, fruit girth, average fruit weight, number of marketable fruits per plant, number of total fruits per plant, plant height and marketable yield per plant.

Pooling of data over the years (2005 and 2006) was done as Bartlett's test of homogeneity (Panse and Sukhatme, 1984) was found to be non-significant. Phenotypic and genotypic coefficient of variability, heritability and genetic advance (in terms of percentage of mean) were determined according to Burton and Devane (1953).

Results and Discussion

Varietal mean for yield and its components along with respective critical differences are given in Table 1. The strains differed significantly for the twelve characters studied. The general mean for individual yield components along with range, phenotypic and genotypic coefficient of variation, heritability (in broad sense) and genetic advance (in per cent of mean) have been given in Table 2. High phenotypic and genotypic coefficients of variation were observed for marketable yield per plant, average fruit weight, fruit girth, number of marketable fruits per plant, fruit length and primary branches per plant. These determinants revealed that considerable genetic variability was available for improvement. Days to first fruit picking exhibited the lowest variability.

Heritability in broad sense is of tremendous significance to the breeders as its magnitude indicates the reliability with which a genotype can be recognized by its phenotypic expression (Lush, 1940). Maximum heritability was recorded for secondary branches per plant (93.70) followed by fruit girth (91.90), primary branches per plant

Table1. Mean performance of chilli genotypes in relation to different horticultural traits

Sr No	Genotypes	Days to 50% flowering	Days to first fruit picking	Primary branches per plant	Secondary branches per plant	Fruit length (cm)	Fruit girth (cm)	Average fruit weight (g)	No. of marketable fruits per plant	Total number of fruits per plant	Plant height (cm)	Marketable yield per plant (g)	Harvest duration (days)
1	G-4	42.67	73.50	5.84	6.65	8.42	0.99	4.45	57.45	68.90	61.40	219.52	63.00
2	HCH-9639	50.17	81.50	4.99	5.48	11.57	0.89	6.58	43.75	55.41	68.30	261.71	52.67
3	Anugraha	47.17	75.00	5.98	6.07	8.08	0.89	3.16	54.90	64.20	48.32	196.76	62.67
4	CO-3	50.33	77.50	6.12	7.08	8.76	0.94	3.73	47.37	59.28	63.48	175.29	53.67
5	P. Yellow	45.50	74.17	6.93	7.48	8.39	1.14	6.41	43.58	54.51	70.31	268.22	52.33
6	PKM-1	54.17	81.50	6.18	7.06	8.80	1.00	4.07	43.59	54.79	67.63	140.78	51.83
7	DPCH-1	50.50	78.50	3.00	3.80	8.40	1.95	5.78	11.31	19.48	32.22	63.65	37.17
8	LCA-357	59.67	86.50	4.08	5.59	10.48	1.01	4.40	36.40	48.24	59.17	161.30	53.83
9	SKAU-SC-304-1	49.50	77.50	3.44	5.93	6.88	1.49	3.38	32.90	43.86	58.30	108.26	50.50
10	NCH-162	47.33	74.50	6.58	7.06	8.82	0.99	4.44	45.97	55.23	59.48	183.13	52.50
11	DCL-352	55.50	84.50	6.58	6.15	5.06	1.01	3.12	32.74	41.90	47.27	98.53	40.83
12	ACH-201	58.83	86.50	7.03	6.55	11.06	0.97	4.18	31.74	43.43	56.77	141.11	51.83
13	Kadyavallur Local	58.50	90.17	5.98	5.52	8.52	1.08	3.18	42.62	53.10	73.12	131.04	53.83
14	Arka Lohit	43.83	72.50	5.03	6.14	8.32	0.91	3.13	42.93	53.58	64.87	120.30	52.30
15	BC-25	51.50	82.83	5.48	5.87	8.08	1.00	3.93	32.09	44.33	53.41	107.41	52.50
16	KCA-190	52.00	83.83	5.80	5.96	8.23	0.99	3.24	40.36	50.83	58.06	126.79	51.50
17	Kashmir local	43.83	75.50	4.02	5.54	8.33	1.29	3.17	42.96	53.79	61.52	142.86	50.50
18	KCA-171	54.50	82.50	4.74	4.94	8.72	0.93	3.97	46.40	55.56	50.21	161.46	51.50
19	K-1	54.50	85.50	6.02	6.21	5.88	1.00	3.98	45.00	54.81	65.10	170.32	50.50
20	DCL-520	50.50	82.00	4.97	5.47	5.82	2.00	3.32	34.58	44.17	48.41	104.16	52.50
21	SKAU-SC-23-1	48.50	77.50	4.33	6.14	9.89	1.18	4.28	38.10	47.43	70.25	174.15	50.50
22	ACS-2000-2	50.50	79.17	3.13	5.83	10.97	1.01	6.40	24.39	34.42	64.03	157.36	51.50
23	SKAU-SC-578-1	43.00	76.83	4.97	4.83	7.82	1.10	4.55	35.49	45.58	66.56	152.91	52.50
24	SKAU-SC-101	43.17	72.50	5.13	6.90	8.25	0.99	4.57	45.40	55.33	73.27	210.47	52.50
25	DCL-524	49.50	78.50	5.09	6.81	7.83	0.98	4.86	39.18	49.30	60.21	154.10	53.50
26	Ujwala	53.33	84.83	7.17	4.98	5.04	0.81	2.38	42.17	51.78	53.62	120.21	63.50
27	Pusa Sada Bahar	58.50	87.83	6.11	7.23	5.85	1.01	2.49	52.13	61.93	42.01	142.93	62.83
28	Surajmukhi	49.50	81.50	7.93	7.18	5.84	1.19	3.32	63.96	74.07	67.29	223.10	63.67
29	Ajeet-1	51.50	79.50	4.84	5.00	6.46	1.00	4.39	33.74	45.14	52.67	135.60	46.50
30	Pant C-1	59.17	88.83	6.21	6.93	5.85	0.86	1.92	53.50	62.16	57.09	110.52	63.00
Mean		50.91	80.43	5.46	6.08	8.01	1.09	4.03	41.22	51.55	59.15	155.47	53.27
SE (d)		0.63	0.56	0.02	0.04	0.02	0.01	0.06	1.15	0.95	1.22	1.36	0.63
CD (P=0.05)		1.03	0.92	0.02	0.06	0.04	0.01	0.10	1.89	1.56	2.00	2.24	1.03
CV (%)		1.48	0.83	0.33	0.77	0.32	0.97	1.84	3.36	2.21	2.47	1.05	1.41

(91.20), marketable yield per plant (91.00), days to first fruit picking (90.30), number of marketable fruits per plant (90.20), fruit length (90.00) and days to 50% flowering (89.80). Lowest value of heritability (87.50) was recorded for harvest duration.

Johnson *et al.* (1955) stressed that for estimating the real effects of selection, heritability alone is not sufficient and genetic advance along with heritability is more useful. High heritability along with high genetic advance was recorded for marketable green yield per plant (62.75), average fruit weight (58.60), fruit girth (52.54) and number of marketable fruits per plant (50.75), whereas high heritability coupled with moderate genetic advance was recorded for primary branches per

plant (45.45), fruit length (44.92) and total number of fruits per plant (41.10). The results revealed that the inheritance of these characters is under the control of additive gene action (Panse, 1957). So, selection will be more effective for the improvement of these traits.

High heritability for harvest duration, days to 50 per cent flowering and days to first fruit picking were found to be associated with low genetic advance. The association of high heritability with low genetic advance reveals that inheritance of these characters is under the control of non-additive gene effects. Improvement of these traits through simple selection might not give desirable results and need to be improved through hybridization (Panse, 1957).

Table 2. Estimates of variability parameters for horticultural traits in chilli

Traits	Range	General mean ± SE (m)	Variance			Coefficient of variation			Heritability (h^2) (%)	Genetic advance (K=2.06)	Genetic advance (% of mean)
			Phenotypic	Genotypic	Environmental	Phenotypic (PCV)	Genotypic (GCV)	Environmental (ECV)			
Days to 50% flowering	42.67-59.67	50.91±0.44	26.34	25.76	0.57	10.08	9.97	1.48	89.80	10.34	20.31
Days to first fruit picking	72.50-88.83	80.43±0.39	25.76	21.39	0.45	6.31	5.75	0.83	90.30	10.27	12.77
Primary branches per plant	3.00-7.93	5.46±0.01	1.45	1.37	0.00	22.08	21.47	0.33	91.20	2.48	45.45
Secondary branches per plant	3.80-7.48	6.08±0.03	0.76	0.66	0.002	14.38	13.36	0.77	93.70	1.79	29.45
Fruit length (cm)	5.04-11.57	8.01±0.02	3.05	2.77	0.00	21.79	20.78	0.32	90.00	3.60	44.92
Fruit girth (cm)	0.81-2.00	1.08±0.01	0.07	0.06	0.00	25.47	23.45	0.97	91.90	0.57	52.54
Average fruit weight (g)	1.92-6.58	4.03±0.04	1.33	1.18	0.005	28.61	27.00	1.84	88.60	2.36	58.60
Number of marketable fruits/plant	11.31-63.96	41.22±0.80	106.87	105.01	1.92	25.08	24.86	3.36	90.20	20.92	50.75
Total number of fruits per plant	19.48-74.07	51.55±0.66	108.43	98.78	1.29	20.20	19.28	2.21	87.80	21.19	41.10
Plant height (cm)	32.22-73.27	59.15±0.84	92.84	79.79	2.14	16.29	15.10	2.47	89.70	19.39	32.78
Marketable yield per plant (g)	63.65-268.22	155.47±0.95	2248.50	2100.62	2.68	30.50	29.48	1.05	91.00	97.55	62.75
Harvest duration (days)	37.17-63.67	53.27±0.44	38.18	37.59	0.57	11.60	11.51	1.41	87.50	12.54	23.54

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