

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

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SUMMARY

Genetic variability, heritability, genetic advance and genetic advance as a per cent over mean for thirty two characters were assessed by field evaluation of fifty chilli accessions at College of Horticulture, Bagalkot (Karnataka) during 2010-11. High degree of variation was observed for all characters. The difference between phenotypic co-efficient of variation and genotypic co-efficient of variation were found to be narrow for most of the traits. The high estimates of heritability was found for plant spread (N-S) at 60 days (64.27%) and 120 day (65.47%) and (E-W) at 60 days (60.56%), number of fruits per plant at first picking (98.20%), early yield (94.67%), late yield (95.62%) and total yield (91.37%). The fruit characters like fruit width (96.22%), stalk length (81.04%) and ten fruit weight (96.44%), chlorophyll-a (95.45%), chlorophyll-b (97.52%), total chlorophyll (97.87%) and ascorbic acid (98.30%), fresh red chilli yield (95.18%) and dry red chilli yield (93.71%), hundred seed weight (70.67%) and number of seeds per fruit (94.67%) had also recorded high heritability.

Key Words : Green chilli, Genetic advance, Heritability, Genotypic variance, Phenotypic variance

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Chilli (*Capsicum annuum* L.) is an important spice cum vegetable crop grown in all parts of the world. It is native of Tropical America and Guatemala is the secondary centre of origin. The Portuguese introduced it into India in the later part of the 16th century (Pruthi, 1976). Chilli is the most economic additive to improve food acceptability. It is cultivated for its vegetable green fruits and dry chilli as the spice of commerce. It has different uses at matured green, red ripe and

dried stage. The pungency is due to the presence of a crystalline volatile alkaloid called capsaicin (8-methyl-N-vanillyl-6-enamide). Extract from the fruits is incorporated into pharmaceutical preparations and the colour oleoresin (capsanthin) obtained from fruits is used in the food processing industry.

Chilli is a rich source of vitamin C. It also contains vitamin A, vitamin B and minerals (Singh *et al.*, 2007). In India, dry chilli is grown over an area of 7.92 lakh hectares with a production of 12.23 lakh tonnes and the productivity of 1.5 tonnes per hectare (Anonymous, 2011). Indian chillies reach over 90 countries in the world. Sri Lanka, USA, UAE, Pakistan, Bangladesh, Saudi Arabia and Malaysia are the important markets for Indian chillies. The productivity of the crop is low and there is need for development of new varieties and hybrids with high productivity. The critical assessment of nature and magnitude of variability in the germplasm stock is one of the important pre-requisites for formulating effective breeding methods as the genetic improvement of any crop depends on magnitude of genetic variability and the extent of heritability of economically important characters, though the part played by environment in the expression of such character also needs to be taken into account. Much of the earlier works in chilli

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were mainly directed towards the red chilli (Awasti *et al.*, 1970 and Hiremath and Mathapati, 1977). Information available on these aspects on green chilli is quite meagre (Basavaraj, 1997). Therefore, a field investigation was carried out with a view to study the genetic variability, heritability and genetic advance in green chilli yield and quality by assessing the chilli germplasm stock maintained at College of Horticulture,

Bagalkot (Karnataka).

MATERIAL AND METHODS

Fifty genetically diverse chilli accessions comprising of established varieties and advanced breeding lines were grown in a Randomized Block Design with two replications during

Table 1: Analysis of variance (mean sum of squares) for growth, earliness, yield and quality parameters in chilli

Sr. No.	Source of variation / character	Replication	Genotypes	Error	S.E. \pm	C.D.	C.D.
						@ 1%	@ 5%
Degrees of freedom		1	49	49			
Growth parameters							
1.	Plant height at 60 days (cm)	204.77	123.25	39.66	4.45	16.87	12.66
2.	Plant height at 120 days (cm)	1073.80	141.52	37.19	4.31	16.34	12.26
3.	Primary branches at 60 days	2.16	1.78	1.23	0.79	NS	NS
4.	Primary branches at 120 days	1.14	1.98	0.34	0.41	1.57	1.18
5.	Secondary branches at 60 days	56.10	3.87	2.85	2.85	NS	NS
6.	Secondary branches at 120 days	0.27	5.67	1.12	0.75	2.83	2.13
7.	Tertiary branches at 60 days	37.82	115.11	7.74	1.97	7.45	5.59
8.	Tertiary branches at 120 days	0.24	125.34	8.31	2.04	7.73	5.80
9.	Plant spread (N-S) at 60 days (cm)	82.02	108.32	23.55	3.43	13.00	9.75
10.	Plant spread (N-S) at 120 days (cm)	18.34	109.28	22.80	3.38	12.79	9.60
11.	Plant spread (E-W) at 60 days (cm)	14.94	69.44	17.05	2.92	11.06	8.30
12.	Plant spread (E-W) at 120 days (cm)	331.82	62.49	24.10	3.47	13.15	9.87
Earliness parameters							
13.	Days to first flowering	8.41	57.08	9.87	2.22	8.42	6.32
14.	Days to 50% flowering	31.36	50.74	15.46	2.78	10.53	7.90
15.	Days to fruit set	24.01	55.35	26.86	3.67	13.89	10.42
Yield parameters							
16.	Number of fruits/plant at first picking	0.81	173.35	1.57	0.89	3.36	2.52
17.	Total number of fruits /plant	42.45	3230.50	71.93	6.00	22.72	17.04
18.	Early yield (g/plant)	835.90	9905.67	257.76	11.35	43.02	32.26
19.	Late yield (g/plant)	2.98	4790.52	107.26	7.32	27.75	20.81
20.	Total yield (g/plant)	3973.28	17582.99	792.74	19.91	75.45	56.58
Green fruit characters							
21.	Fruit length (cm)	0.01	9.83	9.83	0.47	1.79	1.35
22.	Fruit width (cm)	0.04	1.30	0.02	0.11	0.42	0.32
23.	Stalk length (cm)	0.00	0.68	0.07	0.19	0.71	0.54
24.	Ten fruit weight (g)	20.25	1131.67	20.49	3.20	12.13	9.10
Quality parameters							
25.	Ascorbic acid (mg/100g)	1162.81	3796.29	32.40	4.03	15.25	11.44
26.	chlorophyll-“a”(mg/100g)	3.04	0.00	3.12	0.00	0.01	0.01
27.	chlorophyll-“b” (mg/100g)	2.49	0.00	1.79	0.00	0.01	0.01
28.	Total chlorophyll	5.94	0.00	5.86	0.01	0.02	0.02
Red chilli parameters							
29.	Fresh weight of red chilli (g)/plant	175.64	4759.20	117.40	7.66	29.03	21.77
30.	Dry weight of red chilli (g)/plant	313.29	1034.53	33.57	4.10	15.52	11.64
31.	Hundred seed weight (g)	0.143	0.020	0.003	0.04	0.15	0.12
32.	Number of seeds/fruit	1260.25	3997.88	109.39	7.40	28.02	21.02

NS=Non-significant

Khariif 2010-11. Each experimental plot comprised of single row of ten plants. From each plot three plants were randomly selected for recording observations on plant height (cm), primary branches, secondary branches, tertiary branches, days to first flowering, days to fifty per cent flowering, days to fruit set, number of fruits per plant at first picking, fruit length (cm), fruit girth (cm), early yield, late yield and total green chilli yield per plant, red chilli yield, dry chilli yield and quality parameters. Genotypic co-efficient of variation and phenotypic

co-efficient of variation were computed by the method of Burton and Devane (1953). Heritability (broad sense), genetic advance (GA) and genetic advance as a per cent over mean (GAM) were worked by following the methods suggested by Falconer (1981) and Robinson *et al.* (1949).

RESULTS AND DISCUSSION

The analysis of variance was conducted to test significant differences among genotypes studied. The mean

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

Sr. No.	Characters	Range	Mean	GV	PV	GCV (%)	PCV (%)	h^2 (%)	GA	GAM (%)
Growth parameters										
1.	Plant height at 60 days (cm)	32.60-63.30	50.58	41.79	81.46	12.78	17.84	51.30	9.54	18.86
2.	Plant height at 120 days (cm)	40.67-82.30	58.62	52.16	89.35	12.32	16.12	58.37	11.37	19.39
3.	Primary branches at 60 days	2.15-6.15	3.37	0.27	1.51	15.59	36.47	18.27	0.46	13.64
4.	Primary branches at 120 days	3.50-8.50	5.82	0.82	1.16	15.56	18.54	70.45	1.57	26.97
5.	Secondary branches at 60 days	4.30-9.30	6.48	0.50	3.36	10.99	28.30	15.07	0.57	8.79
6.	Secondary branches at 120 days	5.33-14.17	9.74	2.27	3.39	15.47	18.91	66.95	2.54	26.07
7.	Tertiary branches at 60 days	8.80-40.15	23.89	53.68	61.43	30.67	32.81	87.39	14.11	59.06
8.	Tertiary branches at 120 days	13.17-45.50	27.40	58.51	66.83	27.91	29.83	87.55	14.74	53.79
9.	Plant spread (N-S) at 60 days (cm)	24.80-56.30	40.99	42.38	65.94	15.88	19.80	64.27	10.75	26.22
10.	Plant spread (N-S) at 120 days (cm)	27.65-60.13	45.21	43.24	66.04	14.54	17.97	65.47	10.96	24.24
11.	Plant spread (E-W) at 60 days (cm)	25.30-48.95	39.41	26.19	43.25	12.98	16.68	60.56	8.21	20.83
12.	Plant spread (E-W) at 120 days (cm)	31.65-56.97	45.47	19.19	43.30	9.63	14.47	44.32	6.01	13.21
Earliness parameters										
13.	Days to first flowering	15.50-43.50	28.23	23.60	33.48	17.20	20.49	70.49	8.40	29.75
14.	Days to 50% flowering	24.50-50.00	37.08	17.64	33.10	11.32	15.51	53.28	6.32	17.04
15.	Days to fruit set	27.00-51.50	44.85	14.24	41.10	8.41	14.29	34.64	4.58	10.20
Yield parameters										
16.	Number of fruits/plant at first picking	1.30-54.80	11.93	85.89	87.46	77.68	78.39	98.20	18.92	158.59
17.	Total number of fruits/ plant	13.17-192.89	77.04	1579.28	1651.21	51.58	52.74	95.64	80.05	103.42
18.	Early yield (g/plant)	35.80-387.60	155.98	4823.95	5081.71	44.52	45.70	94.67	139.02	89.12
19.	Late yield (g/plant)	8.05-232.00	91.21	2341.63	2448.89	53.05	54.25	95.62	97.47	106.86
20.	Total yield (g/plant)	69.15-549.40	247.26	8395.12	9187.87	37.05	38.76	91.37	180.42	72.96
Green fruit characters										
21.	Fruit length (cm)	2.30-12.35	6.16	4.68	5.14	35.14	36.80	91.22	4.26	10.79
22.	Fruit width (cm)	0.35-3.60	1.44	0.63	0.66	55.39	56.47	96.22	1.61	111.80
23.	Stalk length (cm)	1.15-3.90	2.58	0.30	0.38	21.53	23.92	81.04	1.03	39.92
24.	Ten fruit weight (g)	10.50-133.50	39.45	555.59	576.08	59.74	60.84	96.44	47.68	120.86
Quality parameters										
25.	Ascorbic acid (mg/100 g)	30.00-247.50	86.01	1881.9469	1914.3488	50.43	50.86	98.30	88.60	103.01
26.	chlorophyll-"a" (mg/100 g)	0.03-0.17	0.06	0.0007	0.0007	40.24	41.19	95.45	0.052	86.66
27.	chlorophyll-"b" (mg/100 g)	0.03-0.17	0.06	0.0007	0.0007	41.56	42.08	97.52	0.053	88.33
28.	Total chlorophyll (mg/100 g)	0.06-0.34	0.13	0.0027	0.0028	40.84	41.28	97.87	0.106	81.53
Red chilli parameters										
29.	Fresh weight of red chilli (g)/plant	18.80-199.15	100.66	2320.90	2438.30	47.85	49.05	95.18	96.82	96.18
30.	Dry weight of red chilli (g)/plant	14.00-93.00	53.71	500.47	534.05	41.65	43.02	93.71	44.61	83.05
31.	Hundred seeds weight (g)	0.33-0.85	0.55	0.0084	0.0119	16.73	19.91	70.67	0.15	27.27
32.	Number of seeds/fruit	32.00-301.00	95.05	1944.24	2053.63	46.38	47.67	94.67	88.38	92.98

GV = Genotypic variance, PV = Phenotypic variance, GCV = Genotypic co-efficient of variance, GA = Expected genetic advance, PCV = Phenotypic co-efficient of variance, h^2 = Heritability (broad sense), GAM = Genetic advance (per cent mean)

Table 3a: Per se performance of chilli genotypes for growth parameters

Sr. No.	Name	Plant height (cm)		Primary branches		Secondary branches		Tertiary branches	
		60 days	120 days	60 days	120 days	60 days	120 days	60 days	120 days
1.	SSD	44.30	61.15	2.95	5.17	5.65	9.30	17.15	21.30
2.	Halga-Local	37.50	44.13	2.60	4.17	5.15	8.60	10.30	13.47
3.	Chaina Chilli (JintaVariety)	45.95	53.32	2.80	5.33	5.30	8.60	15.80	20.47
4.	BGM-Yellow	32.60	40.67	2.30	4.30	4.45	7.98	8.80	14.32
5.	Intermediate Capsicum	35.65	43.00	2.30	5.00	5.60	5.33	12.80	18.33
6.	CW x I-CSPC	42.15	52.33	2.60	4.17	4.50	9.50	10.80	14.48
7.	BGN2 x S-33	41.60	49.15	4.15	5.82	5.80	9.83	11.95	16.00
8.	IC-SPC	42.65	50.00	3.10	6.10	6.15	10.32	12.60	13.17
9.	Pusa-Jwala	52.15	60.00	3.30	5.95	7.45	11.16	16.80	19.66
10.	NO-52	41.00	49.50	3.65	6.50	6.80	10.00	16.45	22.50
11.	NO-58A	53.15	57.83	2.30	5.67	4.80	8.67	21.80	26.67
12.	GCS-94-53	49.45	56.66	2.65	5.66	5.50	9.50	18.65	24.16
13.	GPC-82	48.15	55.83	3.80	7.30	8.30	11.33	25.00	30.66
14.	CW x NS-33	33.30	41.50	2.15	5.50	4.30	8.67	12.60	17.30
15.	GCS-94-10	54.15	64.30	3.30	7.30	7.15	9.65	29.80	45.50
16.	GC -0710	59.95	67.30	4.00	5.80	7.30	11.00	26.30	31.00
17.	EC-28DPS-06-01	55.80	64.17	2.65	5.65	5.30	8.66	23.15	28.80
18.	GC-0708	58.00	82.30	4.50	5.70	7.80	10.17	27.60	32.97
19.	GC-07-03	52.65	62.67	5.65	5.83	8.30	11.17	33.45	38.17
20.	CH-1	53.80	62.65	6.15	5.50	5.80	10.83	20.90	25.97
21.	PMR-21 x PANT-C-1	55.45	61.00	3.60	5.67	7.8	11.50	29.80	32.67
22.	HC-0708	50.65	60.30	2.80	5.33	5.5	8.65	24.30	29.30
23.	EC-33DCS-06-01	43.50	51.13	3.65	6.33	8.65	14.00	35.50	39.50
24.	GC-0705	48.65	57.48	3.45	5.83	6.15	8.67	22.30	24.83
25.	HC-0705	54.80	61.82	2.30	5.33	6.45	9.82	29.80	32.67
26.	HC-0707	40.60	47.00	3.95	5.33	6.5	8.80	32.50	34.67
27.	GC-0702	51.45	58.00	3.65	5.73	5.95	9.48	33.15	36.67
28.	HC-0715	52.10	60.65	3.80	6.17	7.6	11.13	28.80	16.17
29.	EC-28-DPS-06-01	51.45	59.30	2.15	5.5	4.5	8.00	26.80	31.17
30.	HC-0702	55.45	64.17	3.60	6.5	7.8	11.30	29.15	32.67
31.	HC-0711	60.80	67.65	3.15	5.98	6.45	10.13	28.65	32.67
32.	HC-0716	57.60	63.33	4.30	6.97	8.45	11.50	36.65	38.83
33.	COS-1	43.80	50.87	2.80	6.48	5.45	8.17	24.65	28.83
34.	EC-13DCS-06-01	52.80	60.48	2.45	6.65	4.95	7.33	21.50	25.50
35.	EC-33DCS-06-02	45.65	53.47	2.80	3.50	5.65	8.97	25.50	31.00
36.	HC-0718	42.30	49.17	4.80	8.17	9.30	14.17	30.50	32.83
37.	ES-32-DPS-06-01	61.30	68.17	2.80	4.83	7.65	10.13	19.65	22.67
38.	DC-10D-06-01	62.45	69.13	3.80	5.00	8.65	10.98	29.80	30.50
39.	HC-0714	50.15	56.67	2.45	4.67	6.15	8.82	27.50	26.30
40.	Cholachagudda local (BCM-1)	54.80	65.8	4.65	7.17	8.95	11.83	40.15	43.00
41.	Arka Lohith	60.30	68.32	5.30	7.15	8.95	11.00	30.00	33.67
42.	DCA-58	58.30	65.97	3.00	6.30	6.30	8.80	28.15	30.65
43.	DCA-60	57.95	62.30	3.10	5.80	8.10	11.15	29.15	31.80
44.	DCA-77	51.15	58.30	3.15	8.50	6.30	11.83	24.15	25.80
45.	DCA-187	56.00	61.65	3.10	6.15	6.15	10.50	21.50	25.50
46.	DCA-192	63.30	71.15	5.00	7.45	7.45	9.30	31.95	35.80
47.	DCA-195	59.15	65.80	2.65	5.30	4.95	7.50	24.50	28.50
48.	DCA-199	55.80	61.45	4.15	4.65	5.30	8.10	14.50	17.65
49.	DCA-202	56.30	64.60	2.15	5.15	4.45	6.30	15.50	17.80
50.	DCA-203	40.80	47.65	3.10	5.15	6.15	9.15	25.50	25.65
Mean		50.58	58.62	3.37	5.82	6.48	9.74	23.89	27.40
S.E.±		4.45	4.31	0.79	0.41	1.20	0.75	1.97	2.040
C.D. (P=0.05)		12.66	12.26	2.23	1.18	3.40	2.13	5.59	5.80
C.V.		12.45	10.40	32.97	10.08	26.09	10.87	11.65	10.53

Table 3b: Per se performance of chilli genotype for green chilli yield and yield components

Sr. No.	Name	Number of fruits/ plant at first picking	Total number of fruits/ plant	Early yield (g/plant)	Late yield (g/plant)	Total yield (g/plant)	Fruit length (cm)
1.	SSD	19.65	124.80	306.32	69.15	375.45	7.05
2.	Halga-Local	4.80	25.60	128.45	40.58	169.03	2.30
3.	Chaina Chilli (JintaVariety)	15.80	49.98	182.80	114.4	297.20	5.75
4.	BGM-Yellow	4.50	21.05	104.10	43.15	147.25	3.05
5.	Intermediate Capsicum	6.30	26.37	207.00	8.05	215.05	2.55
6.	CW x I-CSPC	4.45	19.32	106.55	29.00	135.55	2.30
7.	BGN2 x S-33	4.00	40.26	226.50	55.42	281.92	3.00
8.	IC-SPC	6.30	61.49	149.65	34.83	184.48	7.10
9.	Pusa-Jwala	20.30	43.09	214.50	87.15	301.65	3.90
10.	NO-52	7.15	41.14	206.30	83.00	289.30	4.10
11.	NO-58A	18.80	146.62	160.95	58.95	219.90	5.75
12.	GCS-94-53	4.80	60.45	121.65	30.40	152.05	6.85
13.	GPC-82	15.50	118.65	156.45	200.00	356.45	8.65
14.	CW x NS-33	3.15	13.17	90.65	11.45	102.10	5.55
15.	GCS-94-10	16.10	99.30	169.15	43.80	212.95	9.90
16.	GC -0710	1.80	107.50	79.10	173.15	252.25	9.40
17.	EC-28DPS-06-01	26.50	48.05	253.35	116.50	369.85	8.35
18.	GC-0708	5.60	66.00	146.65	140.50	287.15	8.55
19.	GC-07-03	4.15	173.60	149.95	232.00	381.95	7.15
20.	CH-1	4.60	77.41	125.50	117.80	243.30	4.90
21.	PMR-21 x PANT-C-1	8.80	99.80	132.85	91.15	224.00	5.20
22.	HC-0708	9.50	39.61	178.45	172.15	350.60	8.50
23.	EC-33DCS-06-01	21.50	98.22	118.85	102.15	221.00	5.45
24.	GC-0705	9.65	80.71	79.60	134.30	213.90	6.70
25.	HC-0705	18.30	192.89	387.60	161.80	549.40	12.35
26.	GC-0702	11.50	82.71	93.25	51.50	144.75	4.65
27.	HC-0715	23.15	155.98	200.60	158.15	358.75	6.45
28.	HC-0715	8.50	117.04	186.65	59.15	245.80	4.95
29.	EC-28-DPS-06-01	14.65	87.50	153.00	122.65	275.65	3.80
30.	HC-0702	26.15	68.00	320.45	91.00	411.45	9.45
31.	HC-0711	11.00	71.80	134.30	113.50	247.80	9.60
32.	HC-0716	18.65	129.50	241.65	76.50	318.15	5.20
33.	COS-1	11.50	68.02	137.41	73.30	210.71	6.65
34.	EC-13DCS-06-01	9.30	102.28	114.30	116.00	230.30	4.30
35.	EC-33DCS-06-02	25.15	101.77	260.15	91.50	351.65	4.50
36.	HC-0718	15.50	75.00	90.65	56.13	146.78	5.80
37.	ES-32-DPS-06-01	6.50	36.72	125.05	78.80	203.85	6.15
38.	DC-10D-06-01	12.50	95.20	122.05	140.15	262.20	6.10
39.	HC-0714	20.65	83.29	251.00	157.15	408.15	6.50
40.	Cholachagudda local (BCM-1)	2.50	57.03	38.50	30.65	69.15	2.70
41.	Arka Lohith	1.30	75.90	89.35	81.30	174.68	6.20
42.	DCA-58	11.80	67.09	161.4	123.80	285.20	7.60
43.	DCA-60	6.50	73.81	107.00	110.80	217.80	5.80
44.	DCA-77	4.50	26.92	35.80	66.50	102.30	7.50
45.	DCA-187	4.50	64.62	117.40	53.80	171.20	7.65
46.	DCA-192	9.30	62.80	149.55	72.00	221.55	9.60
47.	DCA-195	6.80	122.96	144.70	70.50	215.20	7.15
48.	DCA-199	5.48	58.96	159.10	73.80	232.90	5.55
49.	DCA-202	4.50	51.73	72.75	77.30	150.05	3.75
50.	DCA-203	13.30	40.18	109.80	63.50	173.30	6.10
Mean		11.93	77.04	155.98	91.21	247.26	6.16
S.E.±		0.89	6.00	11.35	7.32	19.91	0.47
C.D. (P=0.05)		2.52	17.04	32.26	20.81	56.58	1.35
C.V.		10.51	11.01	10.29	11.36	11.39	10.9

Table 3c: Per se performance of chilli genotypes for green chilli fruit quality parameters

Sr. No.	Name	Fruit width (cm)	Stalk length (cm)	Ten fruit weight (g)	Ascorbic acid (mg/100g)	Chlorophyll (mg/100g)		
						a	b	Total (a+b)
1.	SSD	1.95	3.80	32.50	220.50	0.05	0.04	0.09
2.	Halga-Local	2.20	2.05	57.50	185.00	0.03	0.03	0.06
3.	Chaina Chilli (Jinta Variety)	1.08	2.60	42.00	152.50	0.05	0.05	0.09
4.	BGM-Yellow	3.05	1.85	74.00	247.50	0.05	0.05	0.09
5.	Intermediate Capsicum	3.15	1.25	79.00	55.00	0.04	0.04	0.08
6.	CW x 1-CSPC	3.30	1.15	50.50	75.00	0.05	0.05	0.10
7.	BGN2 x S-33	1.65	1.80	70.00	57.50	0.05	0.05	0.09
8.	IC-SPC	1.95	3.90	33.50	52.50	0.07	0.06	0.13
9.	Pusa-Jwala	1.65	1.50	72.50	155.00	0.08	0.08	0.16
10.	NO-52	1.25	2.80	10.50	110.00	0.06	0.06	0.13
11.	NO-58A	1.00	2.05	11.50	35.00	0.08	0.06	0.14
12.	GCS-94-53	0.55	3.20	30.50	75.00	0.05	0.05	0.10
13.	GPC-82	0.85	3.05	30.50	77.50	0.06	0.06	0.12
14.	CW x NS-33	3.45	2.30	77.00	55.00	0.06	0.06	0.11
15.	GCS-94-10	0.95	3.10	21.50	62.50	0.05	0.05	0.10
16.	GC -0710	0.55	2.90	23.50	115.00	0.05	0.05	0.10
17.	EC-28DPS-06-01	1.40	2.30	77.00	85.00	0.06	0.06	0.12
18.	GC-0708	0.95	2.75	43.50	95.00	0.09	0.09	0.17
19.	GC-07-03	1.90	3.60	22.00	65.00	0.07	0.07	0.14
20.	CH-1	1.95	1.90	31.50	95.00	0.06	0.06	0.12
21.	PMR-21 x PANT-C-1	0.90	2.95	22.50	55.00	0.05	0.05	0.09
22.	HC-0708	1.15	2.30	87.50	95.00	0.04	0.04	0.07
23.	EC-33DCS-06-01	1.15	2.10	22.50	95.00	0.04	0.04	0.09
24.	GC-0705	0.85	2.45	26.50	65.00	0.05	0.05	0.11
25.	HC-0705	1.95	2.95	133.50	95.00	0.06	0.06	0.12
26.	HC-0707	0.80	2.30	17.50	75.00	0.07	0.06	0.13
27.	GC-0702	1.10	2.80	23.00	145.00	0.08	0.08	0.16
28.	HC-0715	1.25	2.30	21.00	75.00	0.04	0.04	0.09
29.	EC-28-DPS-06-01	1.45	2.30	31.50	75.00	0.05	0.05	0.10
30.	HC-0702	0.90	3.15	60.50	37.50	0.05	0.05	0.10
31.	HC-0711	1.08	2.95	34.50	65.00	0.06	0.06	0.13
32.	HC-0716	0.95	3.05	24.50	85.00	0.05	0.05	0.10
33.	COS-1	0.95	3.05	31.00	75.00	0.04	0.04	0.08
34.	EC-13DCS-06-01	1.10	2.45	22.50	65.00	0.06	0.06	0.12
35.	EC-33DCS-06-02	1.05	2.25	34.50	77.50	0.05	0.05	0.10
36.	HC-0718	2.00	3.00	23.50	45.00	0.05	0.05	0.10
37.	ES-32-DPS-06-01	3.00	2.75	55.50	95.00	0.05	0.05	0.10
38.	DC-10D-06-01	0.70	2.00	27.50	75.00	0.05	0.05	0.10
39.	HC-0714	0.75	2.20	49.00	85.00	0.07	0.07	0.14
40.	Cholachagudda local (BCM-1)	3.60	2.35	11.50	65.00	0.17	0.17	0.34
41.	Arka Lohith	0.35	2.60	22.50	85.00	0.09	0.09	0.19
42.	DCA-58	0.90	3.10	42.50	75.00	0.15	0.15	0.31
43.	DCA-60	1.25	2.85	29.50	85.00	0.07	0.08	0.15
44.	DCA-77	1.95	3.15	38.00	115.00	0.05	0.05	0.10
45.	DCA-187	1.00	2.40	26.50	30.00	0.06	0.06	0.12
46.	DCA-192	1.00	2.95	34.50	35.00	0.12	0.12	0.24
47.	DCA-195	0.55	2.95	17.50	65.00	0.07	0.09	0.16
48.	DCA-199	1.20	3.00	39.50	65.00	0.09	0.09	0.18
49.	DCA-202	1.00	2.40	29.00	45.00	0.09	0.09	0.17
50.	DCA-203	1.45	1.95	42.50	85.00	0.07	0.07	0.14
Mean		1.44	2.58	39.45	86.01	0.06	0.06	0.13
S.E.±		0.11	0.19	3.20	4.03	0.00	0.00	0.01
C.D. (P=0.05)		0.32	0.54	9.10	11.44	0.01	0.01	0.02
C.V.		10.97	10.42	11.48	6.62	8.79	6.63	6.01

Table 3d: Per se performance of chilli genotypes for red chilli parameter

Sr. No.	Name	Red chilli (g)		Hundred seed weight (g)	Seeds per fruit
		Fresh weight	Dry weight		
1.	SSD	60.65	30.50	0.56	127.00
2.	Halga-Local	30.50	22.00	0.55	160.50
3.	Chaina Chilli (Jinta Variety)	131.30	50.00	0.38	100.00
4.	BGM-Yellow	31.50	22.00	0.45	301.00
5.	Intermediate Capsicum	18.80	14.00	0.55	91.50
6.	CW x1-CSPC	25.65	16.50	0.40	186.50
7.	BGN2 x S-33	84.15	55.00	0.50	85.00
8.	IC-SPC	43.30	33.00	0.37	201.00
9.	Pusa-Jwala	94.30	49.00	0.59	72.50
10.	NO-52	51.50	24.50	0.52	51.50
11.	NO-58A	34.95	24.00	0.58	55.50
12.	GCS-94-53	68.50	24.00	0.54	71.50
13.	GPC-82	112.60	90.00	0.67	76.50
14.	CW x NS-33	58.80	46.50	0.71	71.50
15.	GCS-94-10	85.65	39.50	0.49	89.00
16.	GC -0710	149.65	89.00	0.50	62.50
17.	EC-28DPS-06-01	130.30	55.00	0.66	67.50
18.	GC-0708	169.65	57.50	0.67	76.50
19.	GC-07-03	82.15	57.00	0.47	42.50
20.	CH-1	60.30	44.00	0.56	131.50
21.	PMR-21 x PANT-C-1	120.50	76.50	0.63	61.50
22.	HC-0708	199.15	72.50	0.48	111.50
23.	EC-33DCS-06-01	108.50	82.50	0.46	109.50
24.	GC-0705	111.30	80.00	0.51	92.50
25.	HC-0705	156.65	93.00	0.58	113.00
26.	HC-0707	69.17	43.00	0.52	88.00
27.	GC-0702	186.80	78.50	0.51	95.50
28.	HC-0715	149.50	86.50	0.65	69.50
29.	EC-28-DPS-06-01	130.00	77.50	0.50	70.00
30.	HC-0702	150.00	83.50	0.60	85.50
31.	HC-0711	63.50	21.50	0.58	44.00
32.	HC-0716	160.15	89.50	0.57	83.00
33.	COS-1	149.30	60.00	0.52	48.00
34.	EC-13DCS-06-01	69.50	30.00	0.43	60.00
35.	EC-33DCS-06-02	97.15	64.00	0.56	109.50
36.	HC-0718	56.50	32.00	0.33	87.50
37.	ES-32-DPS-06-01	195.30	68.50	0.59	110.50
38.	DC-10D-06-01	162.30	75.50	0.55	32.00
39.	HC-0714	100.00	64.50	0.56	97.50
40.	Cholachagudda local (BCM-1)	55.65	44.00	0.60	94.50
41.	Arka Lohith	151.65	67.50	0.66	89.50
42.	DCA-58	73.65	55.00	0.47	119.50
43.	DCA-60	159.80	67.50	0.85	82.50
44.	DCA-77	132.30	63.00	0.69	125.00
45.	DCA-187	62.00	30.00	0.45	62.50
46.	DCA-192	137.65	67.50	0.75	132.00
47.	DCA-195	119.15	55.00	0.59	77.50
48.	DCA-199	69.80	45.00	0.46	78.50
49.	DCA-202	51.00	25.00	0.44	101.00
50.	DCA-203	60.95	44.00	0.67	100.50
Mean		100.66	53.71	0.55	95.05
S.E.±		7.66	4.10	0.04	7.40
C.D. (P=0.05)		21.77	11.64	0.12	21.02
C.V.		10.76	10.79	10.78	11.00

sum of squares due to various sources for different character are presented in Table 1. The genotypic and phenotypic co-efficient of variability, heritability and genetic advance as per cent over mean (GAM) for each of the characters are presented in Table 2. High heritability with high GAM was recorded for most of growth as well as yield characters *viz.*, number of fruits per plant, early yield, late yield and total yield indicating the predominance of additive gene components in governing these traits. Thus, there is ample scope for improving these characters based on direct selection from the genetic stock studied.

The difference between the genotypic co-efficient of variation (GCV) and phenotypic co-efficient of variation (PCV) were found to be narrow for most of the characters. The results suggest that these traits are least affected by environment and selection for these traits on phenotypic would be rewarding. For rest of the characters, the estimates of PCV were greater than GCV. This indicates that the variation for these traits is not only by genotypes but also due to environment. Selection based on phenotypes may mislead as their expression depends more on, environmental factors. Similar observations were reported in chilli by Shah *et al.* (1986) and Shirsat (1994).

In the present study, most of the characters exhibited high estimates of heritability except for plant height at 60 and 120 days, primary and secondary branches at 60 days and plant spread (E-W) at 120 and days to 50 per cent flowering, days to fruit set. The high estimates of heritability for days to first flowering (70.49%), number of fruits per plant at first picking (98.20%), total number of fruits per plant (95.64%), early yield (94.67%), late yield (95.62%), total yield (91.37%), fruit length (91.22%), fruit width (96.22%), stalk length (81.04%), ten fruit weight (96.44%), ascorbic acid (98.30%), chlorophyll-“a” (95.45%), chlorophyll-“b” (97.52%), total chlorophyll (97.87%), fresh weight of red chilli (95.18%), dry weight of red chilli (93.71%), hundred seeds weight (70.67%) and number of seeds per fruit (94.67%) suggest that selection will be effective for these characters. These results are in conformity with those of Sahoo *et al.* (1989) and Amarchandra *et al.* (1990). High heritability along with high genetic advance is an important factor for predicting the resultant effect for selecting the best individuals. In the present study, high heritability was accompanied with high values of genetic advance for early yield, late yield, total yield, ten fruit weight, ascorbic acid, fresh weight of red chilli and dry weight of red chilli indicating predominance of additive gene component. Thus, there is ample scope for improving these characters based on direct selection. High heritability with moderate genetic advance noticed for plant height at 120 days, tertiary branches at 60 and 120 days, plant spread (N-S) at 60 and 120 days, number of fruits per plant at first picking, ten fruit weight

implied equal importance of additive and non additive gene action. These results are in agreement with the earlier findings of Rani *et al.* (1996) and Shah *et al.* (1986). From the present (Table 3) study based on their *per se* performance the genotypes the top performing genotypes, HC - 0705, DCA - 199, EC - 28 DPS - 06 - 01, EC - 33 DCS - 06 - 02, HC - 0714, EC - 33 DCS - 06 - 01 and SSD can be further assessed for stability so as to exploit them for commercial cultivation.

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