

## Genetic Variability Studies in Chilli (*Capsicum annuum* L.) for Growth and Early Yield

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### ABSTRACT

Genetic variability, heritability, genetic advance and genetic advance as a percent over mean for fifteen 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 coefficient of variation and genotypic coefficient 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%) and early yield (94.67%).

**Key words:** Green chilli, early yield, Genetic advance, heritability, genotypic variance, phenotypic variance.

### INTRODUCTION

Chilli (*Capsicum annuum* L.) is emerging as one of the commercial vegetable crops at the global level and is probably most important vegetable after Tomato<sup>6</sup>. Chilli finds its place in spice as well as condiments. Particularly in India, there is no home which does not consume chilli. It is used both at green and dry stage and is used and marketed as a whole and as well as ground powder form. It finds a place in pharmaceuticals also. Southern states of India contribute maximum to India's area and

production. Maximum diversity can be noticed among different cultivars available in India and outside with respect to shape, size, yield, quality and other traits. Identification of a variety better suited for a particular region and its improvement is of immediate task to exploit its potential. Chilli is a rich source of vitamin C. It also contains vitamin A, vitamin B and minerals<sup>14</sup>. 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<sup>1</sup>.

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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 were mainly directed towards the red chilli<sup>3,7</sup>. Information available on these aspects on green chilli is quite meager<sup>4</sup>. Therefore, a field investigation was carried out with a view to study the genetic variability, heritability and genetic advance in growth and early yield parameters by assessing the chilli germplasm stock maintained at College of Horticulture, Bagalkot (Karnataka).

#### MATERIALS AND METHODS

Fifty genetically diverse chilli accessions comprising of established varieties and advanced breeding lines were grown in a randomized block design with three replications during *kharif* 2010-2011. 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, early yield. Genotypic coefficient of variation and phenotypic coefficient of variation were computed by the method of Burton and Devane<sup>5</sup>. Heritability (broad sense), genetic advance (GA) and genetic advance as a percent over mean (GAM) were worked by following the methods suggested by Falconer<sup>8</sup> and Robinson *et al*<sup>10</sup>.

#### RESULTS AND DISCUSSION

The analysis of variance was computed to test significant difference among genotypes studied. The mean sum of squares due to various sources for different character are presented in (Table-1). The genotypic and phenotypic coefficient of variability, heritability and genetic advance as percent over mean 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 including number of fruits per plant and early 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 coefficient of variation (GCV) and phenotypic coefficient 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 phenotype 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 phenotype may not be rewarding as their expression depends more on environmental factors. Similar observations were reported in chilli by Shah *et al.*<sup>11</sup> and Shirsat<sup>13</sup>.

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, days to 50% flowering and 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%) and early yield (94.67%) suggest that selection will be effective for these characters. These results are in conformity with those of Sahoo *et al.*<sup>12</sup> and Amarchandra *et al.*<sup>2</sup>. 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 of green 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 implied equal importance of additive and non-additive gene action. These results are agreement with the earlier findings of Rani *et al.*<sup>9</sup> and Shah *et al.*<sup>11</sup>.

**Table 1: Analysis of variance (mean sum of squares) for growth, earliness parameters in chilli (*Capsicum annum L.*)**

Sl. No.	Source of variation / character	Replication	Geno types	Error	SED	CD	CD
						@1%	@5%
Degrees of freedom		1	49	49			
<b>A. Growth parameters</b>							
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
<b>B. Earliness parameters</b>							
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
16	Early yield	835.90	9905.67	257.76	11.35	43.02	32.26

**Table 2: Estimates of mean, range, components of variance, heritability and genetic advance for growth, earliness and early yield in chilli (*Capsicum annum L.*)**

Sl. No.	Character	Range	Mean	GV	PV	GCV (%)	PCV (%)	h <sup>2</sup> (%)	GA	GAM (%)
<b>A. Growth parameters</b>										
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
<b>B) Earliness parameters</b>										
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
16.	Early yield	35.80-387.60	155.98	4823.95	5081.71	44.52	45.70	94.67	139.02	89.12

Table 3 contd...

Sl. 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
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
	<b>Mean</b>	<b>50.58</b>	<b>58.62</b>	<b>3.37</b>	<b>5.82</b>	<b>6.48</b>	<b>9.74</b>	<b>23.89</b>	<b>27.40</b>
	S. Em±	4.45	4.31	0.79	0.41	1.20	0.75	1.97	2.040
	C.D. at 5%	12.66	12.26	2.23	1.18	3.40	2.13	5.59	5.80
	CV	12.45	10.40	32.97	10.08	26.09	10.87	11.65	10.53

Table 3a contd...

Sl. No.	Name	Plant spread (N-S) (cm)		Plant spread (E-W) (cm)		Days to first flowering	Days to 50% flowering	Days to fruit set	Early yield (g/plant)
		60 days	120 days	60 days	120 days				
30	HC-0702	49.30	57.67	47.65	56.97	28.00	34.00	48.50	320.45
31	HC-0711	47.80	55.00	43.80	52.50	29.00	34.00	48.50	134.30
32	HC-0716	56.30	60.13	48.00	54.33	30.00	40.00	47.50	241.65
33	COS-1	42.80	45.83	40.95	48.17	28.00	33.00	39.50	137.41
34	EC-13DCS-06-01	36.45	41.83	37.60	39.80	24.50	34.00	46.50	114.30
35	EC-33DCS-06-02	42.65	50.68	44.60	47.83	21.50	35.50	40.00	260.15
36	HC-0718	44.30	49.50	36.65	43.30	22.50	37.50	48.00	90.65
37	ES-32-DPS-06-01	37.00	38.67	40.50	46.80	33.50	35.50	49.00	125.05
38	DC-10D-06-01	43.15	45.67	38.30	46.17	27.50	38.50	49.00	122.05
39	HC-0714	48.00	55.50	44.65	41.15	29.50	41.00	48.50	251.00
40	Cholachagudda local (BCM-1)	49.95	54.67	42.60	50.43	34.50	45.00	51.50	38.50
41	Arka Lohith	50.30	48.50	40.15	45.15	36.00	46.50	47.50	89.35
42	DCA-58	43.30	49.17	42.30	47.50	30.50	49.00	50.00	161.4
43	DCA-60	44.80	37.83	43.95	49.32	34.00	43.00	50.00	107.00
44	DCA-77	34.80	43.80	38.00	43.15	28.00	50.00	50.00	35.80
45	DCA-187	39.30	41.50	37.80	42.95	30.00	44.50	49.50	117.40
46	DCA-192	43.95	46.00	40.65	45.32	31.50	36.50	46.50	149.55
47	DCA-195	32.80	27.65	28.65	40.33	32.50	41.50	48.50	144.70
48	DCA-199	31.80	32.65	25.30	41.45	25.50	40.00	49.00	159.10
49	DCA-202	39.67	37.50	34.15	42.33	28.00	37.00	48.00	72.75
50	DCA-203	42.65	46.50	43.30	44.15	27.50	37.50	48.00	109.80
	<b>Mean</b>	<b>40.99</b>	<b>45.21</b>	<b>39.41</b>	<b>45.47</b>	<b>28.23</b>	<b>37.08</b>	<b>44.85</b>	<b>155.98</b>
	S. Em±	3.43	3.38	2.92	3.47	2.22	2.78	3.67	11.35
	C.D.at5%	9.75	9.6	8.3	9.87	6.32	7.90	10.42	32.26
	CV	11.84	10.56	10.48	10.80	11.13	10.60	11.56	10.29

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