

## Evaluation of Hot Pepper (*Capsicum annuum* L.) Germplasm of Diverse Origin for Various Horticultural Characters

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A set of thirty three genotypes of hot pepper collected from Punjab, Rajasthan and AVRDC (Asian Vegetable Research and Development Centre), Taiwan were evaluated for various horticultural characters. The material was sown in a complete Randomized Block Design with three replications during 2002-03. Analysis of variance indicated significant genotypic differences for all the characters which showed presence of wide variability in the material. Genotypes Punjab Lal, S-99-3, S-5, Punjab Guchhedar, S-12-1 and S-103 provided higher yield per plant (563.75 g, 555.57 g, 553.10 g, 540.23 g, 521.33 g, 516.13 g) respectively. Punjab Lal and S-12-1 were resistant to fruit rot and virus complex while Punjab Guchhedar, S-99-3 and S-103 were resistant to fruit rot and moderately resistant to virus complex. Genotypes S-2530, S-2, S-5, S-99-3 and S-30 were significantly superior to check varieties for colouring matter. Similarly, S-99-3 and S-5 were also identified for high capsaicin coupled with high yield and could be utilized for the genetic improvement of hot pepper for yield and quality characters.

**Key Words:** Hot pepper, Chilli, Yield, Quality

### Introduction

Hot pepper (*Capsicum annuum* L.) belongs to family Solanaceae and is one of the most valuable commercial spice crop of India. It is grown for export as well as for domestic market. It is widely used in preparing different dishes, pharmaceuticals and in beverage industries throughout the world. It is mainly grown for red fruits, used as spice in powdered form, as medicine and also in pickles of many kinds. Dry chilli powder, soup, sauces, ketchup and oleoresin are its important processed products. Its fresh green fruits, used as salad, are a rich source of vitamin C and A. The important quality characters in chilli are pungency and red colour in fruits. India is the largest producer of chilli in world but productivity is very low as compared to other countries, namely, Japan and Korea due to diseases particularly, viral diseases (virus complex). The important viruses which attack chilli and cause significant losses are cucumber mosaic virus (CMV), leaf curl virus (LCV) and tobacco mosaic virus (TMV) (Horvath, 1986). The improvement in any character through selection depends upon the extent of genetic variability present in the germplasm. Improvement in fruit yield which is an important character may be achieved through selection of one or more direct or indirect components. Therefore, the present study was undertaken to evaluate the chilli genotypes for yield, quality character and tolerance to various diseases, viz., fruit rot and viruses.

### Materials and Methods

The present investigation was conducted at Vegetable Research Farm and Biochemistry Laboratory,

Department of Vegetable Crops, Punjab Agricultural University, Ludhiana during 2002-03. Ludhiana is situated at a latitude of 30°-54'N and longitude of 75°-48'E and at a mean height of 247 meters above sea level. This place is characterized by very hot and dry summer (April to June) followed by hot and humid period and cold winters during December to January. The average rainfall of the area is 600 mm, most of which is received during the monsoon season. A composite soil sample from 0-15 cm depth was taken from the experimental field before transplanting whose physico-chemical properties were as follows: soil texture-loamy sand; soil pH-8.5; organic carbon-0.18%; electrical conductivity (mmhos/cm)-0.20. The experiment comprising thirty-three genotypes of chilli, collected from Punjab and Rajasthan states of India and Asian Vegetable Research and Development Centre (AVRDC), Taiwan including three check varieties (Punjab Guchhedar, Punjab Lal and Punjab Surkh), were grown in a Randomized Complete Block Design. The genotypes and their sources are given in Table 1. The seeds of these genotypes were grown in nursery in first week of November and transplanted in the field during the second week of March. A distance of 60 cm and 30 cm was maintained between rows and plants, respectively. Recommended agronomic and plant protection practices were followed to raise healthy crop. Eight plants per plot in each replication were planted and data were recorded on five randomly taken plants per plot in each replication. The observation were recorded on plant height (cm), fruit length (cm),

number of seeds per fruit, fruit weight (g), number of branches per plant, number of fruits per plant, days to first fruit harvest, fruit yield per plant (g), fruit rot (%), virus complex (%), colouring matter (ASTA units by Rosebrook *et al.*, 1968), ascorbic acid content (mg/100 g) by AOAC (1975), chlorophyll content of green fruits (mg/g) by Anderson and Bourdman (1964) and capsaicin content (%) by Bajaj and Kaur (1979). The analysis of variance for Randomized Complete Block Design was calculated by the formula given by Allard (1960).

### Results and Discussion

The analysis of variance carried out for different characters revealed highly significant differences among genotypes for all the characters. Mean value

and range for each character studied are presented in Table 2. The varietal means for different characters are given in Tables 3 (a) and (b). Fruit length varied from 3.83–9.90 cm and genotype S-5 possessed the maximum fruit length. Plant height varied from 60.37 to 117.57 cm. The maximum plant height was recorded in genotype S-86-1. Number of seed was found maximum in S-59. Fruit weight varied from 1.07 to 6.15 g with general mean of 3.74 g. Maximum fruit weight was recorded in S-3-1 which was followed by S-24 (6.0 g), S-1-1 (5.97 g), S-86-1 (5.90 g) and S-8-1-2 (5.33 g). Mean number of branches per plant were 6.01 with range of 4.00-8.67 and maximum number of branches per plant found in Punjab Guchhedar.

Mean value for number of fruits per plant was 135.65 while this character varied from 28.63 to

**Table 1. List of genotypes of diverse origin evaluated in the study**

S. No.	Genotype	Characters	Origin
1	S-1	Medium ht; medium sized, less pungent fruit	Kapurthala, Punjab
2	S-2	Tall plant; medium sized, less seeded, dark green fruit	Bathinda, Punjab
3	S-3	Medium ht; small sized, less pungent fruit	Bathinda, Punjab
4	S-4	Medium ht; small sized, heavily seeded, less pungent fruit	Kapurthala, Punjab
5	S-5	Small ht; long sized, highly pungent, dark red fruit at maturity	Kapurthala, Punjab
6	S-6	Tall plant; small, less seeded fruit	Bathinda, Punjab
7	S-8	Small ht; small, less pungent fruit	Kapurthala, Punjab
8	S-13	Small ht; long, less pungent fruit	Kapurthala, Punjab
9	S-23	Small ht; medium sized, highly pungent fruit	Kapurthala, Punjab
10	S-24	Medium ht; long, less pungent fruit	Bathinda, Punjab
11	S-30	Small ht; long, dark red fruit at maturity	Bathinda, Punjab
12	S-35	Tall and highly branched plant; less pungent fruit	Kapurthala, Punjab
13	S-59	Small ht; medium sized, heavily seeded fruit	Bathinda, Punjab
14	S-86	Medium ht; medium sized, less pungent, light green fruit	Bathinda, Punjab
15	S-103	Small ht; medium sized, moderately pungent fruit	AVRDC, Taiwan
16	S-1-1	Tall plant; long, dark green fruit	Jaipur, Rajasthan
17	S-3-1	Medium ht; long, less pungent fruit	Bathinda, Punjab
18	S-5-1	Medium ht; small, highly pungent fruit	Bathinda, Punjab
19	S-8-1-2	Small ht; small, heavily seeded fruit	AVRDC, Taiwan
20	S-12-1	Small, highly branched plant; less pungent fruit	Bathinda, Punjab
21	S-30-1	Medium ht; medium sized, dark green fruit	AVRDC, Taiwan
22	S-33-1	Medium, highly branched plant; small, less pungent fruit	Kapurthala, Punjab
23	S-86-1	Tall plant; long, less pungent fruit	Bathinda, Punjab
24	S-99-3	Small ht; highly pungent & dark red fruit at maturity	Bathinda, Punjab
25	S-99-4	Tall, highly branched plant; dark green fruit	Kapurthala, Punjab
26	S-106-1	Small ht; medium sized, highly seeded fruit	AVRDC, Taiwan
27	S-108-2	Small ht; small, light green fruit	AVRDC, Taiwan
28	S-370-2-1	Tall; medium sized, dark green fruit	AVRDC, Taiwan
29	MS 12	Medium ht; small sized, pungent fruit	Kapurthala, Punjab
30	S-2530	Medium ht; medium sized, dark red fruit at maturity	Kapurthala, Punjab
31	Punjab Guchhedar	Medium ht; medium sized fruits borne in cluster picked without stalk	Kapurthala, Punjab
32	Punjab Lal	Small ht; small, erect, more pungent fruit	Kapurthala, Punjab
33	Punjab Surkh	Small ht; long, dark red fruit at maturity	Kapurthala, Punjab

AVRDC: Asian Vegetable Research and Development Centre

**Table 2. Mean and range of different characters in hot chilli**

Character	Range	Mean
Plant height (cm)	60.37–117.57	81.75
Fruit length (cm)	3.83–9.90	6.58
Number of seeds/ fruit	17.27–71.33	37.62
Fruit weight (g)	1.07–6.13	3.74
Number of branches/plant	4.00–8.67	6.01
Number of fruits/plant	28.63–514.37	135.65
Fruit yield/plant (g)	166.07–563.73	378.63
Chlorophyll content (mg/g)	0.11–0.70	0.35
Days to first fruit harvest	70.00–95.00	90.65
Capsaicin (%)	0.30–0.91	0.57
Ascorbic acid (mg/100g)	99.90–140.50	123.39
Colouring matter (ASTA units)	83.36–216.36	145.52
Virus complex (%)	6.06–52.76	17.64

514.37. The maximum number of fruits per plant was found in Punjab Lal followed by Punjab Guchheddar and S-5-1. Fruit yield varied from 166.07-563.73 g with mean value 378.63 g. Maximum fruit yield was found in Punjab Lal (563.73 g) followed by S-99-3 (555.56 g), S-5 (553.10 g), Punjab Guchheddar (540.23 g), S-12-1 (521.33 g) and S-103 (516.13 g). Similar type of variability was recorded in fruit yield, fruit length, number of fruit per plant by Khurana *et al.* (2003) and Kumar *et al.* (1999). Mean value for chlorophyll content was 0.35 mg/g with range from 0.11-0.70 mg/g. Maximum chlorophyll content was recorded in S-99-4. There was no incidence of fruit rot in any genotype under field conditions. There were ten genotypes, *viz.*, Punjab Lal, Punjab Surkh, S-2530, S-1, S-12-1, S-23, S-30-1, S-59, S-106-1, S-370-2-1 which were having less than 10% virus complex.

**Table 3(a). Mean values of different genotypes for various traits**

Genotypes	Plant height (cm)	Fruit length (cm)	No. of seeds /fruit	Fruit weight (g)	No. of branches/plant	No. of fruits/ plant	Fruit yield/ plant (g)	Total Chlorophyll content (mg/g)
S-1	82.83	6.00	27.33	2.63	7.00	134.40	357.63	0.28
S-2	98.17	6.50	19.33	2.47	8.33	188.43	423.80	0.64
S-3	78.40	4.07	48.47	3.97	6.33	47.17	191.50	0.39
S-4	86.43	5.30	63.33	3.23	6.33	104.30	313.03	0.15
S-5	68.27	9.90	43.67	4.70	7.33	122.90	553.10	0.19
S-6	98.97	3.83	17.27	4.33	5.00	121.43	485.87	0.25
S-8	76.90	5.97	51.03	4.00	6.00	82.87	305.53	0.53
S-13	65.73	8.57	22.53	3.13	7.33	66.67	200.10	0.28
S-23	62.77	7.30	34.00	3.17	5.00	124.53	392.63	0.30
S-24	84.40	8.47	34.00	6.00	5.33	48.73	238.87	0.49
S-30	76.97	9.07	58.80	4.47	7.00	95.23	381.20	0.15
S-35	100.27	6.47	41.90	3.23	8.33	113.40	340.23	0.35
S-59	74.03	7.00	71.33	4.00	5.00	110.77	443.23	0.55
S-86	82.10	7.54	28.03	4.47	5.00	80.23	346.00	0.23
S-103	74.00	7.27	26.93	3.20	6.33	172.00	516.13	0.25
S-1-1	107.73	8.33	28.03	5.97	4.00	35.27	172.33	0.57
S-3-1	87.03	8.07	39.80	6.13	5.33	28.63	166.07	0.45
S-5-1	93.20	5.33	29.01	1.63	6.00	306.40	459.63	0.11
S-8-1-2	76.83	5.73	61.47	5.33	5.00	69.77	347.30	0.44
S-12-1	76.13	7.50	52.37	4.00	7.33	130.33	521.33	0.43
S-30-1	82.67	6.43	21.10	4.00	6.33	128.67	490.47	0.63
S-33-1	82.07	5.60	45.00	2.47	8.33	91.27	228.23	0.22
S-86-1	117.50	8.30	25.07	5.90	5.00	53.60	321.80	0.16
S-99-3	62.47	5.13	50.50	4.07	6.00	148.10	555.57	0.25
S-99-4	110.47	5.17	21.53	2.47	7.67	158.40	316.83	0.70
S-106-1	60.37	6.70	59.93	3.97	5.00	85.60	331.83	0.53
S-108-2	66.00	5.43	27.07	2.30	4.33	139.30	348.97	0.13
S-370-2-1	103.07	6.63	34.80	4.17	4.33	118.67	474.73	0.57
MS 12	82.67	4.77	65.93	3.33	5.00	94.37	282.23	0.23
S-2530	82.40	6.57	21.00	3.87	6.33	105.17	394.50	0.13
Punjab Guchheddar	65.27	5.30	20.27	1.93	8.67	477.30	540.23	0.13
Punjab Lal	65.93	4.57	23.63	1.07	4.00	514.37	563.73	0.15
Punjab Surkh	62.73	8.40	26.23	3.83	4.00	178.27	490.23	0.53
CD (p = 0.05)	4.59	0.87	9.82	0.48	1.84	16.71	40.10	0.01

Table 3(b). Mean values of different genotypes for various traits

Genotypes	Days to first fruit harvest	Capsaicin (%)	Ascorbic acid (mg/100g)	Colouring matter (ASTA units)	Virus complex (%)
S-1	95.00	0.33	130.77	145.43	6.06
S-2	95.00	0.50	130.60	215.47	16.06
S-3	85.00	0.48	121.17	96.50	17.76
S-4	95.00	0.46	128.63	152.37	36.40
S-5	95.00	0.90	108.20	210.53	26.93
S-6	95.00	0.68	127.83	175.50	18.63
S-8	95.00	0.45	120.47	151.17	24.36
S-13	94.67	0.59	140.40	164.20	26.93
S-23	95.00	0.80	136.43	145.27	8.70
S-24	95.00	0.30	140.50	100.70	52.76
S-30	94.67	0.46	101.50	210.27	17.63
S-35	95.00	0.50	135.93	145.30	17.50
S-59	80.00	0.75	116.80	151.13	6.76
S-86	80.00	0.47	104.87	97.17	19.03
S-103	88.00	0.58	125.40	86.10	18.13
S-1-1	95.00	0.45	138.97	164.33	16.53
S-3-1	95.00	0.40	115.90	150.23	18.43
S-5-1	95.00	0.85	141.17	151.10	26.93
S-12-1	86.00	0.35	136.07	85.50	8.00
S-30-1	95.00	0.48	131.13	151.87	9.33
S-33-1	95.00	0.45	108.97	149.33	17.73
S-86-1	91.67	0.43	131.37	101.80	25.46
S-99-3	85.00	0.92	114.90	210.43	16.63
S-99-4	95.00	0.48	125.00	163.87	18.63
S-106-1	87.00	0.54	115.43	101.73	8.40
S-108-2	95.00	0.48	120.07	99.30	17.36
S-8-1-2	88.00	0.48	124.47	206.17	15.33
S-370-2-1	95.00	0.47	115.57	153.40	8.59
MS 12	95.00	0.90	135.90	96.87	18.46
S-2530	88.00	0.61	104.77	216.37	7.80
Punjab Lal	83.33	0.91	99.90	92.43	8.50
Punjab Guchhedar	80.00	0.86	116.50	83.37	18.53
Punjab Surkh	70.00	0.65	126.33	177.17	7.80
CD (p = 0.05)	1.83	0.02	1.89	17.02	1.74

Note: There was no incidence of fruit rot on any of the genotypes. It did not appear under natural epiphytotic condition

Punjab Surkh was found early yielding than other genotypes. Capsaicin content varied from 0.30-0.91% with mean value of 0.57%. The genotypes S-99-3 and Punjab Lal were statistically at par for capsaicin content. Ascorbic acid varied from 99.90–140.50 mg/100 g. Maximum ascorbic acid content was found in S-24 (140.50 mg/100 g) and S-13 (140.40 mg/100 g). Kumar *et al.* (2003) also found wide variability in ascorbic acid content in 30 chilli genotypes. The range of colouring matter was 83.36–216.36 ASTA units with a mean value of 145.52. Maximum colouring matter was found in S-2530 (216.37 ASTA units) followed by S-2 (215.46 ASTA units), S-5 (210.53 ASTA units), S-99-3 (210.43 ASTA units) and S-30 (210.26 ASTA units).

Genotypes Punjab Lal, S-99-3, S-5, Punjab Guchhedar, S-12-1 and S-103 provided higher yield per plant. Punjab Lal and S-12-1 were resistant to fruit rot, virus complex while Punjab Guchhedar, S-99-3 and S-103 were resistant to fruit rot and moderately resistant to virus complex. Genotypes S-2530, S-2, S-5, S-99-3 and S-30 were significantly superior to check varieties for colouring matter. Similarly, genotypes S-99-3 and S-5 were also identified for high capsaicin content, yield and quality characters. The results identified the genotypes possessing the desirable horticultural characteristics, which the breeder can make use of in production of new improved cultivars.

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