Characterization of *Capsicum* spp. Germplasm

K Pradheep*[1] and D Veeraragavathatham

Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore-641 003 (Tamil Nadu)

[1] *Present Address: National Bureau of Plant Genetic Resources, Regional Station, Phagli, Shimla-171 004 (Himachal Pradesh)*

A total of 53 accessions of *Capsicum* spp. collected from Kanyakumari district of Tamil Nadu was characterized for 38 characters. The frequency was very high for four characters *viz.* absence of anthocyanin spots over fruits, neck at base of fruit and fruit blossom end appendage, and lanceolate-shaped cotyledonous leaf. Predominance of single descriptor state was found in more than 50 per cent accession for 25 characters. Wide variability was exhibited in all the quantitative characters studied except for the trait fruit bearing period. Importance of studied characters in utilization is narrated.

Key words: Chilli, Characterization, Utilization, Western Ghats

Hot pepper (*Capsicum annuum* L.) is one of the most commercially grown vegetables in the tropics. It was probably introduced by Portuguese into southern parts of India as evidenced by the fact that there were only three races of chilli being cultivated in India by the year 1642 AD (Heiser, 1976). Cultivation spread throughout the country by the end of 19th century. Due to continuous selection, long history of cultivation and popularity of the crop, sufficient genetic variability has been generated. Now India is believed to be one of the secondary centres of diversity for *Capsicum annuum* L. (Gupta *et al.*, 1996). Other species occurring in India include *C. frutescens* L. (Hooker, 1885) and *C. baccatum* L. var. *pendulum* (IBPGR, 1983). Rich variability in morphological traits in hot pepper occurs throughout India particularly in the south Peninsular region, north eastern foothills of Himalayas and Gangetic plains. Gupta *et al.* (1996) reported that the germplasm collection of chilli is prioritised owing to its cultivated status, widespread distribution, high variability and moderate genetic erosion status. Kanyakumari district of Tamil Nadu (8°03' to 8°35'N latitude & 77°15' to 77°36'E longitude) lies relatively nearer to equator and covers a part of Western Ghats, experiencing typical tropical humid climate with an average rainfall of 1450mm. Under National Agricultural Technology Project on Plant Biodiversity (1999-2004), a huge variation in plant, leaf, flower and seed characters available in the entire district was collected. In this study, the germplasm accessions assembled in the Department of Vegetable Crops, Horticultural College and Research Institute (HC&RI), Coimbatore were characterized for 38 traits.

Investigation was carried out at the orchard of Horticultural College and Research Institute, TNAU, Coimbatore during December 2001 and May 2002. All the 53 accessions collected from Kanyakumari district of Tamil Nadu were included in the study. The experiment was laid out in a completely randomized design (pot culture) involving three replications with a minimum of ten plants per treatment (accession). Forty five day old seedlings were transplanted into pot (one seedling/pot) which consists of four kg substrate containing a mixture of loam soil and farmyard manure in the ratio of 3:1. Recommended cultural practices were taken up during the study period. A total of 38 characters (Tables 1 & 2) including few quantitative ones useful for management, maintenance and utilization of germplasm were characterized by adopting the descriptor jointly developed by IPGRI, AVRDC and CATIE (1995). In case of quantitative characters, mean value of five observations in each treatment was taken into account. Frequency distribution of various qualitative characters and variability parameters for quantitative characters were worked out.

Characterization of germplasm indicated that out of 32 qualitative characters studied, the frequency was very high (96.23%) for four characters *viz.* absence of anthocyanin spots over fruits, neck at base of fruit and fruit blossom end appendage followed by lanceolate cotyledonous leaf shape (94.34). Frequency was high (>80%) in traits like purple hypocotyl, number of locules per fruit and lengthy placenta i.e. placenta more than half the length of fruit. More than 50 per cent of germplasm accessions exhibited solitary erect flowers, white-coloured corolla spot, campanulate-shaped corolla,

*Corresponding Author's E-mail: hort_pradheep@yahoo.co.in

Table 1. Frequency distribution of 53 accessions of *Capsicum* spp. for different descriptors

S. No.	Descriptor state	Descriptor code	Absolute frequency	Relative percentage
1	2	3	4	5
1	**Hypocotyl colour**			
	White	1	–	–
	Green	2	8	15.09
	Purple	3	45	84.91
2	**Hypocotyl pubescence**			
	Sparse	3	25	47.17
	Intermediate	5	26	49.06
	Dense	7	2	3.77
3	**Cotyledonous leaf colour**			
	Light green	1	–	–
	Green	2	20	37.74
	Dark green	3	–	–
	Light purple	4	14	26.42
	Purple	5	6	11.32
	Dark purple	6	13	24.53
	Variegated	7	–	–
	Yellow	8	–	–
	Other	9	–	–
4	**Cotyledonous leaf shape**			
	Deltoid	1	–	–
	Ovate	2	–	–
	Lanceolate	3	50	94.34
	Elong–deltoid	4	3	5.66
5	**Stem colour**			
	Green	1	13	24.53
	Green with purple stripes	2	26	49.06
	Purple	3	14	26.42
	Other	4	–	–
6	**Number of flowers per axil**			
	One	1	32	60.38
	Two	2	12	22.64
	Three or more	3	8	15.09
	Many flowers in bunch	4	–	–
	Others	5	1	1.89
7	**Flower position**			
	Pendant	3	7	13.21
	intermediate	5	10	18.87
	Erect	7	36	67.92
8	**Corolla colour**			
	White	1	18	33.96
	Light yellow	2	15	28.3
	Yellow	3	–	–
	Yellow-green	4	–	–
	Purple with white base	5	9	16.98
	White with purple base	6	–	–
	White with purple margin	7	–	–
	Purple	8	20	37.74
	Other	9	–	–
9	**Corolla spot colour**			
	White	1	27	50.94
	Yellow	2	3	5.66
	Green–yellow	3	16	30.19
	Green	4	–	–
	Purple	5	7	13.21
	Other	6	–	–
10	**Corolla shape**			
	Rotate	1	21	39.62
	Campanulate	2	32	60.38
	Other	3	–	–
11	**Anther colour**			
	White	1	–	–
	Yellow	2	–	–
	Pale blue	3	36	67.92
	Blue	4	7	13.21
	Purple	5	10	18.87
	Other	6	–	–
12	**Filament colour**			
	White	1	19	35.85
	Yellow	2	5	9.43
	Green	3	–	–
	Blue	4	–	–
	Light purple	5	–	–
	Purple	6	29	54.72
	Other	7	–	–
13	**Calyx pigmentation**			
	Absent	0	34	64.15
	Present	1	19	35.85
14	**Calyx margin**			
	Entire	1	2	3.77
	Intermediate	2	22	41.51
	Dentate	3	29	54.72
	Other	4	–	–
15	**Anthocyanin spots or stripes over fruits**			
	Absent	0	51	96.23
	Present	1	2	3.77
16	**Fruit colour at intermediate stage**			
	White	1	–	–
	Yellow	2	10	18.87
	Green	3	11	20.75
	Orange	4	–	–
	Purple	5	32	60.38
	Deep purple	6	–	–
	Other	7	–	–
17	**Fruit set**			
	Low	3	10	18.87
	Intermediate	5	30	56.60
	High	7	13	24.53
18	**Fruit colour at mature stage**			
	White	1	–	–
	Lemon-yellow	2	–	–
	Pale orange-yellow	3	–	–
	Orange-yellow	4	1	1.89
	Pale Orange	5	–	–
	Orange	6	3	5.66
	Light red	7	5	9.43
	Red	8	28	52.83
	Dark red	9	16	30.19
	Purple	10	–	–
	Brown	11	–	–
	Black	12	–	–
	Other	13	–	–
19	**Fruit shape**			
	Elongate	1	18	33.96
	Almost round	2	10	18.87
	Triangular	3	12	22.64
	Campanulate	4	1	1.89
	Blocky	5	12	22.64
	Other	6	–	–
20	**Fruit shape at pedicel attachment**			
	Acute	1	–	–
	Obtuse	2	20	37.74
	Truncate	3	30	56.60
	Cordate	4	3	5.66
	Lobate	5	–	–

1	2	3	4	5
21	**Neck at base of fruit**			
	Absent	0	51	96.23
	Present	1	2	3.77
22	**Fruit shape at blossom end**			
	Pointed	1	33	62.26
	Blunt	2	19	35.85
	Sunken	3	1	1.89
	Sunken and pointed	4	–	–
	Other	5	–	–
23	**Fruit blossom end appendage**			
	Absent	0	51	96.23
	Present	1	2	3.77
24	**Fruit cross-sectional corrugation**			
	Slightly corrugated	3	42	79.25
	Intermediate	5	9	16.98
	Corrugated	7	2	3.77
25	**Number of locules per fruit**			
	2	1	43	81.13
	3	2	8	15.09
	4	3	1	1.89
	5	4	1	1.89
	>5	5	–	–
26	**Fruit surface**			
	Smooth	1	39	73.58
	Semi-wrinkled	2	8	15.09
	Wrinkled	3	6	11.32
27	**Pedicel persistence with ripe fruit**			
	Slight	3	–	–
	Intermediate	5	36	67.92
	Persistent	7	17	32.08
28	**Placenta length**			
	<1/4 fruit length	1	–	–
	1/4 -1/2 fruit length	2	7	13.21
	>1/2 fruit length	3	46	86.79
29	**Seed colour**			
	Deep yellow	1	36	67.92
	Brown	2	17	32.08
	Black	3	–	–
	Other	4	–	–
30	**Seed surface**			
	Smooth	1	39	73.58
	Rough	2	2	3.77
	Wrinkled	3	12	22.64
31	**Seed size**			
	Small	3	7	13.21
	Intermediate	5	40	75.47
	Large	7	6	11.32
32	**Number of seeds per fruit**			
	<20	1	6	11.32
	20-50	2	22	41.51
	>50	3	25	47.17

pale blue anther, purple filament colour, no pigmentation in calyx, dentate calyx margin, purple fruit color at intermediate stage, medium fruit set, red fruit color at maturity stage, truncate-shape at pedicel attachment with fruit, pointed fruits at blossom end, slightly corrugated fruits with smooth surface, medium pedicel persistence with ripe fruit, and deep yellow, medium sized and smooth seeds. All the descriptor states mentioned in IPGRI, AVRDC and CATIE (1995) were exhibited by characters *viz.* hypocotyl pubescence, flower position, calyx pigmentation, presence or absence of anthocyanin spots over fruits, neck at base of fruits and fruit blossom end appendages, fruit set, fruit cross-sectional corrugation, fruit surface texture, seed size and number of seeds per fruit indicating wide diversity existed in the studied germplasm for those characters.

The study also showed that in the germplasm, wide variability (>15% CV) was exhibited in all the quantitative characteristics studied (Table 2) except for one character i.e. the fruit bearing period. Fruit length varied from 1.23 to 8.10cm whereas width from 0.83 to 3.10cm. The main objective of this characterization study is two fold *viz.* to have an easy and quick discrimination of phenotypes; the other is to simply correlate with practical utilization. In this regard, those traits expressed in seedling stage such as hypocotyl and cotyledonous leaf color, hypocotyl pubescence, stem color before transplanting can be utilized to know and discard any varietal admixture at a very early stage, or as a marker for early selection of hybrid provided genetics of these traits known. Thin walled fruits dry quickly hence may be of good use for dry chilli purpose. Smooth fruit surface is well preferred for canning purpose. Capsaicin content is more in placenta followed by seeds, and hence, accessions with lengthy placenta and more number of seeds per fruit may be useful in breeding for high pungency. Rajagopal and Muthukrishnan (1977) also reported the importance of high seed weight in breeding high pungent chilli.

Table 2. Variability parameters for different quantitative traits in 53 *Capsicum* spp. accessions

Feature	Fruit bearing period	Fruit length (cm)	Fruit width (cm)	Fruit pedicel length (cm)	Fruit wall thickness (mm)	Seed diameter (mm)
Mean ± SE	65.33 ± 0.76	3.26 ± 0.22	1.75 ± 0.07	2.46 ± 0.07	1.50 ± 0.07	3.15 ± 0.09
Range	80.00 - 54.33	8.10 - 1.23	3.10 - 0.83	3.60 - 1.37	2.50 - 0.50	4.53 - 2.03
CV (%)	8.62	50.47	29.46	22.25	33.62	20.25

References

Gupta PN, M Rai and S Kocchar (1996) Characterization and evaluation: descriptor and descriptor states for vegetable crops. In: RS Rana, PN Gupta, M Rai and S Kocchar (ed.) *Genetic Resources of Vegetable Crops: Management, Conservation and Utilisation.* NBPGR, New Delhi, p 76-90.

Heiser CB (1976) Pepper *Capsicum* (Solanaceae). In: N.W. Simmonds (ed.) *Evolution of Crop Plants.* Longman, London, p 265-268.

Hooker JD (1885) *Flora of British India* Vol. IV. L. Reeve & Co., London. p 239.

IBPGR (1983) *Genetic Resources of Capsicum – a Global Plan of Action.* IBPGR Secretariat, Rome. 49 p.

IPGRI, AVRDC and CATIE (1995) *Descriptors for* Capsicum (*Capsicum* spp.). International Plant Genetic Resources Research Institute, Rome, Italy; Asian Vegetable Research Centre, Taipei, Taiwan, and the Centro Agronomico Tropical de Investigacion y Ensenanza, Turrialba, Costa Rica. 110 p.

Rajagopal A and CR Muthukrishan (1978) Evaluation of chilli varieties at Coimbatore. *South Indian Hort.* **26:** 8-11.