Indian J. Pl. Genet. Resources 12(1): 31-35, 1999

EVALUATION OF SOME CULTIVARS OF *Capsicum annuum* IN SAURASHTRA REGION WITH SPECIAL REFERENCE TO FRUIT SHAPE AND CAPSAICIN CONTENT

M. P. BUCH[1], S. M. PANDEYA[2], SEEMA CHAUHAN (nee SOLANKI)[3] AND S. V. S. CHAUHAN[3],
[1]Department of Botany, Bahaudin College of Science, Junagadh, 362 001 (Gujarat);
[2]Department of Botany, Saurashtra University, Rajkot 360 001 (Gujarat);
[3]Department of Botany, Dr. B.R. Ambedkar University, Agra 282 002 (Uttar Pradesh)

A survey of red pepper (*Capsicum annuum* L) cultivation at different centres of Saurashtra region was made. Based upon the shape and size of fruits and their capsaicin contents, twenty populations were studied and these were classified into three channels named as A, B and C. A new cultivar named 'Khumkhiya' was also recorded and was placed under channel D and named as D 70.

Key words: Red pepper, *Capsicum*, fruit shape, capsaicin, evaluation

Red pepper (*Capsicum annuum*), a native of tropical America and West Indies (Hill, 1952) was introduced into India by the Portugese in the Seventeenth century (Mathew *et al.*, 1971). *C. annuum* commonly known as red pepper or chillies are mainly cultivated for fruits which are used as vegetable for culinary purposes, in medicine as a stimulant and as a source of oleoresin (Mathew *et al.*, 1971). A large number of varieties of *C. annuum* are under cultivation in India and perhaps these have developed by hybridization, climatic variations and long period of cultivation. The fruits contain an active pungent principle substance, an alkaloid known as Capsaicin $C_{18}H_{27}O_3N$ (Ananthasamy *et al.*, 1960). In Saurashtra, chillies are cultivated during the period of August to February and local markets are flooded with different types of ripe fruits. Based on the shape of fruits, these types are known as **gholar, resham patta, double patta, lawingia and deshi. So far, systematic studies in the variation of fruits shape in various cultivars have not been made. Present investigation has, therefore, been** undertaken to study the intraspecific variation with respect to fruit shape, size, colour and capsaicin contents.

MATERIALS AND METHODS

The seeds of *C. annuum* were collected from 20 recognised places and were used for the present study at Vegetable Research Centre, Gujarat Agricultural University, Junagarh Campus. Plants were raised from seeds in plots of one square meter during August. The saplings were transplanted into plots of 4.5 × 2.4 m^2 in the month of October. Forty plants were maintained in each plot at equal distance in four rows (plant density was 3.7/sq.m.). The plots were regularly irrigated and were kept weed free throughout the period of study. Morphological characters, like shape, size and colour of fruits were recorded. Chromosome number was verified in the root tips of the seedlings grown on wet filter paper in petriplates by the smear method (Sass, 1958).

The quantitative estimation of capsaicin in the dry fruits was done by colorimetric procedure after Bajaj and Kaur (1979). 0.5 g dried power was extracted with acetone. This was passed through basic alumina column. A mixture of acetone, methanol and distilled water (75:25:2) was added to the extract. From this mixture, 10 ml of aliquot was evaporated to dryness and 0.5 ml of folin-ciocalten reagent was added to develop colour. One ml saturated calcium carbonate solution was added and the final volume was made to 10 ml by addition of distilled water. The optical density of the blue coloured solution which developed after one hour was measured by spectrophotometer at 780 nm. Quantity of capsaicin was calculated by a standard curve prepared by using pure capsaicin (BDH).

RESULTS AND DISCUSSION

I. **Fruit Morphology** : On the basis of Anderson's (1949) scattered diagram method, all the 20 populations cultivated were found different from each other. These populations showed variations in fruit shape, size and colour (Table 1), however, the chromosome number of all these populations was 2n = 24. Since the entire Saurashtra region has uniform semi-arid climate and there is not much variation in the soil under cultivation, the twenty populations have been recognized as varieties. Based on the fruit shape, size and colour, these populations are classified into following three channels and their main morphological features are given in Table 1.

1. Channel A : Fruit broad, short and bell shaped

2. Channel B : Fruits long, broad at upper end, tapering below and become flat and conical on drying.

3. Channel C : Fruits linear and cylindrical and they retain their shape even after drying

II. **Capsaicin** : The quantity of capsaicin in the fruits at different stages of development in various cultivars is shown in Table 2.

It is evident from the data in Table 2, that the quantity of capsaicin was the lowest in young green fruits, which increased considerably in mature green fruits but again declined in mature red fruits. The plausible reason for the decrease in capsaicin content from green mature fruits to red fruits may be due to the conversion of pigment carotenoid into red pigment called capsanthin which has identical chemical structure with capsaicin (Mathew *et al.*, 1971). It is also evident that the cultivars are of mild, medium hot and hot fruit varieties. The cultivars of Channel A are of mild type with 0.12-0.52 mg/g capsaicin in mature green fruits. The cultivars of Channel B are medium hot with 0.15-0.57 mg/g capsaicin in mature green fruits and Channel C consisted of hot type of varieties with 0.32-0.73 mg/g capsaicin in their mature green fruits.

The quantity of capsaicin in different parts of a fruit in various cultivars of different Channels also showed considerable variation (Table 3). The peduncle of fruits of different varieties consisted of lowest quantity of capsaicin (0.001-0.002 mg/g), while placenta consisted of maximum capsaicin (0.41-0.67 mg/g) in all the cultivars. On the other hand, the quantity of capsaicin in seeds was mild (0.12-0.22 mg/g) and in pericarp, it was moderate (0.22-0.45 mg/g).

It was interesting to note that most of the mild chillies (Channel A) were low yielding varieties. Similarly, the medium chillies (Channel B) were also low yielding ones, but sometimes there were medium to high yielding type which exhibited higher capsaicin contents. On the other hand, the hot chillies (Channel C) were high yielding and rarely low or medium yielder also with lower or moderate capsaicin contents in their fruits.

Table 1. Morphological features of the fruits of different varieties of *C. annuum*

S.No.	Cultivars	Fruit Characters				
		Shape	Size (cm)		Colour	Other characters
	Channel A					
1	A 13	Very broad bell shaped	4-5 3.4-4	long broad	Bright red	Smooth walled
	A 35	Broad bell shaped	4-5 3-3.5	long broad	Pale green bright red	Shining
3.	A 37	Bell shaped	4-4.5 2-3	long broad	Shining bright red bright red	Wrinkled, pointed shining
4.	A 54	Long	2-3 1.2-2.5	long broad	Pale green orange	Shining
	Channel B					
5.	B 17	Long	3-4 1.5-2	long broad	Medium green dark red	Flat, blunt
6.	B 23	Long	8-9 2.5-3	long broad	Light green light red	Pointed wrinkled
7.	B 30	Tapering below below	6-7 1.5-2.5	long broad	Medium green dark red	Thick, pointed
8.	B 32	Long	6-8 1.5-2.5	long broad	Medium green bright red	Smooth
9.	B 44	Very long	13-14 2.5-3.5	long broad	Dark green bright red	Pointed shining
10.	B 48	Long	5-5.5 1.5-2	long broad	Medium green light red	Wrinkled
11.	B 59	Very long	13-15 3.5-4	long broad	Pale green bright red	Wrinkled blunt, shining
	Channel C					
12.	C 33	Curved pointed	7-8 2-2.5	long broad	Light green bright red	Thick
13.	C 37	Pointed	7-9 2.5-2	long broad	Pale green bright red	
14.	C 43	Curved blunt	5.6 2-5.3	long broad	Pale green bright red	
15.	C 50	Thin	5-7 3-3.5	long broad	Dark green dark red	Rough, wrinkled shining
16.	C 32	Curved	7-8 2.5-3	long broad	Medium green shining dark red	
17.	C 64	Thin pointed	5-6 1.5-2	long broad	Medium green Wrinkled orange	
18.	C 67	Thin, pointed, curved	7.5-8 2.5-3.5	long broad	Dark green light red	Wrinkled
19.	C 71	Pointed, thick thick	8-9 3.0-3.5	long broad	Bright red	Shining
20.	C 73	Pointed	6-7.5 1.5-3	long broad	Medium green dark red	Shining
	Channel D					
21.	D 70	Erect tapering below	4-5 1-2.5	long broad	Orange yellow	Shining, smooth walled

Table 2. Capsaicin content of fruits at different stages of development in various cultivars of *Capsicum annuum*

S.No.	Cultivars	Capsaicin (mg/g)*		
		Young green	Mature gren	Mature red
	Channel A			
1.	A 13	0.05 ± 0.00	0.12 ± 0.02	0.11 ± 0.03
2.	A 35	0.15 ± 0.01	0.33 ± 0.03	0.30 ± 0.04
3.	A 37	0.18 ± 0.02	0.35 ± 0.02	0.33 ± 0.02
4.	A 54	0.31 ± 0.02	0.52 ± 0.02	0.50 ± 0.06
	Channel B			
5.	B 17	0.10 ± 0.00	0.15 ± 0.02	0.14 ± 0.07
6.	B 23	0.13 ± 0.01	0.21 ± 0.03	0.19 ± 0.02
7.	B 30	0.14 ± 0.02	0.28 ± 0.02	0.26 ± 0,02
8.	B 32	0.18 ± 0.01	0.30 ± 0.06	0.28 ± 0.03
9.	B 44	0.22 ± 0.01	0.42 ± 0.07	0.40 ± 0.04
10.	B 48	0.24 ± 0.02	0.45 ± 0.05	0.41 ± 0.05
11.	B 50	0.38 ± 0.04	0.57 ± 0.08	0.54 ± 0.06
	Channel C			
12.	C 33	0.16 ± 0.01	0.32 ± 0.02	0.30 ± 0.02
13.	C 37	0.18 ± 0.01	0.34 ± 0.02	0.32 ± 0.03
14.	C 43	0.20 ± 0.01	0.42 ± 0.03	0.40 ± 0.03
15.	C 50	0.25 ± 0.02	0.48 ± 0.04	0.45 ± 0.04
16.	C 52	0.31 ± 0.02	0.50 ± 0.06	0.47 ± 0.05
17.	C 64	0.35 ± 0.03	0.62 ± 0.07	0.59 ± 0.06
18.	C 67	0.40 ± 0.04	0.65 ± 0.08	0.61 ± 0.03
19.	C 71	0.45 ± 0.03	0.71 ± 0.09	0.65 ± 0.03
20.	C 73	0.47 ± 0.04	0.72 ± 0.06	0.67 ± 0.04
	Channel D			
21.	D 70	0.48 ± 0.03	0.70 ± 0.04	0.68 ± 0.04

*Mean of data from 5 replicates
± Standard deviation

Table 3. Quantity of capsaicin in different parts of mature green fruits of various cultivars of *Capsicum annuum*

S.No.	Cultivars	Capsaicin (mg/g)			
		Peduncle	Pericarp	Placenta	Seeds
	Channel A				
1.	A 13	0.001	0.22	0.41	0.12
2.	A 35	0.002	0.24	0.45	0.14
3.	A 37	0.001	0.21	0.44	0.13
4.	A 54	0.001	0.25	0.42	0.11
	Channel B				
5.	B 17	0.002	0.26	0.45	0.13
6.	B 23	0.001	0.26	0.46	0.16
7.	B 30	0.002	0.28	0.46	0.15
8.	B 32	0.002	0.27	0.47	0.14
9.	B 44	0.001	0.29	0.48	0.16
10.	B 48	0.001	0.30	0.50	0.17
11.	B 59	0.002	0.31	0.52	0.17
	Channel C				
12.	C 33	0.001	0.32	0.46	0.18
13.	C 37	0.001	0.35	0.52	0.19
14.	C 43	0.001	0.33	0.53	0.18
15.	C 50	0.001	0.36	0.54	0.19
16.	C 52	0.002	0.34	0.55	0.20
17.	C 64	0.002	0.38	0.57	0.20
18.	C 67	0.002	0.40	0.58	0.20
19.	C 71	0.002	0.41	0.62	0.21
20.	C 73	0.002	0.45	0.67	0.22
	Channel D				
21.	D 70	0.002 ± 0.0	0.46 ± 0.08	0.69 ± 0.06	0.23 ± 0.02

*Mean data from 5 replicates

III. **New Cultivar** : A new cultivar with morphological features different to those of variations in Channels A, B and C, particularly in fruit shape was noticed in the fields of Saurashtra region. The plants of this cultivar were about 15 cm long, dark green, non-bushy. Leaves were long with acute apex. Fruits were broad, medium sized (4-5 cm long), shining, smooth walled, tapering

and orange yellow in colour. The fruits were erect and not pendant as in the cultivars of other three Channels (Table 1). The chromosome number of this cultivar was, however, the same (2n = 24).

Mature green fruits of this cultivar consisted of high capsaicin contents (0.70 mg/g) which declines slightly in mature red fruits (0.68 mg/g). Thus, this cultivar is also of hot type as is the case with those of Channel C (Table 2). In mature green fruits, the quantity of capsaicin was the highest in the placenta (0.69 mg/g), followed by pericarp, seeds and peduncle (Table 3). Thus, on the basis of erect fruit type and higher capsaicin content, this cultivar '**Khumkhiya**' has been placed in Channel D and named as D 70.

ACKNOWLEDGEMENTS

Authors are grateful to Professor G.K. Patel, Director and Dr. A.S. Yusufzai, Associate Professor (Vegetables), Gujarat Agricultural University, Junagadh for providing facilities for conducting experiments.

REFERENCES

Ananthasamy, T.S., V.N. Kamat and H.G. Pandeya. 1960. Capsaicin contents of chilli varieties. *Curr. Sci.* **29**: 271-273.

Anderson, E. 1949. Introgressive hybridization. John Wiley & Sons, Inc. N.Y.

Bajaj, K.L. and Gurdep Kaur. 1979. Calorimetric determination of capsaicin in *Capsicum* fruits with Folin-Ciocalt reagent. *Mirochemica Acta* **1**: 81-86.

Hill, A.F. 1952. Economic Botany, McGraw-Hill New York, 448-450.

Mathew, A.G., Y.S. Lewis, R. Jogadishan, E.S. Nambudiri and N. Krishnamurthy. 1971. Oleoresin *Capsicum*. *Flavour Industry* **2**(1): 23-25.

Sass, J.E. 1958. Botanical Microtechnique. Oxford 'IBH' Calcutta, p. 106-108.