

COMPARATIVE STUDY OF SOME NEW HOT PEPPER "*Capsicum annuum* L." CULTIVARS IN EGYPT

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ABSTRACT

The present study was carried out during two successive seasons of 1999-2000 and 2000-2001, to compare between four cultivars of hot pepper (*Capsicum annuum* L.), viz. Bohemian, Cherry, Long-Red Cayenne, and Anaheim. The plants were grown in loamy-sand soil in a greenhouse under drip irrigation system in the Experimental Farm of the Desert Development Center, American University in Cairo (DDC, AUC) in Sadat City. The obtained results showed that cv. Bohemian was the least in vegetative growth, however, with more branches. It produced more fruits number but less fruit weight due to the size of the fruits in comparison to other cultivars. This cultivar could be cultivated at higher planting density to compensate the lower yield per unit area. Fruits of this cultivar characterized with minimum seed number/fruit and flesh thickness that may facilitate the dehydration process of this type. They also dominated over the other cultivars regarding their contents of N, P, K, Fe, Mg, Ca, and vitamin C that make this cultivar preferable from the nutritional point of view. Also, this cultivar had the highest pungent content, it contained 1.70 to 1.86 % of total capsaicinoids, and it might be preferable for the purpose of food and pharmaceutical preparations. The cultivars Cherry, Long-Red Cayenne and Anaheim showed total capsaicinoids contents ranging between 0.52 and 1.26%, but much higher yield of fruits. The productivity and the pungency may affect the proper use of the studied varieties for culinary, food processing, or pharmaceutical industry.

Keywords: Evaluation, Capsicum, Pepper, Capsaicinoids, Varieties, and Cultivars.

INTRODUCTION

Capsicum is variously known as pepper, cayenne, and chili pepper. The used part consists of the dried ripe fruits of *Capsicum annuum* L. and *C. frutescens* L., and a large number of varieties and hybrids of these members of the family *Solanaceae*. For centuries, these plants have been highly valued as spices, and the extensive cultivation carried out over that period of time has resulted in peppers widely differing from one another in size, color, shape, and pungency, and accordingly their uses. The labeling of commercial samples is really meaningful only if the variety is specifically designated, Tyler (1993)

Applied externally, capsicum is a rubifacient, that is an agent that reddens the skin, thereby producing a counterirritant effect. Internally, it is valued as a stomachic carminative and gastrointestinal stimulant, Tyler (1994). All of these activities depend upon the presence of a group of five alkaloids known as capsaicinoids, viz. capsaicin, dihydrocapsaicin, nordihydrocapsaicin, homocapsaicin and homodihydrocapsaicin. Capsaicin is the most important pungent compound in most capsicum species followed by dihydrocapsaicin, Bennett and Kirby (1968). Creams containing low concentrations of capsaicin have been found to be effective in the treatment of intractable pain such as that associated with herpes zoster, postmastectomy and postamputation neuroma, diabetic neuropathy, and

even cluster headache. In addition, capsicum serves as a relatively good source of vitamin C, Tyler (1994). Other important substances in pepper fruits include carotenoids, which are the pigments responsible for the color of fruits. Capsanthin is the major carotenoid in red peppers, comprising about 35% of the total carotenoids, Philip et al. (1971).

Due to increased consumption of hot pepper in Egypt in the fresh form as well as for food and pharmaceutical industries, several varieties and cultivars were introduced in Egypt during the last years. Such varieties should be evaluated for productivity together with their pungency. The present study aimed to evaluate four cultivars of *Capsicum annuum* L. introduced in Egypt, from the agronomical and chemical points of view. The four cultivars are: Bohemian, Cherry, Long-Red Cayenne and Anaheim.

MATERIALS AND METHODS

The present study was carried out during two successive seasons (1999-2000 and 2000-2001). *Capsicum annuum* L. cultivars; Bohemian, Cherry, Long-Red Cayenne and Anaheim were used in this study. Seeds of *Capsicum annuum* L. cv. Bohemian "OSU 6-2" selection were kindly donated from Prof. Dr. James Motes, Oklahoma State University, USA. The author, through propagation in isolated area for successive years, maintained them. This cultivar is almost twenty times more pungent than any other common cultivar. Seeds of Cherry cultivar were imported from Moravo Seed Co., Mirulov, Czech Republic. On the other hand, seeds of Long-Red Cayenne and Anaheim cultivars were delivered through Burpee Exclusive Co., Warminster, USA.

Prior to sowing, the seeds were left under running water over night to facilitate their germination. They were sown in July 16th in foam trays (98 holes each) filled with a planting media consisted of sand + peatmoss + vermiculite (1:1:1). The seedbed was prepared in a greenhouse. Seedlings of 45 days old were transplanted to the greenhouse of the Experimental Farm of the Desert Development Center, American University in Cairo (DDC, AUC) in Sadat City. The plants were raised in loamy-sand soil under drip irrigation system, so they were cultivated at 50x100cm distances. Each line contained 20 plants representing one replicate. Each cultivar was cultivated in three replicates in a complete randomized block design. The plants received the proper agricultural practices of irrigation, fertigation, and weed control according to the technical recommendations released by the Ministry of Agriculture. The ripe fruits were harvested every 15 days starting from middle of December until the end of April. Data on the growth and yield parameters of the different cultivars were recorded on 8 homogeneous plants in each replicate. The plant growth parameters were recorded at the end of the growing season namely; height of 45 days old seedlings, plant height, plant fresh weight, leaves fresh weight/plant, number of main branches/plant, number of lateral branches/plant and number of nodes to the first branch. However, the fruit parameters were measured on fruits harvested on the 15th of March namely; fruit length, fruit diameter, fruit fresh weight, flesh thickness, number of carbels, seeds number/fruit, weight of 1000 seeds, germination percentage and germination rate of the ripe seeds. At the same time samples

of leaves and fruits were dried in an oven at 60°C, then subjected to chemical investigations. Facilities for chemical investigations were kindly offered by the Horticulture Research Institute and DDC, AUC laboratories.

Chlorophylls contents were determined after extraction in 80% acetone using a "Spectronic 2000" spectrophotometer, according to the method of Saric *et al.* (1967).

Capsaicinoids were investigated adopting the HPLC technique according to Attuquayefio and Buckle (1987). The used apparatus was using a Shimadzu LC-6A, HPLC, SPD-6A UV Spectrophotometric detector, with SCL-6B system controller, fitted with C18 Rad-Pak column (8mm i.d., 5µm pore size), the used wave length was 280nm, and a mobile phase of methanol/water (63:37, v/v) at a flow rate of 3.5 ml/min.

Capsanthin content was Spectrophotometrically determined using a "Spectronic 2000" spectrophotometer at 470nm wavelength, according to the method of Worku *et al.*, (1975).

Pure authentic of capsaicin, dihydrocapsaicin and capsanthin were obtained from Sigma Chemical Co., to be used for preparation of the standard curves as well as identification and determination of the chemical composition.

NPK, microelements, and vitamin C contents were determined adopting the methods of A.O.A.C. (1984).

Anova test was applied for the statistical analysis of the collected data through COSTAT, PIF computer program.

RESULTS AND DISCUSSION

Growth parameters:

The recorded data on the growth parameters are tabulated in Table (1). It could be noticed that the recorded values in the second season are slightly lower than those recorded in the first one. That may be due to differences in the environmental conditions.

Table 1: Growth parameters of the *Capsicum annum* cultivars in the two seasons; 1999-2000 and 2000-2001.

Growth Parameters	First season					Second season				
	1*	2	3	4	LSD 5%	1	2	3	4	SD 5%
Height of 45 days seedling (cm)	12.6	14.3	12.5	9.7	1.5	12.3	13.8	11.8	8.8	1.3
Plant height (cm)	108.8	104.6	114.7	128.5	10.6	89.4	85.4	113.3	121.0	14.6
Plant weight (g)	888.8	734.1	1477.5	1475.0	30.5	863.2	616.3	952.5	916.3	29.7
Leaves weight (g/pl)	162.8	95.6	187.0	198.8	22.4	148.8	76.1	180.6	184.7	17.6
No. of main branches	4.9	3.0	3.3	3.3	1.0	4.5	2.9	2.8	3.3	1.0
No. of lateral branches	50.4	27.6	45.5	30.9	8.4	49.4	26.1	39.4	30.1	5.9
No. of nodes to 1 st branch	3.5	3.5	3.5	3.9	0.7	3.4	3.4	3.4	3.4	0.7

*1: Bohemian, 2: Cherry, 3: Long-Red Cayenne, 4: Anaheim.

Seedlings of Bohemian, Cherry and Long-Red Cayenne reached about 12.5- 14.3cm at time of transplanting (45 days after sowing), on the other hand, Anaheim was only 9.7cm height at that time in the first season. The difference between the two groups is significant in the two seasons.

It is obvious that the vegetative growth in terms of plant height and fresh weight of the whole plant and leaves of the two cultivars Bohemian and Cherry was lower in comparison with Long-Red Cayenne and Anaheim. The recorded values were 108.6cm, 888.8g, 162.8g and 104.6cm, 734.1g, 95.6g

for cv. Bohemian and cv. Cherry, respectively, while they were 114.7cm, 1477.5g, 187.0g, and 128.5cm, 1475.0g, 198.8g, respectively for cv. Long-Red Cayenne and cv. Anaheim.

Although the Bohemian cultivar bore more branches (50.4) than the Long-Red Cayenne (45.5) and Anaheim (30.9), but the first had less biomass than the other two. Cherry cultivar was the least regarding number of branches (27.6) and plant weight (734.1g).

The four cultivars did not differ in the possession of the first branching point taking place at the fourth node.

Differences in soil, climate, and cultivation conditions, possibly played roles in the characteristics of capsicum cultivars, differing in shape, size, color, pungency, and aroma, Worku *et al.* (1975).

Yield parameters:

1-Fruits number/plant:

It could be noticed from Table (2) that cv. Bohemian produced the highest number of fruits/plant (492 and 485 in the two seasons, respectively) compared with the other cultivars. On the contrary, the least number of fruits/plant was produced by cv. Anaheim; 132.3 and 129.5 in the two seasons, respectively. Sidky (1993) reported fruit number ranging between 240 and 320/plant for cv. Bohemian grown in pots.

2-Fruits fresh weight g/plant:

Although the cv. Bohemian was superior regarding the number of fruits/plant however, its yield as weight of fresh fruits was the least (837.5g and 795.3g/plant in the two seasons, respectively). That is due to the small fruits characterizing this cultivar. The cultivar Long-Red Cayenne was superior regarding the total fruits yield; it gave 2905.0g and 2850.3g/plant in the two seasons, respectively, followed by Anaheim, Cherry, then and Bohemian. The Cherry cultivar gave the highest portion of the yield as early crop (30.2% and 29.1% in the two seasons, respectively).

Fruit parameters:

For the first glance, the four cultivars under investigation could be categorized in two groups with regard to the fruit length, weight and number of seeds per fruit (Table 3). The first group contains the Bohemian and

Table 2: Fruits number and weight (g)/plant of the *Capsicum annum* cultivars at successive harvests in the two seasons; 1999-2000 and 2000-2001.

Yield Parameters	First season					Second season				
	1*	2	3	4	LSD 5%	1	2	3	4	LSD 5%
Fruits Number										
From Dec. 15 to Jan. 29	40.3	54.7	33.7	16.2	9.4	43.2	34.3	42.7	15.3	7.7
% Early crop	8.2	19.0	17.3	12.2		8.9	13.2	22.4	11.8	
From Jan. 29 to April 30	451.7	232.8	180.8	116.1		441.8	225.7	147.8	177.2	
Total crop	492.0	287.5	194.5	132.3	40.3	485.0	260.0	190.5	129.5	35.3
Fruits fresh weight (g /plant)										
From Dec. 15 to Jan. 29	113.9	520.4	647.8	390.4	61.2	108.3	283.3	425.3	230.0	48.5
% Early crop	13.6	30.2	22.3	14.3		15.6	29.1	20.1	13.2	
From Jan. 29 to April 30	723.6	1202.9	2257.2	2339.6		687.0	1406.7	2425.0	2410.3	
Total crop	837.5	1723.3	2905.0	2730.0	160.3	795.3	1690.0	2850.3	2640.3	139.1

*1: Bohemian, 2: Cherry, 3: Long-Red Cayenne, 4: Anaheim.

Table 3: Fruits parameters of the *Capsicum annum* cultivars in the two seasons; 1999-2000 and 2000-2001.

Fruits parameters	First season					Second season				
	1*	2	3	4	LSD 5%	1	2	3	4	LSD 5%
Fruit length (cm)	8.5	2.4	19.2	14.3	0.9	7.5	2.4	18.0	13.8	0.9
Fruit diameter (cm)	0.6	2.3	1.8	3.1	0.3	0.6	2.1	1.7	2.9	0.3
Fruit fresh weight (g)	1.8	8.0	15.5	33.4	3.2	1.6	8.0	14.7	32.1	3.5
Flesh thickness (cm)	0.1	0.3	0.2	0.3	0.01	0.1	0.3	0.2	0.3	0.01
Number of carbels	2.4	2.9	3.3	2.0	N.S	2.3	2.3	3.0	2.0	N.S
Seeds number/fruit	60.0	237.4	212.0	90.3	31.9	46.3	218.8	154.7	72.0	25.6
Seeds weight (g/fruit)	0.3	1.9	2.3	0.9	0.3	0.2	1.7	1.7	0.7	0.3
1000 seeds weight (g)	4.5	7.9	10.7	9.9	1.1	4.5	7.7	10.7	9.9	1.0
Germination %	85.0	94.3	98.0	65.8	6.6	84.0	94.0	95.6	65.3	6.3
Germination rate (day)	3.2	4.6	4.6	6.0	0.6	3.1	4.6	4.6	5.9	0.5

*1: Bohemian, 2: Cherry, 3: Long-Red Cayenne, 4: Anaheim.

Cherry cultivars, while the second one contains the Long-Red Cayenne and Anaheim. Long-Red Cayenne showed the highest fruit length of 19.2 and 18.0cm in the two seasons, respectively, followed by cv. Anaheim, while cv. Cherry was the least, 2.4cm in both seasons. On the contrary, cv. Anaheim was superior regarding fruit diameter, weight and flesh thickness; 3.1cm, 33.4g and 0.3cm, respectively, in the first season, while cv. Bohemian was the least in this regard; 0.6cm, 1.8g and 0.1cm, respectively.

The four cultivars did not differ in number of carbels. Fruits of the two cultivars Cherry and Long-Red Cayenne contained much more higher of seeds per fruit; 237.4 and 212.0 in the first season, as well as, 218.8 and 154.7, respectively in the second season, compared with the other two cultivars.

Regarding the seed index, as weight of 1000 seeds, cv. Long-Red Cayenne showed the highest value (10.7g) followed by cv. Anaheim (9.9g) in both seasons, while the other two cultivars showed lower values.

Seeds of Anaheim cultivar had the least germination capacity as germination percentage of 65.8% and rate of 6 days. On the contrary, seeds of Long-Red Cayenne showed the highest germination percentage of 98.0%, followed by Cherry (94.3%), then Bohemian (85.0%). Both Cherry and Long-Red Cayenne showed similar germination rate of 4.6 days. Almost the same figures were recorded in the second season.

Capsicum varieties are usually classified according to fruit characters, viz., pungency, color, fruit shape, and by their use. When mature, red pepper pods are dried and ground; they become the most consumed spice in the world. Cayenne group fruits are slim, pointed, slightly curved, and have varying lengths (10 to 20 cm). Fruits of Anaheim group ranged between 10 to 15cm long. Cherry group fruits are globosely, three celled, upright fruits, small to large, Worku *et al.* (1975), Bosland *et al.* (1988), and Bosland and Iglasias (1989).

Chemical composition:

Dry matter content:

For the first glance, the four cultivars could be grouped in two groups based on their content of the dry matter, Tables (4 and 5). The first group includes the Bohemian cultivar characterized with much higher dry matter in both leaves (23.0%) and fruits (35.4%) in the first season. The second group

contains the other three cultivars with lower dry matter contents ranging between 12.6 and 14.3% in the leaves, while ranging between 18.2 and 20.6% in the fruits, in the first season. The same trend continued in the second season.

Chlorophylls and carotenoids contents:

Leaves of cv. Bohemian had the highest chlorophylls content, i.e., chlorophylls A, B, and carotenoids; 1.76, 0.73 and 1.30 mg/g fresh weight in the first season, respectively, while they were 1.85, 0.80 and 1.36 mg/g in the second one. Kandeel *et al.* (1993) mentioned a chlorophyll content in the dry leaves of capsicum ranging between 35 and 49 mg/g.

Total carbohydrates content:

Leaves of cv. Long-Red Cayenne was the richest in carbohydrates, its content reached 55.32 and 54.73% in the two seasons, respectively. On the contrary, leaves of cv. Bohemian contained the least carbohydrates of 40.71 and 37.12% in the two seasons, respectively. Regarding the carbohydrates content in the fruits, the cv. Bohemian was the richest; it contained 64.20% in the first season and 58.10% in the second one. It was followed by cv. Cherry and Long-Red Cayenne, while Anaheim was the least.

Vitamin C content:

Vitamin C content was the highest in fruits of cv. Anaheim; 86.33 and 93.00mg/g in the two seasons, respectively. On the contrary, cv. Bohemian contained the least of vitamin C; 43.83 and 33.67mg/g in the two seasons, respectively. Varieties greatly differ as regards to vitamin C content, green colored varieties generally contain more vitamin C than the yellowish-white ones. Vitamin C content depends on several factors; the variety, season, and environmental factors are all of importance in this respect, Somos, (1984).

Capsanthin content:

The capsanthin content in fruits of the four varieties ranged between 2.5 and 3.9mg/g in the two seasons, with cv. Bohemian having the highest values of 3.9mg/g in the two seasons, while Anaheim having the least content of 2.7 and 2.5mg/g in the two seasons, respectively. Sidky (1993) reported that, capsanthin content ranging between 1.95 and 2.15mg/g in Bohemian cultivar. While the capsanthin content in the dry fruits of varieties belonging to *C. annum* ranged between 1.8 and 3.8 mg/g, Worku *et al.* (1975).

Capsaicinoids content:

Fruits of the Bohemian cultivar had the highest pungency due to high contents of both capsaicin and dihydrocapsaicin (Table 5 and Fig.1). They contained 0.95 and 1.04% of capsaicin in the two seasons, respectively, as well as 0.75 and 0.83% of dihydrocapsaicin in the two seasons, respectively. Regarding the total capsaicinoids, cv. Bohemian was the richest one (1.70 and 1.86%), followed by Long-Red Cayenne (1.19 and 1.26%), then cv. Cherry (0.91 and 0.89%), while cv. Anaheim was the poorest cultivar (0.55 and 0.52%), in the two seasons, respectively. The capsaicin content is mainly a hereditary trait. There are considerable differences between the varieties with regard to their pungency. The real amount, however, may vary to a certain extent as a response to changes in the environmental factors. Somos

(1984), Deb *et al.* (1963), Thirumalachar (1967) and Khalaf-Allah *et al.* (1982) reported a content of capsaicin ranging between 0.25 and 1.6% in fruits of hot pepper.

Table 4: Leaves chemical composition of the *Capsicum annum* cultivars in two seasons; 1999-2000 and 2000-2001.

Parameters	First season					Second season				
	1*	2	3	4	LSD 5%	1	2	3	4	LSD 5%
Dry matter (%)	23.0	14.3	13.7	12.6	3.8	20.8	13.9	12.9	12.5	1.5
Chlor.A (mg/g)**	1.76	1.25	1.18	1.11	0.20	1.85	1.35	1.25	1.18	0.20
Chlor.B (mg/g)**	0.73	0.69	0.51	0.45	0.10	0.80	0.75	0.78	0.45	0.15
Carotene (mg/g)**	1.30	1.28	1.23	1.18	0.10	1.36	1.34	1.30	1.29	0.15
Total carbohyd.(%)	40.71	41.72	55.32	49.00	4.40	37.12	38.50	54.73	44.01	4.20
N (%)	4.08	3.54	3.47	3.51	0.32	4.37	4.01	4.15	3.79	0.36
P (%)	0.35	0.25	0.31	0.28	0.03	0.48	0.32	0.44	0.41	0.02
K (%)	3.90	4.32	4.00	3.94	0.29	4.70	5.94	4.44	4.31	0.31
Fe (ppm)	538.83	390.33	307.33	308.67	31.93	569.83	430.33	349.33	375.00	32.22
Zn (ppm)	24.10	35.60	28.70	31.50	3.20	36.60	45.60	33.80	40.40	4.60
Mn (ppm)	32.17	27.67	22.67	30.50	2.41	51.17	38.83	33.00	40.00	3.22
Cu (ppm)	87.00	33.83	39.17	59.00	3.35	97.33	38.00	41.17	63.83	3.66
Mg (%)	0.59	0.62	0.62	0.66	N.S.	0.67	0.73	0.73	0.76	0.04
Ca (%)	2.05	2.10	2.26	2.85	0.14	2.08	2.23	2.43	3.03	0.15

* 1: Bohemian, 2: Cherry, 3: Long-Red Cayenne, 4: Anaheim. ** On bases of fresh weight.

Table 5: Fruits chemical composition of the *Capsicum annum* cultivars in two seasons; 1999-2000 and 2000-2001.

Parameters	First season					Second season				
	1*	2	3	4	LSD 5%	1	2	3	4	LSD 5%
Dry matter (%)	35.4	19.9	20.6	18.2	3.6	27.2	17.1	17.8	13.9	2.5
Tot. Carbohyd. (%)	64.20	58.50	56.30	39.50	4.44	58.10	52.60	49.20	36.30	4.20
Vit.C (mg/g)**	43.83	85.33	68.33	86.33	2.78	33.67	90.33	74.17	93.00	2.92
Capsanthin (mg/g)	3.9	3.4	3.7	2.7	NS	3.9	3.4	3.6	2.5	NS
Capsaicin (%)	0.95	0.52	0.67	0.32	0.06	1.04	0.53	0.68	0.33	0.04
Dihydr.caps. (%)	0.75	0.39	0.52	0.23	0.04	0.83	0.36	0.58	0.19	0.03
Tot.capsaicins (%)	1.70	0.91	1.19	0.55	0.12	1.86	0.89	1.26	0.52	0.17
N (%)	2.33	2.20	1.70	1.47	0.18	2.47	2.43	1.93	1.57	0.20
P (%)	0.42	0.40	0.31	0.25	0.02	0.47	0.42	0.34	0.31	0.02
K (%)	2.07	2.03	1.77	1.67	0.20	2.20	2.17	1.83	1.60	0.15
Fe (ppm)	123.33	113.67	70.67	78.83	13.59	134.00	122.83	104.00	95.00	9.38
Zn (ppm)	8.10	12.50	9.83	10.50	1.57	13.33	16.33	11.67	14.17	2.13
Mn (ppm)	8.57	10.33	11.23	9.67	1.33	11.33	12.33	13.67	12.33	1.06
Cu (ppm)	8.33	11.67	12.17	12.17	NS	11.50	12.50	16.17	12.67	NS
Mg (%)	0.22	0.17	0.11	0.10	0.02	0.24	0.20	0.14	0.14	0.01
Ca (%)	0.15	0.05	0.06	0.07	0.02	0.17	0.09	0.08	0.08	0.02

*1: Bohemian, 2: Cherry, 3: Long-Red Cayenne, 4: Anaheim. ** On bases of fresh weight.

Major elements:

Data on the chemical composition of leaves and fruits of the four cultivars (Tables 4 and 5) revealed that leaves of cv. Bohemian characterized with the highest contents of N and P in the leaves. The recorded values were 4.08 and 4.37% for N in the two seasons, respectively, while 0.35 and 0.48% for P, respectively. Also, fruits of the same cultivar contained the highest values of N, P, and K. The recorded values were 2.33, 0.42 and 2.07%, respectively in the first season, and 2.47, 0.47 and 2.20%, respectively in the second one. Leaves of cv. Cherry was the richest in K, it contained 4.32 and 5.94% in the two seasons, respectively. Sidky (1993) reported that the N

content ranged between 2.8 and 5.9%. Somos (1984) reported that in the individual plant parts N content ranged between 2 and 3% and comparison of hot and non-hot varieties indicated that the hot varieties contained more P than the non-hot ones. He added that paprika contains much more K than N and P, most K is to be found in the leaves (4.7 to 6.8%). Similarly to calcium it is the leaf of paprika that contained more Mg than the fruit and root contained the least.

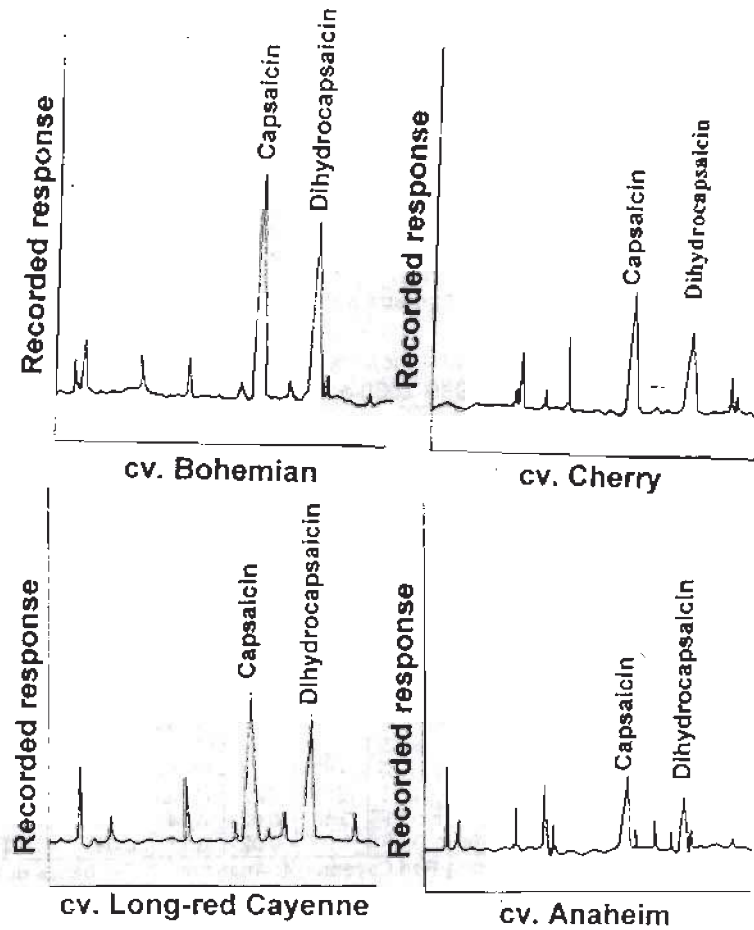


Fig. (1): Results of HPLC analysis of major capsaicinoids of *Capsicum annuum* cultivars

Minor elements:

Regarding the micro-elements content of the leaves and fruits, it is evident from data in Tables (4 and 5) that leaves of cv. Bohemian were the richest in Fe, Mn and Cu. They contained 538.83 and 569.83 ppm of Fe, 32.17 and 51.17 ppm of Mn, and 87.00 and 97.33 ppm of Cu in the two seasons, respectively.

In case of fruits, cv. Bohemian was also the richest in Fe (123.33ppm), Mg (0.22%) and Ca (0.15%) in the first season. While the cv. Cherry was the richest in Zn (12.50ppm), and Long-Red Cayenne the richest in both Mn (11.23ppm) and Cu (12.17ppm) in the first season. The same trend continued in the second season.

Based on the above-mentioned results, it could be concluded that plants of the Bohemian cultivar although smaller in size but they are branching more than the other cultivars studied. It produced much more fruits per plant but with lower weight due to smaller fruit size, in comparison to the other cultivars. Cultivation of this cultivar at higher density, meaning more plants per unit area, may compensate the lower yield. Fruits of this cultivar characterized with minimum seeds and fruit thickenings that facilitate their dehydration. They also dominated over the other cultivars regarding their contents of N, P, K, Fe, Mg, Ca, and vitamin C, all characters that value this cultivar from the nutritional point of view. Also, this cultivar had the highest pungency that makes it distinguished when looking for a pungent cultivar for the purposes of the food and pharmaceutical industries. The variety Long-Red Cayenne was superior regarding its yield, but it is intermediate in its pungency, it is primarily used for making the hot sauces. Cherry fruits are less pungent than the Bohemian and Long-Red Cayenne cultivars; they could be used for pungent seasonings, chili powder, and oleoresins. Fruits of the cv. Anaheim are mild in pungency and could be used in the green stage for preparing fresh salad and green sauce, while the fully mature red dry pods for making chopped red pepper.

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دراسة مقارنة لبعض أصناف جديدة من الفلفل الحريف في مصر

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أجرى هذا البحث خلال موسمي نمو متتاليين (1999-2000 و 2000-2001) لدراسة مقارنة بين أربعة أصناف من الفلفل الحريف (*Capsicum annuum*) والتي اخذت زراعتها في مصر وهي Anaheim، Long-Red Cayenne، Cherry، Bohemian. وقد تمت زراعتها في تربة طينية-رملية بالصوب القائمة بالمحطة التجريبية بمركز تنمية الصحراء-الجامعة الأمريكية بمدينة السادات تحت نظام الري بالتنقيط.

وقد أوضحت النتائج أن الصنف Bohemian قد تميز بحجم نمو خضري أقل من الأصناف الأخرى رغم أنه أكثرها تفرعاً وبالتالي أعلاها في عدد الثمار/نبات لكن الوزن الإجمالي للمحصول أقل نظراً لصغر حجم ثماره بالمقارنة بالأصناف الأخرى. ويمكن تعويض ذلك بتكثيف زراعته بعدد أكثر من النباتات في وحدة المساحة. وقد تميزت ثمار هذا الصنف بأقل عدد من البذور/ثمرة وكذلك سمك جدار الثمرة مما يلائم عمليات التجفيف والتي أحياناً ما تمثل مشكلة في تصنيع ثمار الفلفل الحريف. كذلك فإن ثمار هذا الصنف قد تميزت بأعلى محتوى من النتروجين، الفوسفور، البوتاسيوم، الماغنسيوم، الكالسيوم والتي ترفع من قيمته الغذائية. أيضاً فإن ثمار هذا الصنف كانت الأكثر حرافة حيث احتوت 1.86% - 1.70% كابسيسينات مما يجعله الأفضل عند اختيار صنف ملائم لإنتاج المواد الحريفة في الصناعات الغذائية والصيدلية.

أما الأصناف الأخرى فقد احتوت على مستويات أقل من مادة الكابسيسينات تراوحت بين 0.52% و 1.26% إلا أنها تفوقت عن الصنف الأول في المحصول. لذلك يمكن القول أن الموائمة بين المحصول ومحتوى الثمار من المواد الحريفة يحدد مدى ملاءمة أي صنف لإستخدامه سواء كتابل أو في الصناعات الغذائية أو الصيدلية.