FOLIA
HORTICULTURAE
Ann. 18/2, 2006, 99-103

SHORT COMMUNICATION

Differences of capsaicinoids content in pericarp and paste of soft-flesh *Capsicum* spp. fruit

Paweł Nowaczyk[1], Lubosława Nowaczyk[1], Magdalena Banach[2], Ineza Król[1]

[1]Department of Genetics and Plant Breeding
[2]Department of Environmental Chemistry
University of Technology and Life Sciences
Bernardynska 6, 85-029 Bydgoszcz, Poland
e-mail: warz@utp.edu.pl

Key words: capsaicin, dihydrocapsaicin, HPLC

ABSTRACT

The subject of the research was to compare the content of capsaicinoids in pericarp with their content in whole fruits, mixed and pressed through sieves. The research material was constituted by fruit of three soft-flesh lines of F_6 generation selected from interspecific hybrids of *Capsicum frutescens* L. × *Capsicum annuum* L. and one breeding line of *C. frutescens* L. The analysis of the capsaicinoids content was made using HPLC method. Capsaicin and dihydrocapsaicin content in all examined genotypes was always higher in the paste than in the pericarp. The several-times increase of the content of the discussed compounds was undoubtedly the consequence of the effect of their considerable amounts being released from the

interlocular septa and the placenta. Typically for each of the examined lines, a much higher content of capsaicin than dihydrocapsaicin was observed.

INTRODUCTION

An interesting technological characteristic of some species of *Capsicum* genus is the soft flesh of fruit at the physiological maturity phase. Among the materials we had at our disposal, the presence of the foregoing characteristic was ascertained in *C. frutescens* L. The condition for it is the presence of a dominant *S* gene (Lippert et al. 1965). Its practical aspect is based upon the possibility of a mechanical separation of soft flesh ripe pericarp from inedible and ballast parts, such as placenta with seeds, peel and interlocular septa.

Among biologically active components, capsaicinoid content is of vital significance for the quality of fruit and products obtained from them. These compounds are specific for each species of *Capsicum* genus, and they are characterized by antioxidant properties (Perucka and Materska 2003). The latest research results (Tremblay 2005) also indicate that capsaicinoids have a positive influence on fat metabolism in human body. Eating pepper fruit which contain these components can therefore prevent the ever more common problem of obesity. The subject of the research discussed herein was the establishment of the content of major capsaicinoids in pericarp and paste, in the context of anticipated differences resulting from diverse distribution of these substances in fruit.

MATERIAL AND METHODS

The research material was constituted by fruit of three lines of F_6 generation (32/3/4, 32/3/4/1 and 32/3/16) selected from interspecific hybrids of *Capsicum frutescens* L. × *Capsicum annuum* L. and one breeding line of *C. frutescens* L. (Cf SF 2/2). The symbols of the researched lines are provided in brackets. The average weight of their fruit amounted to 125, 59, 89 and 10 g respectively. Dried raw material of the pericarp and the paste was prepared from the fruits of four plants each of the mentioned genotypes.

The analysis of capsaicinoids content, represented by capsaicin and dihydrocapsaicin, was made according to the method described and proved by Collins et al. (1995). In order to extract capsaicinoids, ground samples of 1.5 g poured over with 15 ml of acetonitrile were placed in 50 ml glass bottles with teflon – lined lids. The bottles were capped and placed in an 80°C water bath for 4 h and swirled manually every hour. The samples were cooled to room temperature. Ca. 3 ml of supernatant was extracted and filtered (0.45 µm Waters Millex – HN filter unit on a 5 ml disposable syringe) into glass vail, capped and

stored at 5°C until analyzed. A 10 µl aliquot was used for each HPLC injection. Each sample was analysed in four replications. Determinations were made with the use of Perkin Elmer, Series 200 HPLC device equipped with autosampler system and PE Nelson Network Chromatography Interface NC 1900. The amount of capsaicin and dihydrocapsaicin was determined by isocratic flow of the analysed solution through the column (Waters S50DS2 4.6 × 100 mm C18 column) at the speed of 1 ml min^{-1} for the period of 7 min using detector set with excitation at 280 nm. The mobile phase was isocratic, with 70% solvent A (100% methanol) and 30% solvent B (10% methanol in water, by volume). Standards of 8-methyl-N-vanillyl-6-nonenamide (capsaicin) and N-vanillylnonanamide (dihydrocapsaicin) were obtained from Sigma-Aldrich. Standard solutions of 1000, 500, 100, 50, 25, 10, 5 and 1 ppm were prepared in 100% methanol by dilution of a 2000 ppm stock solution. Making use of the formula given in the work referred to above, the level of taste pungency with the use of Scoville Units (SU) was also determined. The results obtained during the experiments were subjected to statistical analysis. The volume of the lowest significant difference was determined by means of Tukey's test with $p = 0.05$. In the table, statistically different data were identified by different letters.

RESULTS AND DISCUSSION

Capsaicinoid concentration in different parts of the fruit is not equal. Hauffman et al. (1978) concluded that in the fruit of 'Jalapeno' cultivar the largest amount of these compounds was found in cross walls, then in placenta and seeds, and the smallest amount was found in outer walls. The subject of the research was to compare the content of capsaicinoids in pericarp only with their content in whole fruits, mixed and pressed through sieves.

Capsaicin and dihydrocapsaicin content in all examined genotypes was always higher in the paste than in the pericarp (Table 1). Similar observations refer to the sum of both capsaicinoids. The several-times increase of the content of the discussed compounds was undoubtedly the consequence of the effect of their considerable amounts being released from the interlocular septa and the placenta. This took place during the mixing of the fruit and the separation of the flesh from inedible parts. Particularly gross differences were found in line 32/3/16. The pericarp of that line contained small amounts of capsaicinoids. Their amount in paste was sixteen times higher.

Typically for each of the examined lines, a much higher content of capsaicin than dihydrocapsaicin was observed. Both of the discussed compounds constitute, according to research by Zewdie and Bosland (2001), over 90% of the total content of all capsaicinoids. Thus, from the practical point of view, capsaicinoid analysis in

the material for food processing and pharmaceutical industry can be limited to the former two capsaicinoids. Practical reasons are also behind our presenting the obtained results in the widely known and used Scoville scale (Fig. 1).

Table 1. Capsaicin and dihydrocapsaicin content [ppm of dry matter]

Genotype	Capsaicin [ppm]	%	Dihydrocapsaicin [ppm]	%	Total [ppm]
Pericap					
32/3/4	12.8 c*	74	4.5 c	26	17.3 c
32/3/4/1	9.2 b	75	3.0 b	25	12.2 b
32/3/16	1.9 a	68	0.9 a	32	2.8 a
Cf SF 2/2	12.0 c	63	5.5 d	37	17.5 c
Paste					
32/3/4	20.4 d	76	6.3 e	24	26.7 d
32/3/4/1	25.8 e	65	13.6 g	35	39.4 e
32/3/16	36.7 f	80	9.0 f	20	45.7 f
Cf SF 2/2	46.4 g	84	8.6 f	16	55.0 g

*Values marked with the same letter do not differ significantly at p = 0.05

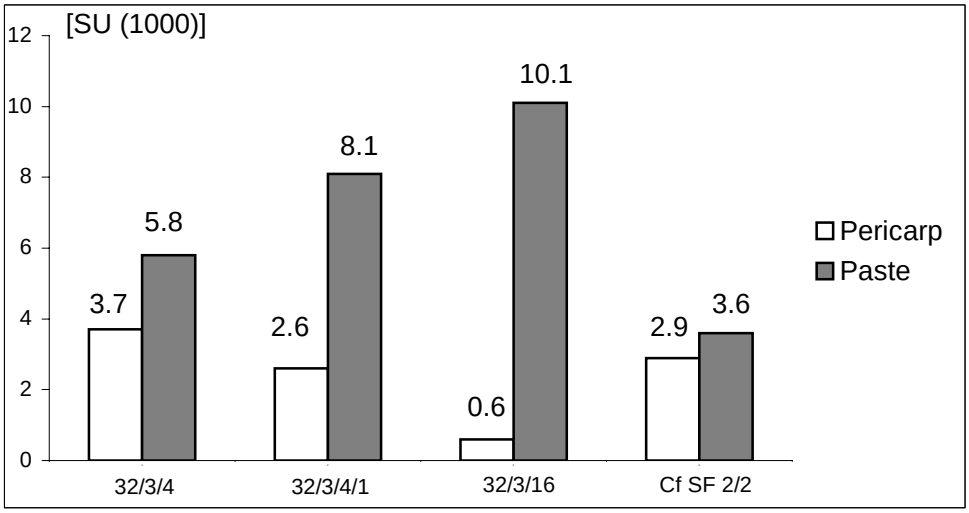

Fig. 1. Pungency level of pericarp and paste in Scoville Units (according to Greenleaf 1986)

According to Otha (quoted in Greenleaf 1986) the mentioned pungency scale divides genotype groups in the following way: no pungency detectable (0.0-10), mildly pungent (11-30), moderately pungent (31-80), and highly pungent (>80).

However, it appears that the division is not absolutely strict, particularly as far as the first group is concerned. Since paste obtained from line 32/3/16 can be described as mildly pungent, it is therefore possible to enter the discussed compounds into the human body without exposing oneself to mouth irritation.

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RÓŻNICE ZAWARTOŚCI KAPSAICYNOIDÓW W PERYKARPIE I PRZECIERZE Z OWOCÓW SOFT – FLESH *CAPSICUM* SPP.

Streszczenie: Przedmiotem badań było porównanie zawartości kapsaicynoidów w perykarpie oraz w całych owocach, które poddano miksowaniu i przetarciu przez sita. Materiałem badawczym były owoce trzech linii typu soft-flesh pokolenia F_6 wyselekcjonowanych z mieszańców międzygatunkowych *Capsicum frutescens* L. × *Capsicum annuum* L. oraz jedna linia hodowlana *C. frutescens* L. Analizy zawartości kapsaicynoidów, dokonano używając metody HPLC. Zawartość kapsaicyny i dihydrokapsaicyny u wszystkich badanych genotypów była zawsze wyższa w przecierze niż w perykarpie. Kilku lub kilkunastokrotny wzrost stężenia omawianych związków w przecierze był niewątpliwie efektem uwolnienia znacznych ich ilości z przegród i łożyska. Dla każdej z badanych linii, jako charakterystyczne, obserwowano zdecydowanie wyższy udział kapsaicyny niż dihydrokapsaicyny.

Received March 08, 2006; accepted December 12, 2006