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EVALUATON OF SOME CULTIVARS OF *DAUCUS CAROTA* IN EGYPT

Part VII: Investigation of the Protein and Pectin of The Roots and Pectins of the Fruits of the Yellow and Red Cultivars

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ABSTRACT

The total protein content of the roots of the yellow and red cultivars of Daucus carota var. sativa were 2.89% and 2.05% respectively. Glutamic acid constituted the major component of the amino acids identified in the hydrolysate of the protein of the roots of the yellow cultivar followed by aspartic acid, proline, alanine, valine, serine and glycine. Threonine represented the major component of the amino acids identified in the hydrolysate of the protein of the roots of the red cultivar followed by proline, alainine, valine and glycine. Pectins were isolated from the roots and fruits of the red and yellow cultivars. Pectins reached abut 8.3% in the roots and 2.1% in the fruits of the red cultivar. It reached about 4.1% in the roots and 2.1% in the fruits of the yellow cultivar. Pectins

INTRODUCTION

Carrot, beside its nutritive values as a good palatable edible food[1], it is widely cultivated in Egypt as a public vegetable. The aerial parts and fruits of carrot plant play a good role in folk medicine. They are also used for treatment of ulcers, chronic cough and dyspepsia. At present, they are used as diuretic and antispasmodic[2-6].

The fruits are commonly used as carminative, anthelmintic and stimulant. They are also useful for the treatment of skin cancer, some tumors, as well as swellings[2-6]. Powdered carrot roots are marketed in pharmacies under the name (Caril and Beblac carrot) to support the treatment of infantile diarrhoea.

In a previous publication, the unsaponifiable and saponifiable matters of the roots of the red and yellow cultivars of carrot[7], as well as their anthelmintic activities[8] were studied. Also, the fixed oils of the fruits of the red and yellow cultivars were investigated and their protein contents were studied[9]. Moreover the Macro-and Micro-morphology of both cultivars were also studied[10,11]. Also lipids, carbohydrates, vitamins and aminoacids contents of carrot were studied[12].

Cohesion of pectin chains and cellulose chains by Van der Waals' forces was reported by El-Atawy[13]. Fishman et al., isolated the pectins from carrot and some other fruits and vegetable by-products obtained from some Egyptian food factories. Also they analysed the isolated pectins, by GC and other techniques to clarify their chemical structures[14,5].

Also it was stated that the fruits of *D. carota* were among plants which are rich in free amino acids[16].

The amino acids composition of the proteins of carrot were previously analysed[17].

In the present work, investigation of proteins and pectin contents of the roots of the two Egyptian cultivars was carried out.

EXPERIMENTAL

Materials:

The fruits and roots of chantenay (yellow) and balady (red) selected cultivars of *Daucus carota* L. var. sativa were obtaind from teh Horticultural Research Station (El-Qanater El-Khyriah), Egypt, in March, 1992.

Methods:

A- Protein analysis;

1- Quantitative determination of total proteins:

The anout of crude proteins was determined by the macrokjeldahl method[18] based on the fresh material.

2- Analysis of amino acids:

Analysis was done by using high performance amino acid analyzer: (Beckman high performance amino acid aalyzer); system 7300; data system 7000 and Na- A/B/D 25 cm column; at the central Laboratory for Food and Feed, Horticultural Research center, Giza, Egypt, Amino acids determination was performed adopting Moore et. al. method[19].

B- Pectin analysis:

1- Isolation and quantitative determination of pectins:

Pectins were isolated from the roots and fruits of both red and yellow cultivars adopting methods followed by Fishman, et. al.[15]. They were hydrolysed for GLC analysis adopting methods follwed by Chrums, et. al[20].

2- GLC analysis of the pectin hydrolysates:

GLC analysis of the hydrolysates of pectines

isolated was performed adopting the following conditions:

A- About 2 mg of the residue obtained from each hydrolysate under investigation was separately dissolved in one ml of anhydrous pyridine. About one ml of N,N-bistrimethyl silyl acetamide was added to each solution. The mixture was vigorously shaked for 30 sec, then heated at 50°C for about one minute. The mixture was kept for about five minutes at room temperature prior to chromatography.

B- Sigma 3B, Perkin-Elmer gas chromatograph was used. It is equiped with a flame ionization detector, packed column of 3% SE-30 of 6 ft length and 1/4 in outer diameter. Sample size 1 µl; nitrogen was used as a carrier gas with flow rae of 30 ml/min; Hydrogen flow rate was 30 ml/min. Air flow rate was 300 ml/min. Injector temperature was 280°C, detector temperature was 300°C. Chart speed was 15 cm/hr. Oven was programmed fom 100°C for one min to 280°C for 10 min at 10°C/min.

RESULTS AND DISCUSSION

The total protein amounted 2.89% and 2.05% in the roots of the yellow and red cultivars respectively (Table 1). Sixteen amino acids were identified in the roots of the yellow cultivar. Glutamic acid represented the major component (0.63%) in the yellow cultivar followed by aspartic acid (0.47%), proline (0.42%), alanine (0.19%), valine (0.18%), serine (0.17%), glycine (0.17%), threonine (0.14%), lysine (0.11%) and leucine (0.10%). The essential amino acids constitute about 20% of these acids. Qualitative and quantitative variation is noticed from that previously reported[12]. This variation may be due to enviromental factors.

Fourteen amino acids were identified in the red cultivar. Threonine represented the major component (0.44%) in the red cultivar followed by proline (0.42%), alanine (0.19%), valine (0.17%), glycine (0.17%), lysine (0.12%), leucine (0.11%) and serine (0.11%). The essential amino acids constitute about 40% of the total amino acids. This is the first report for the amino acid contents of red carrot.

The pectins reached about 8.3% in the roots and 2.1% in the fruits of the red cultivar. It reached about 4.1% in the roots and 2.1% in the fruits of the yellow cultivar. GLC analysis of the hydrolysates of the isolated pectins (Table 2) revealed that; Galacturonic acid represented the major component of each hydrolysate under investigation followed by galactose, arabinose, rhamnose, mannose and glucose. Also galacturonic acid reached about 66.10% in the roots and 59.20% in the fruits of the yellow cultivar. It reached 65.40% in the roots and 56.80% in the fruits of the red cultivar. Galactose reached about 13.80% in the roots and 12.70% in the fruits of the yellow cultivar.

While it reached about 14.10% in the roots and 13.61% in the fruits of teh red cultivar. Arabinose reached 09.01% in the roots and 08.76% in the fruits of the yellow cultivar, while it reached about 09.00% in the roots and 08.92% in the fruits of the red cultivar. Rhamnose reached about 04.81% in the roots and 04.79% in the fruits of the yellow cultivar. It reached 04.71% in the roots and 04.62% in the fruits of the red cultivar.

Mannose reached about 03.31% in the roots and 03.21% in the fruits of the yellow cultivar, while it reached 03.51% in the roots and 03.22% in the fruits of the red cultivar. Glucose reached about 00.80% in the different organs examined.

Pentoses reached about 13.82% in the roots and 13.55% in the fruits of the yellow cultivar, while they reached about 13.71% in the roots and 13.54% in the fruits of the red cultivar. Hexoses reached about 17.93% in the roots and 16.71% in the fruits of the yellow cultivar, while it reached about 18.40% in the roots and 17.64% in the fruits of the red cultiver.

Table 1. Amino acids content of the roots of the yellow and red cultivars of *D. carota* L. var. sativa.

	Amino acids	Percentage	
		red cultivar	yellow cultivar
01	Aspartic acid	--	0.47
02	Threonine	0.44	0.14
03	Serine	0.11	0.17
04	Glutamic acid	--	0.63
05	Proline	0.42	0.42
06	Glycine	0.17	0.17
07	Alainine	0.19	0.19
08	Cysteine	0.01	0.01
09	Valine	0.17	0.18
10	Methionine	--	--
11	Isoleucine	0.06	0.05
12	Leucine	0.11	0.10
13	Tyrosine	0.04	0.04
14	Phenylalanine	0.06	0.07
15	Histidine	0.06	0.06
16	Lysine	0.12	0.11
17	Arginine	0.09	0.08
Total		2.05	2.89

Table 2. Sugars percentages of the pectins hydrolysates, isolated from the roots and fruits of the yellow and red cultivars of *D. carota* L. var. sativa, after analysis with GLC.

No.	Components	Percentage			
		Yellow cultivar		Red cultivar	
		Roots	Fruits	Roots	Fruits
01	Galacturonic acid	66.10	59.20	65.40	56.80
02	D(+)-Galactose	13.80	12.70	14.10	13.61
03	L(+)-Arabinose	09.01	08.76	09.00	08.92
04	L(+)-Rhamnose	04.81	04.79	04.71	04.62
05	D(+)-Mannose	03.31	03.21	03.51	03.22
06	D(+)-Glucose	00.82	00.80	00.79	00.81
Total		97.85	89.46	97.51	87.98

The obtained findings of the pectins and proteins showed the nutritive value of the roots of yellow and red cultivars of *D. carota* var. sativa. Also it explained their use in powdered or entire form, either in the folk or modern medicine as antidiarrhoeal drugs[2-6], where, the dried powdered carrot roots are used recently in combination with other drugs to treat the infantile diarrhoea.

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تقييم بعض الأصناف المنزرعة لنبات الجزر (دواكس كاروتا لينيه) فى مصر

الجزء السابع: فحص المحتوى البروتينى، لجذور الجزر الأصفر والأحمر

وكذلك المحتوى البكتينى لكل من جذور وثمار الجزر الأصفر والأحمر

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فى هذا البحث تم تحديد نسبة المحتوى البروتينى لجذور الجزر الأصفر والأحمر وكذلك تركيبها الكيماوى، كما تم تحديد المحتوى البكتينى لكل من جذور وثمار الجزر الأصفر والأحمر وتم تحليل المحتوى البكتينى بواسطة كروماتوجرافيا الغاز.