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MORPHOLOGICAL AND ANTIOXIDANT CHARACTERISTICS OF QUINCE (*CYDONIA OBLONGA* MILL.) AND CHINESE QUINCE FRUIT (*PSEUDOCYDONIA SINENSIS* SCHNEID.)

Anton Monka, Oľga Grygorieva, Peter Chlebo, Ján Brindza

ABSTRACT

Quince (*Cydonia oblonga* Mill.) is a fruit species, whose fruits have a high therapeutic value and therefore are used in many countries in traditional medicine. Chinese quince (*Pseudocydonia sinensis* Schneid.) is a lesser used species, although it is a relative of quince. The aim of the study was to evaluate some morphological characters of both kinds of fruit and antioxidant activity of morphological parts of the fruit. For these experiments, two genotypes were used from each species growing in the Arboretum Mlyňany (Slovakia). We determined the antioxidant activity of different parts by the DPPH method. In the genotypes from the evaluated species *C. oblonga*/*P. sinensis* we determined the average weight of the fruit in the fresh condition to be in the range 147.61 – 253.27 g / 197.85 – 466.38 g, the exocarp weight 28.50 – 43.89 g / 24.85 – 45.10 g, the mesocarp weight 116.36 – 204.99 g / 160.30 – 389.80 g, the seed weight 1.05 – 1.54 g / 9.22 – 17.42 g, the height of fruit 74.09 – 80.88 mm / 98.06 – 124.48 mm, average of fruit 60.11 – 81.51 mm / 62.33 – 88.64 mm. In aqueous extracts we determined antioxidant activity of the species *C. oblonga* / *P. sinensis* in dry exocarp in the range 43.52 – 67.73% / 52.76 – 82.20%, in fresh mesocarp 7.36 –14.78% / 15.30 – 23.50%, in dry mesocarp 30.92 – 41.30% / 41.68 – 50.15% and dry endocarp 55.19 – 76.44% / 91.20 – 92.72%. We determined antioxidant activity in methanolic extracts of the species *C. oblonga* / *P. sinensis* in dry exocarp in the range 93.29 – 93.32% / 91.87 – 93.25%, in fresh mesocarp 10.29 – 36.0% / 17.10 – 17.11%, in dry mesocarp 54.55 – 74.11% / 80.39 – 84.11% and in dry endocarp 95.14 – 95.39% / 94.97 – 95.62%. Results document that the fruits of both species can be practically used in the preparation of many dishes, while they can be used as raw material for pharmaceutical and cosmetic use.

Keywords: quince; Chinese quince; fruits, morphology; antioxidant activity

INTRODUCTION

Quince fruit (*Cydonia oblonga* Mill.) in terms of taxonomy belongs to the genus *Cydonia* and the *Rosaceae* family **(Bollinger, 2005)**. This species comes from Asia Minor **(Purves et al., 2004)**. The fruits are big hairy and pear – shaped (var. *pyriformis*) or apple – shaped (var. *maliformis*) pomes yellow color with typical flavor and aroma **(Wagner, 2011)**. In folk medicine quince is used in teas for sore throat, upset stomach and diarrhea. Quince seed infusion is used as a gargle mouth, or mixed with glycerol as emollient for cracked skin twigs. The knowledge indicates that different parts of quince fruits are used as traditional medicines in disorders and diseases of the respiratory system, cough, bronchitis, for fever in digestive disorders, vomiting and diarrhea, for constipation and bloating, inflammation of the kidneys, urinary tract and bladder, cardiovascular and metabolic diseases such as hypertension, hypercholesterolemia, hyperlipidemia, diabetes mellitus, and other **(Khoubnasabjafari and Jouyban, 2011)**. Many previous studies show positive effects of different parts of quinces fruits in various forms on human health. **Hemmati et al., (2010)** studied therapeutic effect of mucilage of quince seed on skin injuries caused by T-2 toxin with positive regenerative effect. Seed mucilage has antiallergic effect and regenerative effect in atopic eczema (**Silva et al., 2002)**. **Khademi, (2009)** describes the hipolipidemic effect of tea and positive effect in lowering cholesterol levels. **Aslan et al., (2010)** reports in his work anti-diabetic effect, **Shinomiya et al., (2009)** and **Jouyban et al., (2010)** describe the hypolipidemic effect of quince leaf decoction on kidney disease caused by hypercholesterolemia. **Magalhães et al., (2009)** deals with antioxidant effect. Many epidemiological studies show the amount of the beneficial effects of quince fruit that need to continue to monitor. Other studies point out that consuming fruits of the family *Rosaceae* is generally beneficial to health effects. However, protectionist effect of various micronutrients and phytochemicals is unclear. Polyphenols as the largest and quantitatively the most important group of phytochemicals may explain part of this effect **(Erlund et al., 2008)**. Chinese quince (*Pseudocydonia sinensis* Schneid.) belongs to the family *Rosaceaea* and for the first time was described by Camilo Karl Schneider as Quince oblong (*Cydonia oblonga* Mill.). It is the only one species from *Pseudocydonia* genus **(USDA, 2013)**. Fruit of the Chinese quince is yellow colored eatable pomes. It has elliptical (var. *ellipsoidea*) or ovoid (var. *ovoidea*) shape. It ripe in October as fruits of Quince oblong those are not eatable directly after harvest due to bitter pinching taste. The consumption it is possible after appropriate canning heat treatment like compotes, fruit spreads, marmalades, jams, fruit jellies, candied pulp, sweetened syrups and juices combined with ginger, honey and so on **(Facciola, 1990)**. Fruits are very big, 18cm long **(Yan Li et al., 2012)**. Fruits of the Chinese quince are used especially in folk medicine as antitussives that central or peripheral suppress cough. They contain some medically complex of active ingredients including organic acids, flavonoids of rutin and quercetin. Fruits are used for treatment of astma, cold, sore throat, mastitis and tuberculosis in Korea **(NPRI, 1998)**. Another using of these fruits is in household. They are very aromatic so they are often placed into bowl on the table and enrich the room by pleasant spicy fragrance. Hard, dark red wood is used for production of frames **(Khoshbakht and Hammer, 2006)**.

MATERIAL AND METHODOLOGY

The object of our experiment was evaluating the morphological and antioxidant parameters from two genotypes of quince (CO1 – var. *pyryformis*, CO2 – var. *maliformis*) and two genotypes of Chinese quince (PS1 – var. *ellipsoidea*, PS2 – var. *ovoidea*) from the Arboretum Mlynany of Slovak Academy of Sciences (Figure 1). Antioxidant activity of tested quince and Chinese quince genotypes was determined by spectrophotometer Thermo Scientific GENESYS 20. All samples pericarp were homogenized enough for 30 seconds and water and methanolic extract (1 g of native sample of pulp with 25 mL distilled water or methanol) were subsequently prepared from each sample, which was after 8 hours of mixing and filtration subjected to measurement of antioxidant activity by DPPH method. This method lies in reaction of tested substance with stable radical diphenylpicrylhydrazyl – •DPPH (1,1-diphenyl-2-(2,4,6-trinitrophenyl hydrazyl). In the reaction, the radical is reduced and DPPH-H (diphenylpicrylhydrazin) is formed. The reaction is monitored spectrophotometrically. Decrease of absorbance at 515 nm was measured after a certain constant time **(Brand - Williams et al., 1995)**, in our experiment after 10 minutes. Values of antioxidant activity were classified as high (>70% of inhibition), average (40 – 70% of inhibition) and low (<40% of inhibition).

RESULTS AND DISCUSSION

In the first part of the experiment we provide morphological analysis of fruits. In the genotypes from evaluated species *C. oblonga* / *P. sinensis* we determined the average weight of the fruit in fresh condition in the range 147.61 – 253.27 g / 197.85 – 466.38 g, exocarp´s weight 28.50 – 43.89 g / 24.85 – 45.10 g, mesocarp´s weight 116.36 – 204.99 g / 160.30 – 389.80 g, seeds´ weight 1.05 – 1.54 g / 9.22 – 17.42 g, fruit´s height 74.09 – 80.88 mm / 98.06 – 124.48 mm, fruit´s diameter 60.11 – 81.51 mm / 62.33 – 88.64 mm. The obtained experimental data presented in Table 1 and Table 2.

Klimenko, (1993) found in a study of the quinces elongate average weight in the range of 40.00 to 234 grams. In some varieties determine the weight of 300 g (Portugalska) to 2 kg (Berecki). **Salaš, (2001)** determine the weight of the fruit depending on variety from 100 to 1200 g. Comparing our results with those of these authors, we found some consistency. It is common knowledge that the morphological features of the variety are specific and related to the shape of the fruits.

Figure 1 Variability in the shape of fruits quince (*Cydonia oblonga* Mill., CO1 – var. *pyriformis*, CO2 – var. *maliformis*) and Chinese quince (*Pseudocydonia sinensis* Schneid., PS1 – var. *ellipsoidea*, PS2 – var. *ovoidea*); (Photography: A. Monka, 2013).

Table 1 Variability of morphological parameters of fruits quince (*Cydonia oblonga* Mill., CO1 – var. *pyriformis*, CO2 – var. *maliformis*).

Parameters		Sample	Variety	*n*	*Min.*	*Max.*	$\bar{x}$	*CV*
Weight (g)	Whole fruit	CO1	*pyriformis*	10	105.09	205.67	147.61	19.51
		CO2	*maliformis*	10	195.40	301.81	253.27	11.99
	Exocarp	CO1	*pyriformis*	10	21.79	37.49	28.50	19.33
		CO2	*maliformis*	10	33.42	55.03	43.89	16.05
	Mesocarp	CO1	*pyriformis*	10	79.52	163.72	116.36	20.43
		CO2	*maliformis*	10	158.40	246.20	204.99	11.64
	Pubes	CO1	*pyriformis*	10	0.01	0.16	0.07	70.85
		CO2	*maliformis*	10	0.02	0.16	0.08	54.79
	Seeds	CO1	*pyriformis*	10	0.39	1.45	1.05	35.68
		CO2	*maliformis*	10	1.22	1.97	1.54	16.99
Height fruit (mm)		CO1	*pyriformis*	10	71.16	99.60	80.88	10.41
		CO2	*maliformis*	10	65.40	82.34	74.09	7.67
Average fruit (mm)	Middle fruit	CO1	*pyriformis*	10	46.55	68.08	60.11	10.12
		CO2	*maliformis*	10	77.92	89.55	81.51	4.84
	10 mm under apical part of the Stem	CO1	*pyriformis*	10	29.20	38.28	33.14	9.93
		CO2	*maliformis*	10	30.57	41.67	36.10	9.60
	10 mm above basal part of the Fruit	CO1	*pyriformis*	10	32.71	47.06	38.80	12.49
		CO2	*maliformis*	10	32.09	45.60	37.10	9.87
Core (mm)	Height	CO1	*pyriformis*	10	13.58	32.22	27.93	21.08
		CO2	*maliformis*	10	20.35	35.20	25.79	16.98
	Width	CO1	*pyriformis*	10	10.80	27.29	21.43	22.16
		CO2	*maliformis*	10	20.27	33.17	27.73	15.57
Number of seeds in fruits (pc)		CO1	*pyriformis*	10	7.00	23.00	16.50	35.94
		CO2	*maliformis*	10	24.00	42.00	31.80	19.99
Height seeds (mm)		PS1	*ellipsoidea*	10	6.77	8.34	7.53	6.33
		PS2	*ovoidea*	10	8.58	9.65	9.04	4.40
Width seed (mm)		PS1	*ellipsoidea*	10	4.41	5.27	4.88	6.10
		PS2	*ovoidea*	10	4.73	5.52	5.13	5.81

Legend: *n* – number of fruits; *X* – mean – average set; *min*. – minimum value measured in the file; *max*. – maximum value measured in the file; *CV* – coefficient of variation %.

Found in a study of the quinces number of seeds in the range of 32 – 54. Many users do not use the elongate quince seeds. In doing so, the seeds are very valuable resource because they contain up to 22% of slime. Slime is composed of carbohydrates, pentosan, oil, enzymes of cyanogenic glycoside amygdalin, which gives the typical fruit aroma and taste. The seeds swell in water, resulting slime has characteristic effects that are used not only in medicine, but also in cosmetics. Slime is reassuring, anti-irritant, Mitigation and softening the skin and mucous membranes, especially in the treatment of frostbite, bedsores. A fine layer of slime has unique effects. It is used in diseases and inflammations of the mouth and larynx. The cooling effect of slime and is used in inflammatory processes, the defects of the skin (itching, burning, etc.). In cosmetics is used for the preparation of bland protective creams and various dips, but mucilage solutions for the treatment of small, small cracks on the lips, face and nipples. In the pharmaceutical art, and are used for medicinal as mucilaginosum mucilages for the preparation of syrups, drops, and the solution cough, expectoration of sputum respectively to respiratory diseases **(Súkeník, 1997)**. With correlation analysis we determined the degree of tightness of the total weight of the fruits and weight of the individual parts of the fruits when evaluated shaped elongated forms *quinces* and *Chinese quince* (Tab. 3). Among the total weight and the weight of the fruits exocarp we identified statistically significant tightness, which is documented with correlation coefficient for fruits and quince ranging from r = 0.81 (var. *pyrimorfis*) to r = 0.85 (var. *maliformis*) and for fruits Chinese quince in the range from r = 0.50 (var. *ovoidea*) to r = 0.79 (var. *ellipsoidea*). Betweenw eight of fruits and weight of mesocarp of quince and Chinese quince determined high degree of linear dependencies.

Table 2 Variability of morphological parameters of fruits Chinese quince (Pseudocydonia sinensis Schneid., PS1 – var. ellipsoidea, PS2 – var. ovoidea).

Parameters		Sample	Variety	*n*	*min.*	*max.*	$\bar{x}$	*CV*
Weight (g)	Whole fruit	PS1	*ellipsoidea*	10	144.18	273.30	197.85	21.22
		PS2	*ovoidea*	10	346.70	596.80	466.38	19.52
	Exocarp	PS1	*ellipsoidea*	10	19.08	33.46	24.85	21.37
		PS2	*ovoidea*	10	35.05	56.77	45.10	14.09
	Mesocarp	PS1	*ellipsoidea*	10	116.78	233.62	160.30	22.89
		PS2	*ovoidea*	10	261.40	514.50	389.80	22.69
	Seeds	PS1	*ellipsoidea*	10	6.42	13.03	9.22	24.07
		PS2	*ovoidea*	10	13.98	22.79	17.42	17.62
Height fruit (mm)		PS1	*ellipsoidea*	10	86.57	109.61	98.06	8.27
		PS2	*ovoidea*	10	112.18	132.37	124.48	5.10
Average fruit (mm)	Middle fruit	PS1	*ellipsoidea*	10	51.21	70.91	62.33	8.98
		PS2	*ovoidea*	10	77.96	100.25	88.64	9.08
	10 mm under apical part of the Stem	PS1	*ellipsoidea*	10	29.87	47.00	36.31	14.42
		PS2	*ovoidea*	10	38.50	53.98	44.42	12.84
	10 mm above basal part of the Fruit	PS1	*ellipsoidea*	10	24.67	38.58	32.17	14.48
		PS2	*ovoidea*	10	25.56	42.69	33.84	15.72
Core (mm)	Height	PS1	*ellipsoidea*	10	54.50	86.72	66.29	12.98
		PS2	*ovoidea*	10	59.37	84.30	76.44	12.17
	Width	PS1	*ellipsoidea*	10	25.08	32.52	27.85	9.35
		PS2	*ovoidea*	10	27.67	47.19	39.44	14.10
Number of seeds in fruits (pc)		PS1	*ellipsoidea*	10	49.00	203.00	140.50	34.14
		PS2	*ovoidea*	10	161.00	219.00	198.20	7.55
Height seeds (mm)		PS1	*ellipsoidea*	10	6.77	8.34	7.53	6.33
		PS2	*ovoidea*	10	8.58	9.65	9.04	4.40
Width seed (mm)		PS1	*ellipsoidea*	10	4.41	5.27	4.88	6.10
		PS2	*ovoidea*	10	4.73	5.52	5.13	5.81

Legend: n – number of fruits; X – mean – average set; min. – minimum value measured in the file; max. – maximum value measured in the file; CV – coefficient of variation %.

This ours resultes also documented a correlation coefficient determined for both test species ranging from r = 0.98 (CO - var. *pyriformis*) to r = 0.99 (PS - var. *ovoidea*). Between fruit weight and seed weight, we identified for fruits quinces correlation coefficient from r = 0.15 (var. *maliformis*) to r = 0.69 (var. *pyrimorfis*) for fruits and Chinese quince from r = 0.58 (var. *ovoidea*) to r = 0.62 (var. *ellipsoidea*). In aqueous extract we determined antioxidant activity at the species *C. oblonga* / *P. sinensis* in dry exocarp in the range 43.52 – 67.73% / 52.76 – 82.20%, in fresh mesocarp 7.36 – 14.78% / 15.30 – 23.50%, in dry mesocarp 30.92 – 41.30% / 41.68 – 50.15% and dry endocarp 55.19 – 76.44% / 91.20 – 92.72% (Table 4). We determined antioxidant activity in methanolic extracts at the species *C. oblonga* / *P. sinensis* in dry exocarp in the range 93.29 – 93.32% / 91.87 – 93.25%, in fresh mesocarp 10.29 – 36.0% / 17.10 – 17.11%, in dry mesocarp 54.55 – 74.11% / 80.39 – 84.11% and in dry endocarp 95.14 – 95.39% / 94.97 – 95.62% (Table 4). **Tzanakis et al., (2006)** found the average value of antioxidant activity in the dry mesocarp at 65.63% and **Karadenüz et al., (2005)** at 60.40%. **Zavadilová, (2010)** determined the average value of antioxidant activity in fresh mesocarp for genotype var. maliformis values in the range from 21.15 to 36.16% for genotype and var. pyriformis from 16.17 to 36.91%. In comparison to our results we have set significant matches. We have confirmed experimentally comparatively higher antioxidant activity in dry mesocarp compared to fresh mesocarp. This is logical, since the content of the drying and the concentration of all components increase, but can also occur in oxidation of certain biologically active substances. We experimentally confirmed relatively high antioxidant activity of the Quince oblong and the Chinese quince products. Methanol extracts from dry exocarp and endocarp worked effectively against •DPPH radical than from dry and fresh mezocarp. We can classify antioxidant activity of dry exocarp and endocarp like high and almost identical. Pericarp includes exocarp, mezocarp and endocarp. Results document that the fruits of both species can be practically used in the preparation of many dishes, while they can be used as raw material for pharmaceutical and cosmetic use.

Table 3 Correlation coefficients of the linear relationship between the weight of the whole fruit weight and fruit basic parts of evaluated varieties of quince (*Cydonia oblonga* Mill.) and Chinese quince *(Pseudocydonia sinensis* Schneid.) by Pearson.

Sample	Variety	*r*	Confidence Interval $r_{95\%}$	r^2	*p*
Weight whole fruit (g) – Weight exocarp (g)					
CO1	*pyriformis*	0.811	0.370<= r >= 0.953	0.657	0.004
CO2	*maliformis*	0.855	0.489<= r >= 0.965	0.731	0.001
PS1	*ellipsoidea*	0.793	0.327<= r >= 0.949	0.629	0.006
PS2	*ovoidea*	0.501	-0.187<= r >= 0.859	0.251	0.140
Weight whole fruit (g) – Weight mesocarp (g)					
CO1	*pyriformis*	0.989	0.955<= r >= 0.997	0.979	0.000
CO2	*maliformis*	0.991	0.961<= r >= 0.998	0.982	0.000
PS1	*ellipsoidea*	0.993	0.973<= r >= 0.998	0.987	0.000
PS2	*ovoidea*	0.995	0.980<= r >= 0.999	0.991	0.000
Weight whole fruit (g) – Weight seeds (g)					
CO1	*pyriformis*	0.685	0.098<= r >= 0.918	0.469	0.028
CO2	*maliformis*	0.147	-0.531<= r >= 0.710	0.021	0.685
PS1	*ellipsoidea*	0.621	-0.013<= r >= 0.899	0.386	0.055
PS2	*ovoidea*	0.576	-0.083<= r >= 0.884	0.332	0.081

Legend: *r* – Pearson correlation coefficient, *min/max* – 95% confidence interval for *r*, r^2 – coefficient of determination, *p* – significance level.

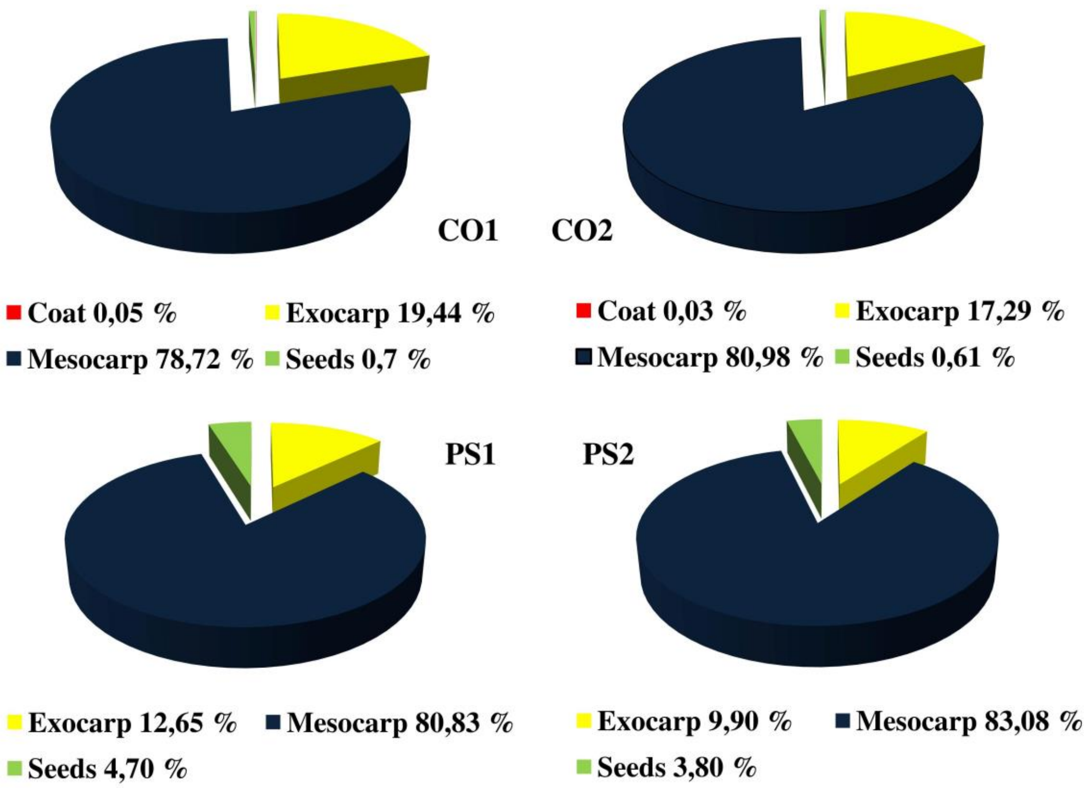

Figure 2 Share pubes, exocarp, mesocarpu and seeds by weight of the total weight of quince fruits (*Cydonia oblonga* Mill., CO1 – *var. pyriformis*, CO2 – *var. maliformis)* and Chinese quince (Pseudocy*donia sinensis Schneid*., PS1 – var. *ellipsoidea*, PS2 – *var. ovoidea*) in fresh condition (whole fruit – 100%).

Table 4 Antioxidant activity of dry endocarp, fresh and dry mesocarp, dry endocarp quince (*Cydonia oblonga* Mill., CO1 – var. *pyriformis*, CO2 – var. *maliformis*) and Chinese quince fruit (*Pseudocydonia sinensis* Schneid., PS1 – var. *ellipsoidea, PS2* – var. *ovoidea*) in methanolic and water extracts to •DPPH in %.

Cydonia oblonga Mill.										
Sample	**Variety**	***n***	***min.***		***max.***		$\bar{x}$		***CV***	
			M	**W**	**M**	**W**	**M**	**W**	**M**	**W**
Dry exocarp										
CO1	*pyriformis*	5	92.66	43.07	93.87	43.79	93.32	43.52	0.47	0.70
CO2	*maliformis*	5	93.16	66.85	93.39	68.26	93.29	67.73	0.11	0.79
Fresh mesocarp										
CO1	*pyriformis*	5	7.12	7.18	17.96	7.63	10.29	7.36	42.34	2.50
CO2	*maliformis*	5	30.40	14.01	38.53	15.35	36.00	14.78	9.57	4.48
Dry mesocarp										
CO1	*pyriformis*	5	48.24	28.28	57.34	33.42	54.55	30.92	6.74	7.88
CO2	*maliformis*	5	73.52	40.57	74.93	42.19	74.11	41.30	0.73	1.69
Dry endocarp										
CO1	*pyriformis*	5	95.03	54.74	95.68	55.82	95.39	55.19	0.26	0.80
CO2	*maliformis*	5	94.92	74.54	95.33	78.03	95.14	76.44	0.21	1.97
***Pseudocydonia sinensis* Schneid.**										
Dry exocarp										
PS1	*ellipsoidea*	5	93.16	80.25	93.40	84.57	93.25	82.20	0.11	2.60
PS2	*ovoidea*	5	91.62	50.07	92.23	55.36	91.87	52.76	0.25	3.72
Fresh mesocarp										
PS1	*ellipsoidea*	5	15.97	22.66	18.83	23.85	17.11	23.50	6.12	2.06
PS2	*ovoidea*	5	15.91	14.09	18.23	17.41	17.10	15.30	5.35	9.41
Dry mesocarp										
PS1	*ellipsoidea*	5	83.63	46.79	84.94	54.58	84.11	50.15	0.59	5.70
PS2	*ovoidea*	5	79.84	40.19	80.84	46.15	80.39	41.68	0.51	6.04
Dry endocarp										
PS1	*ellipsoidea*	5	94.79	92.12	95.05	93.09	94.97	92.72	0.12	0.40
PS2	*ovoidea*	5	95.33	90.98	95.88	91.42	95.62	91.20	0.26	0.20

Legend: *n* – number of fruits; *X* – mean – average set; *min.* – minimum value measured in the file; *max.* – maximum value measured in the file; CV – coefficient of variation %.; M – methanolic extract; W – water extract.

CONCLUSION

Quince is among the forgotten species. In the past, the fruit pulp is mainly used for the preparation of various food products. Its advantages are high in pectin, which is used to thicken fruit juices. The individual parts of the fruit and other plant parts are used and to date used in folk medicine. Therefore, in many regions indicates quince as "pharmacy in the garden" The results confirm the thesis that it is entitled. In all essential parts of the fruit we set a high antioxidant activity, which demonstrates the presence of biologically active components. In aqueous extracts we determined antioxidant activity of the species *C. oblonga* in dry exocarp in the range 43.52 – 67.73%, in fresh mesocarp 7.36 – 14.78%, in dry mesocarp 30.92 – 41.30% and dry endocarp 55.19 – 76.44%. This is confirmed by much literary knowledge. Chinese quince in terms of Europe used very little. It is a relative of quinces elongate. The results presented in the work confirmed that the fruits that have a higher weight than with quince oblong are also an important raw material for the preparation of various food products and a source of biologically active components. This was confirmed by the results of the high antioxidant activity of the essential parts of the fruit. In aqueous extracts we determined antioxidant activity of the species *P. sinensis* in dry exocarp in the range 52.76 – 82.20%, in fresh mesocarp 15.30 – 23.50%, in dry mesocarp 41.68 – 50.15% and dry endocarp 91.20 – 92.72%.

Both fruit can be used to significantly expand their production, processing and practical use in Slovakia. They are very good subject for practical use, especially for family farms and preparation of highly valuable food products with high biological value and therapeutic effects. Therefore, a good subject for the socio-economic development of micro, bio-economy and landscaping.

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Contact address:

Ing. Anton Monka, Slovak University of Agriculutre in Nitra, Faculty of Agrobiology and Food Resources, Department of Human Nutrition, Trieda Andreja Hlinku 2, 949 76 Nitra, Slovakia, Tel.: +421 37 6414 210, E-mail: anton.monka@gmail.com.

Mgr. Oľga Grygorieva, PhD., M. M. Grishko National Botanical Gardens of Ukraine National Academy of Sciences, Timiryazevska 1, 01014 Kiev, Ukraine, E-mail: ogrygorieva@mail.ru.

MUDr. Peter Chlebo., Slovak University of Agriculutre in Nitra, Faculty of Agrobiology and Food Resources, Department of Human Nutrition, Trieda Andreja Hlinku 2, 949 76 Nitra, Slovakia, Tel.: +421 37 6414 883, E-mail: peter.chlebo@uniag.sk.

doc. Ing. Ján Brindza, PhD., Slovak University of Agriculutre in Nitra, Faculty of Agrobiology and Food Resources, Institute of Biological Conservation and biosafety, Trieda Andreja Hlinku 2, 949 76 Nitra, Slovakia, Tel.: +421 376 414 787, E-mail: Jan.Brindza@uniag.sk.