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SLOVAK REPUBLIC

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

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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 Matoušová, 1992). The knowledge indicates that plant from different parts of quince is 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. Magalhaes 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.) belong 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 yeallow colored eatable pomes. It has elliptical (var. *ellipsoidea*) or ovoid (var. *ovoidea*) shape. It mellows in october as fruits of Quince oblong that 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, 18 cm long (Tanaka, 1976; Reid, 1977). 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 (Uphof, 1959). Hard, dark red wood is used for production of frames (Kariyone , 1971).

Material and methods

The aim of thesis was to evaluate some morphological characters of both kinds of fruit and antioxidant activity of basic morphological parts of the fruit in order to determine its potential use in food industry and in human nutrition. Antioxidant activity of tested quince and Chinese quince genotypes was determined by spectrophotometer Thermo Scientific GENESYS 20. All samples were homogenized enough for 30 seconds and water and methanolic extract (1g 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 [4], 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

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 average 60.11 – 81.51 mm / 62.33 – 88.64 mm (Table 1). In aqueous extract we determined antioxidant activity at the species *C. oblonga* / *P. sinensis* in dry mesocarp 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 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 %. 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.

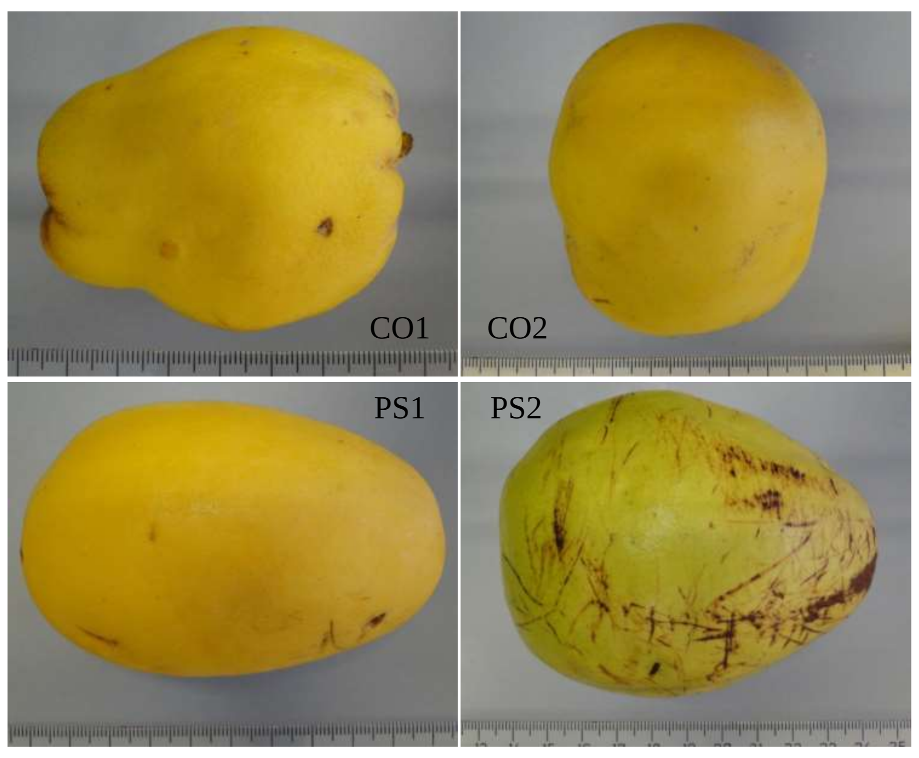

Fig. 1 Variability in the shape of fruits quince (*Cydonia oblonga* Mill., CO1 – var. *pyriformis*, CO2 – var. *maliformis*) and Chinese quince (*Pseudocydonia sinensis* Schneid., PS1 – var. *ellipsoidea*, PS2 – var. *ovoidea*); (Foto: A. Monka, 2012)

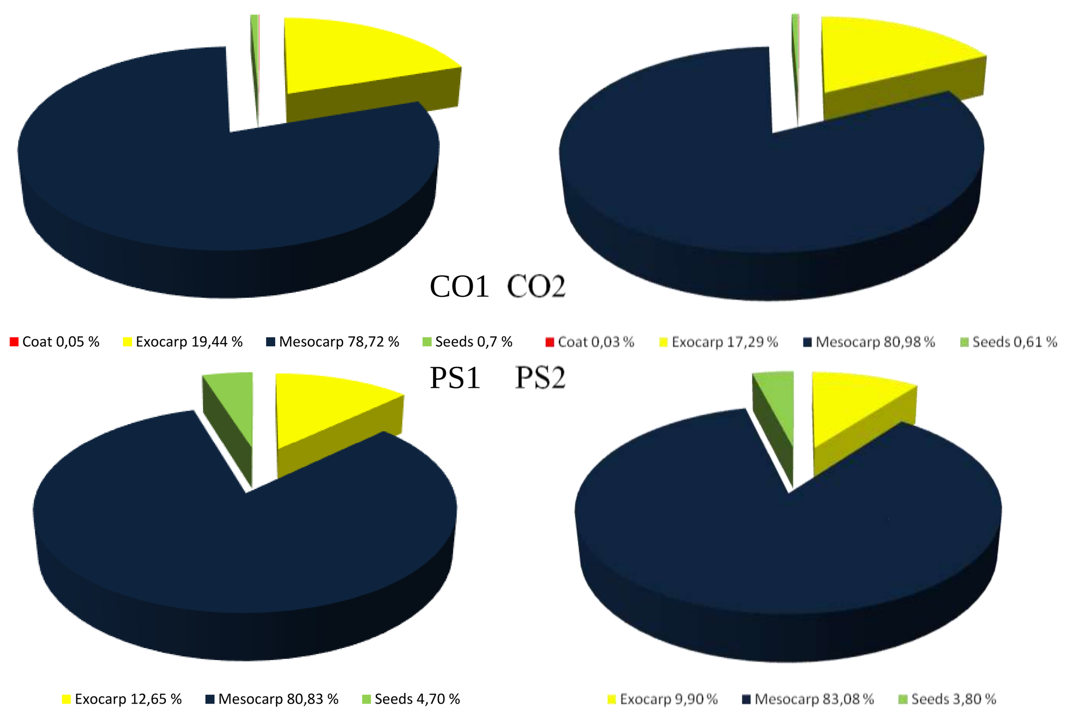

Fig. 2 Share coat, exocarp, mesocarpu and seeds by weight of the total weight of quince fruits (*Cydonia oblonga* Mill., CO1 – *var. pyriformis*, CO2 – *var. maliformis*) and Chinese quince (Pseudocy*donia sinensis Schneid*., PS1 – var. *ellipsoidea*, PS2 – *var. ovoidea*) in fresh condition (whole fruit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

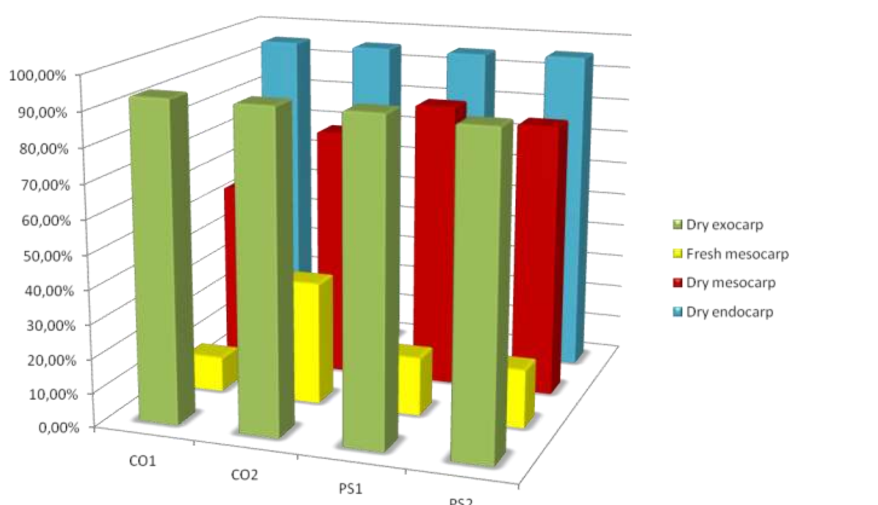

Fig. 3 Antioxidant activity of dry endocarp, fresh and dry mesocarp, dry endocarp of fruits quince (*Cydonia oblonga* Mill., CO1 – var. *pyriformis*, CO2 – var. *maliformis*) and Chinese quince (*Pseudocydonia sinensis* Schneid., PS1 – var. *ellipsoidea, PS2* – var. *ovoidea*) in methanolic extracts to DPPH● in %

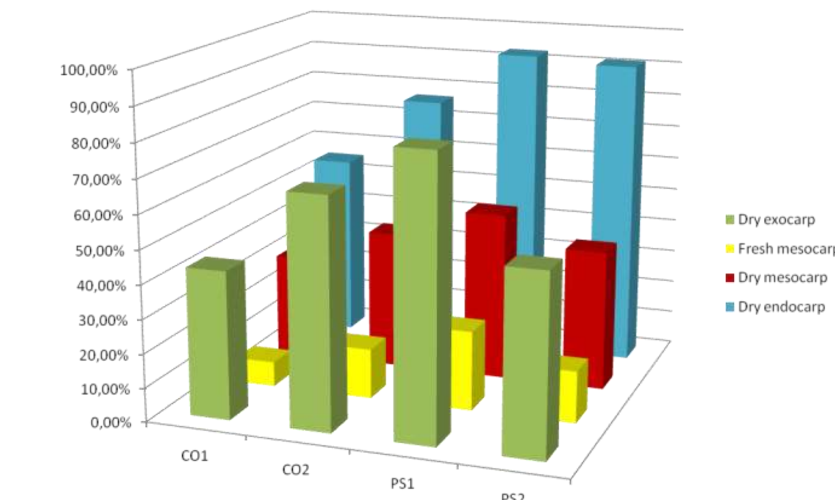

Fig. 4 Antioxidant activity of dry endocarp, fresh and dry mesocarp, dry endocarp of fruits quince (*Cydonia oblonga* Mill., CO1 – var. *pyriformis*, CO2 – var. *maliformis*) and Chinese quince (*Pseudocydonia sinensis* Schneid., PS1 – var. *ellipsoidea*, PS2 – var. *ovoidea*) in water extracts to DPPH●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

Tab. 1 Variability of morphological parameters of fruits quince (*Cydonia oblonga* Mill., CO1 – var. *pyriformis*, CO2 – var. *maliformis*) and Chinese quince (*Pseudocydonia sinensis* Schneid., PS1 – var. *ellipsoidea*, PS2 – var. *ovoidea)*

Parameters		Sample	Variety	n	Min.	Max.	$\bar{x}$	$V_{\%}$
***Cydonia oblonga* Mill.**								
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
	Coat	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 (ks)		CO1	*pyriformis*	10	7.00	23.00	16.50	35.94
		CO2	*maliformis*	10	24.00	42.00	31.80	19.99
Pseudocydonia sinensis Schneid.								
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
	Exokarp	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
Jadrovník (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 (ks)		PS1	*ellipsoidea*	10	49.00	203.00	140.50	34.14
		PS2	*ovoidea*	10	161.00	219.00	198.20	7.55

Tab. 2 Antioxidant activity of dry endocarp, fresh and dry mesocarp, dry endocarp quince fruit (*Cydonia oblonga* Mill., CO1 – var. *pyriformis*, CO2 – var. *maliformis*) in methanolic and water extracts to DPPH● in %

Sample	Variety	n	Min.		Max.		$\bar{x}$		$V_{\%}$	
			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

Tab. 3 Antioxidant activity of dry endocarp, fresh and dry mesocarp, dry endocarp Chinese quince fruit (*Pseudocydonia sinensis* Schneid., PS1 – var. *ellipsoidea*, *PS2* – var. *ovoidea*) in methanolic and water extracts to DPPH● in %

Sample	Variety	n	Min.		Max.		$\bar{x}$		$V_{\%}$	
			M	W	M	W	M	W	M	W
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; $\bar{x}$ – mean – average set; Min. – minimum value measured in the file; Max. – maximum value measured in the file; $V_{\%}$ – coefficient of variation.; M – methanolic extract; W – water extract

Conclusion

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 include exocarp, mezocarp and endocarp. It is possible effectively use like raw material for cosmetic, pharmaceutical and for food use.

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