ISSN 1644-0692
www.acta.media.pl

ACTA Acta Sci. Pol. Hortorum Cultus, 15(3) 2016, 71-82

NUTRACEUTICAL VALUE OF THE NEW STRAWBERRY CULTIVARS

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Abstract. Regarding an increasing interest of consumers towards berry fruit, as they have been proved to have potential health benefits, the nutraceutical fruit value of seven strawberry cultivars: 'Felina', 'Feltar', 'Hulta', 'Jota', 'Pastel', 'Plena' and 'Teresa' selected at the University of Life Sciences in Lublin, Plant Genetics and Breeding Department was evaluated in this study. In fruits harvested at maturity, the level of phytochemical compounds such as sugars, vitamin C, and polyphenols including quercetin and gallic acid as well as antiradical activity was estimated. Among all genotypes tested, the cultivar 'Jota' showed the highest content of glucose and fructose as well a high content of sucrose, therefore the total sugar content exceeded 12 g per 100 g of fresh weight (FW). Similar parameters in terms of content of total sugars and the individual fractions have cultivar 'Pastel'. Cultivars with low sucrose content were 'Feltar' and 'Teresa', but as regards monosaccharide's cvs. 'Plena' and 'Felina'. The content of vitamin C in fruits of the cultivars tested showed significant differences. It ranged from 64.5 mg·100 g^{-1} FW in cv. 'Jota' to 104.33 mg·100 g^{-1} FW in cv. 'Plena'. The highest level of antiradical activity occurred in cultivars 'Jota', 'Teresa' and 'Feltar' (90.1%, 87.1% and 86.3% DPPH; respectively). The results obtained indicated that the differentiation of the chemical composition of strawberry fruit is clearly dependent upon the genetic diversity of cultivars tested, what we argue that all of them grown under the same climatic and soil conditions using the same agricultural technology.

Key words: antioxidant activity, DPPH, polyphenols, fruit quality, sugars, vitamin C

INTRODUCTION

The cultivated strawberry *Fragaria* × *ananassa* Duch. is the most widely distributed small fruit crop in the world. It is grown in every country with a temperate or subtropi-

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cal climate and even in many tropical countries in highland areas, where the climate is mild. Breeding of the species was initiated with selection of hybrids of *F. chiloensis* × *F. virginiana* and hybrids obtained from crosses with other wild representatives of *Fragaria* genus. The breeding was undertaken by amateurs and private firms in England in the XIX c. to obtain plants producing big fruits [Darrow 1966, Staudt 1989]. Since the middle of the XX c., strawberry breeders have been focused on improving the plant's resistance to diseases, productivity and local adaptation, as well as on improving fruit quality [Hancock et al. 2008].

In recent years, as a result of the increasing requirements of food consumers, greater attention has been placed on the nutraceutical value of fruits. Nutraceutical, a portmanteau of the words "nutrition" and "pharmaceutical", is a food or food product that reportedly provides health and medical benefits, including the prevention and treatment of disease. The term "nutraceutical" was originally defined by Dr. Stephen L. DeFelice, founder and chairman of the Foundation of Innovation Medicine (FIM), Crawford, New Jersey [www.fimdefelice.org 2011]. The evidence-based health benefits of berry consumption provide a means of promoting strawberries [Schöpplein et al. 2002, Cordenunsi et al. 2003]. Strawberry fruits are a valuable component of the diet, since they are of low caloric content and contain easily assimilable sugars, as well as several bioactive phytochemicals, including vitamin C and other antioxidant compounds such as polyphenols in that phenolic acids and flavonoids. Phenolic classes commonly found in strawberries are hydroxybenzoic acids (gallic and ellagic acids), hydroxycinnamic acids (p-cumaric). Flavonoids are grouped in several structural classes including anthocyanins (pelargonidin-3-glycoside pigment), flavones, flavan-3-ols (catequins), flavanones, flavonols (quercetin, kaempferol and myricetin) and hydrolysable tannins (ellagitannins). *In vivo* and *in vitro* studies have been recently carried out to establish the effects of strawberries on free radical scavenging and on the prevention of cardiovascular diseases [Mateos et al. 2005, Pinto et al. 2008].

In 1970s, at the Genetics and Horticultural Plant Breeding Department of the Faculty of Horticulture (nowadays Faculty of Horticulture and Landscape Architecture), University of Life Sciences in Lublin, the strawberry breeding program had been undertaken to select new cultivars of this species. This program was carried out to improve the fruit yield and its quality i.e. the fruit weight, shape, texture, colour, taste and firmness. As a result of this breeding work based on the conventional clone selection, some new cultivars were released in that: 'Felina', 'Feltar', 'Hulta', 'Jota', 'Pastel', 'Plena' and 'Teresa'. All of them originated from the hybrid seedlings obtained after crosses between different parental cultivars of the species. Regarding an increasing interest of consumers towards berry fruit, as they have been proved to have potential health benefits, the nutraceutical fruit value of these seven cultivars selected at the University of Life Sciences in Lublin was evaluated in this study.

MATERIAL AND METHODS

The field experiment was established in August 2009 in triplicates with 20 plants per each cultivar at the Felin Experimental Station (N 51°13', E 22°39'). During the experiment typical agronomic procedures recommended for strawberry plantations [Żurawicz et al. 2005] were used. The fruit samples were evaluated in the first and second year of full yielding of plants i.e. in 2011 and 2012. Samples of 500 g of full-ripened strawberry fruit of the cultivars 'Felina', 'Feltar', 'Hulta', 'Jota', 'Pastel', 'Plena' and 'Teresa' (pedigree of cultivars is presented in Table 1.) were hand-harvested twice in June 2011 and 2012. After harvest the fruit samples were delivered to the laboratory where they were manually washed and carefully sorted to remove any damaged ones. The level of phytochemical compounds such as sugars (glucose, fructose and sucrose), vitamin C, total polyphenols including flavonoids and phenolics as well as antiradical activity was measured in fruits.

Table 1. Pedigree of cultivars investigated

Cultivar	Pedigree
Felina	Ottawa × Purpuratka
Feltar	(Senga Tigaiga × Merton Dawn)S_1
Hulta	Senga Litessa × Torrey
Jota	(Tioga S_1 × Cambridge Vigour S_1) × Dukat
Pastel	Paula × (Senga Sengana × Talisman)
Plena	Senga Sengana × Merton Dawn
Teresa	Redgauntlet S_1 × Senga Sengana S_1

Evaluation of vitamin C and soluble sugars content

Determination of the vitamin C and soluble sugars (glucose, fructose and sucrose) content in fruits of cultivars tested was conducted at the Central Laboratory of Agriecology, University of Life Sciences in Lublin with the use of the HPLC method in accordance with PN-EN 12630:2002 and PN-EN 14130:2003 standards (respectively).

Polyphenols assay

Fruit extract preparation. Fruit extract was prepared from 10 g of fresh samples using 40 mL of 80% (by volume) aqueous ethanol. The mixture was extracted (in water bath at 80°C), kept for 20 min in inert atmosphere, and filtered through a Whatman filter paper using a Büchner funnel. Extraction of the residue was repeated under the same conditions. The filtrates were combined and diluted to 100 mL in volumetric flask with 80% aqueous ethanol, and the obtained extract was used for determination of total polyphenols (phenolics, flavonoids) as well as DPPH assay.

Phenolics content of fruit extracts was measured by Folin-Ciocalteu's phenol reagent [Kim et al. 2003]. First, 200 µl of appropriately diluted sample or gallic acid standard were added to 2.6 ml of distilled deionized water. Then, 200 µl of Folin-Ciocalteu's phenol reagent was added at time zero and mixed. After 6 min, 2 ml of 7% (w/v) Na_2CO_3 solution was added and mixed. Absorbance was measured after incubation for 90 min at room temperature; absorbance was measured at 750 nm versus a prepared blank. The blank consisted of 200 µl 50% (v/v) methanol instead of sample. Gallic acid in 50% (v/v) methanol solution in concentrations of 10, 30, 60 and 100 mg·l^{-1} was used as a standard and a calibration curve was drawn for each day of analysis. The content of phenolics was expressed as mg gallic acid equivalent (GAE)·100 g^{-1} of fresh weight. All samples were analyzed in five replicates.

Flavonoids content of fruit extracts was determined using a spectrophotometric method [Floegel et al. 2010]. 500 µl of sample or standard (quercetin) were mixed with 3.2 ml of distilled deionized water. At time zero, 150 µl of 5% (w/v) sodium nitrite

($NaNO_2$) solution were added and mixed. After 5 min, 150 µl of 10% (w/v) aluminum chloride ($AlCl_3$) was added and mixed. After 6 min, 1 ml of 1 M sodium hydroxide (NaOH) was added and mixed. Absorbance of the colored flavonoid-aluminum complex was measured immediately at 510 nm versus a blank. The blank consisted of 500 µl of 50% (v/v) methanol instead of sample. For standard quercetin was dissolved in 50% (v/v) methanol to concentrations of 10, 30, 60 and 100 $mg \cdot l^{-1}$. A calibration curve was drawn. Flavonoids content in the strawberry extract was expressed as mg quercetin equivalent (QE)$\cdot$100 g^{-1} fresh sample. All samples were analyzed in five replicates.

Evaluation of antiradical activity (DPPH)

Antioxidant activity was determined by the DPPH (2, 2-diphenyl-1-picryldrazyl) radical – scavenging method developed by Brand-Wiliams et al. [1995] slightly modified by Kim et al. [2002]. DPPH radical solution was prepared by dissolving 0.02 g of DPPH in 50 ml of methanol (analytical grade, POCh). From this solution 5 ml was taken and diluted with methanol to a volume of 50 ml. In this way the final concentration of the radical 0.04 mg/ml was obtained. To 100 ml of the extract was added 3 ml of DPPH (a concentration of 0.04 mg/ml). Samples were mixed; the tube was capped with a stopper and allowed to stand for 30 minutes. After this time the absorbance was measured at a wavelength of 517 nm. A control was prepared by diluting 100 µl methanol (analytical grade) in 3 ml of DPPH.Antioxidant activity was calculated according to the formula: $AA = [1 - (A_p / A_k)] \cdot 100\%$, where: AA – antioxidant activity, A_p – absorbance of the sample, Ak – absorbance of the control sample. Antioxidant activity was expressed as the percent of inhibition. Results obtained underwent statistical analysis with the use SAS Enterprise Guide 3.0 and Excel 3.0 statistical software. The significance of differences between means was established by the Tukey test at $p \leq 0.05$.

RESULTS AND DISCUSSION

Sugars. The results indicated the existence of a varietal diversity in relation to the content of glucose, fructose and sucrose in the fruit of the cultivars tested (tab. 2). Among them cv. 'Jota' showed the highest content of glucose and fructose and also a high sucrose therefore as the only one exhibited a total sugar content exceeding 12 g per 100 g FW. Cultivar with similar parameters in terms of total sugar and individual fractions was 'Pastel'. The group of varieties of low sucrose content included 'Feltar' and 'Teresa', while monosaccharide's 'Plena' and 'Felina'. In the Koszański et al. [2006] studies cultivar 'Senga Sengana' had the highest content of total sugars. However, their content was lower as compared to the cultivars 'Pastel' and 'Jota', but similar to the 'Plena' cultivar. In other studies of these authors the cultivars 'Elsanta' and 'Elkat' had lower sugar content, even compared to the lowest in this respect cultivars investigated in this work. In contrast Rochalska et al. [2011] obtained a very high sugar content (in range of 28.93–30.98 $g \cdot 100\ g^{-1}$ FW) significantly exceeding these both values presented in this work and in works of other authors [Koszański et al. 2005, Kopytowski et al. 2006, Mishra et al. 2015]. Content of reducing sugars obtained for all cultivars tested were similar to the results obtained by Skupień [2003] for 'Pandora', 'Elsanta', 'Senga Sengana', 'Vicoda', 'Marmolada' and 'Kent' strawberry cultivars, however, the sucrose content compared to the cultivars studied by this author was significantly higher. Impact on the level of these characteristics other then cultivar has climatic, agronomic and edaphic factors [Koszański et al. 2006].

Table 2. The sugars content (mg·100 g^{-1} FW) in the fruits of cultivars tested

Cultivar	Sugars			Total sugar
	sucrose	glucose	fructose	
Felina	4644 a*	2932 cd	3007 b	10583 a
Feltar	3439 c	3259 bc	3655 ab	10353 a
Hulta	4171 abc	3137 bc	3605 ab	10913 a
Jota	4416 ab	4166 a	4152 a	12701 a
Pastel	4325 ab	3631 b	3670 ab	11626 a
Plena	4151 abc	2588 d	2889 b	9628 a
Teresa	3692 bc	3179 bc	3409 ab	10280 a

* – means followed by the same letter are not significantly different in columns at $p \le 0.05$

Vitamin C. The vitamin C content in the fruit of the cultivars tested showed significant differences (tab. 3). The lowest occurred in the cultivar 'Jota', while the highest in cv. 'Plena'. The value of this trait in studies of other authors also reached a high degree of volatility and amounted to 47.5 mg·100 g^{-1} FW in 'Senga Sengana', [Koszański et al. 2006], 81.27 mg·100 g^{-1} FW in 'Selva' [Mortazavi et al. 2014]. However, in studies conducted by Mishra et al. [2015] the value of this trait ranged from 62.67 to 73.6 mg·100 g^{-1} FW (on average for twenty genotypes), Nunes and Delgado [2014] reported values in the range of 60.1–71.8 mg·100 g^{-1} FW while in studies by Lal et al. [2013] varied between 51.03 and 89.40 mg·100 g^{-1} FW. It was also observed, that genotypes with lower content of vitamin C (tab. 3) had higher contents of sugars (tab. 2). This was in line with Mishra et al. [2015] reports about statistically negative correlation between these properties at both genotypic (-0.906) and phenotypic (-0.773) level. However, as Aubert and Bosc [2014] stated changes in the content of vitamin C in fruit distribution are irrelevant (although some think otherwise – Mortazavi et al. 2014), but significantly reduces the level of sucrose.

Flavonoids. Differentiation of flavonoids content expressed as quercetin equivalent (mg QE·100 g^{-1} FW) in the fruits of cultivars studied proved to be highly significant and ranged from 192.40 to 707.41 mg QE·100 g^{-1} FW (tab. 3). The best in this regard the variety 'Jota' (707.41 mg QE·100 g^{-1} FW) included almost 4× more of this compound than 'Teresa'. Cheel et al. [2007] determined the flavonoid content between 30 mg quercetin equivalents·100 g^{-1} fresh fruit for the white strawberry to 123.2 mg quercetin equivalents·100 g^{-1} fresh fruit for *F* × *ananassa* cv. 'Chandler', while Meyers et al. [2003] reported the highest flavonoid content for cultivars 'Evangeline' and 'Earliglow' and the lowest for 'Sparkle' and 'Allstar'. Wang and Lewers [2007] indicated significant differences in the content of flavonoids between the cultivars of strawberries, which were reflected in the results of this work. Crespo et al. [2010] recognized the levels of the properties of a significant feature of the cultivar mainly conditioned by the action of genetic factors, and only slightly environmental factors. However Andreotti et al. [2014], noticed differences in the content of this compound in the fruit of cultivar 'Elsanta' from plantations with different habitat conditions (especially altitude). It must therefore be regarded as Aubert and Bosc [2014] suggested, that the level of the characteristics analyzed was a cultivar's feature, wherein one must take into account the fact that the fruits which are not fully mature contain lower concentration of this compound in compared to the ripe fruit [Mahmood et al. 2012].

Table 3. The content of antioxidants in fruits of cultivars investigated and their antiradical activity

Cultivar	Vitamin C (mg·100 g^{-1}FW)	Polyphenols compounds		Polyphenols content (mg·100 g^{-1} FW)	Antiradical activity DPPH (% of inhibition)
		flavonoids (mg QE·100 g^{-1} FW)	phenolics (mg GAE·100 g^{-1} FW)		
Felina	88.76 abc*	344.51 c	321.25 bc	665.76 bc	80.08 d
Feltar	74.85 cd	222.58 ef	416.18 a	638.76 bc	86.30 b
Hulta	79.35 bcd	249.82 e	408.39 a	658.22 bc	84.38 bc
Jota	64.50 d	707.41 a	335.95 abc	1043.36 a	90.06 a
Pastel	71.66 d	484.70 b	305.63 c	790.33 b	82.18 cd
Plena	104.33 a	295.45 d	318.40 c	613.85 c	75.73 e
Teresa	90.92 ab	192.40 f	400.46 ab	592.86 c	87.07 ab

* – means followed by the same letter are not significantly different in columns at $p \leq 0.05$

Phenolics. Phenolics content expressed as gallic acid equivalent varied from 305.63 in cultivar 'Pastel' to 416.18 mg GAE in 'Feltar' (tab. 3). In the study of Pineli et al. [2012] phenolic acids content ranged from 180 to 280 mg GAE·100 g^{-1} FW, in Lal et al. [2013] ranged from 380.1 (cv. 'Douglas') to 888.1 (cv. 'Howard') mg GAE·100 g^{-1} FW, while in Wang et al. [2014] noted 210 mg GAE·100 g^{-1} FW. The differences in the content of these compounds between strawberry cultivars were also observed by Proteggente et al. [2002], Scalzo et al. [2005], Djilas et al. [2011], while between 62 fruit species by Fu et al. [2011]. Among the strawberry cultivars tested the highest concentration of phenolic compounds with antioxidant activity was characterized by the cultivar 'Jota' (tab. 3). Significantly lower level was observed in the cultivar 'Pastel', while the lowest occurred in cv. 'Teresa'. Different levels of this trait between genotypes were also observed by Scalzo et al. [2005] and Debnath and Ricard [2009]. Wang and Lewers [2007] showed that the fruit of *Fragaria virginiana* accessions had significantly higher antioxidant capacity and total phenolics content (expressed as GAE) then the fruit from different *Fragaria* × *ananassa* cultivars. Capocasa et al. [2008] stated that limited knowledge is available on the possibility of improving strawberry nutritional traits by breeding; however they showed an improvement in fruit nutritional quality in the breeding material originated from *F. virginiana* ssp. *glauca* inter-specific crosses. According to Khanizadeh et al. [2014], despite the fact that the content of phenolic compounds and antioxidant properties depended mainly on genetic factors, however, the production system can significantly affect at their level. The providing of fruit nutritional and nutraceutical quality can by achieved by appropriate post-harvest fruit treatment [Wang et al. 2014].

DPPH. The present data provided the evidence that strawberry genotypes tested differed in their activity to react and quench DPPH radicals (tab. 3). Cultivar 'Jota' was the best for an antioxidant activity, while ‘Plena’ was the worst. Cheel et al. [2007] accessed DPPH activity for cultivated strawberry at the level of 86% whereas native accessions characterized lower activity (42%). Previous studies conducted by other researchers reported the variation in antioxidant activity among 10 strawberry cultivars and 9 advances selections [Debnath and Ricard 2009]. As a reason for variation of this trait Anttonen et al. [2006] indicated a fruit order in inflorescence and planting date, whereas Wang and Zheng [2001] saw it in a day/night temperature but above all growing variety. Floegel et al. [2011] classified strawberries among species with a high antioxidant capacity.

Table 4. The correlation and determination coefficients matrix between antiradical activity (DPPH) and antioxidant components content for 7 strawberry cultivars

Cultivar	Antioxidant components	
	flavonoids (QE)	phenolics (GAE)
Felina	0.78[1] 0.61[2]	-0.27 0.07
Feltar	0.29 0.08	-0.26 0.07
Hulta	-0.46 0.21	0.32 0.10
Jota	0.45 0.20	-0.45 0.20
Pastel	0.95* 0.90	0.42 0.18
Plena	0,41 0.17	0.04 0.002
Teresa	0.98* 0.97	0.34 0.12
Mean	0.49 0.24	0.22 0.05

[1] – correlation coefficient, [2] – determination coefficient, * – correlation significant at $p \leq 0.05$

Interrelations between the antiradical activity (DPPH) and antioxidant compounds content in fruits of cultivars tested are presented in Table 4, but only a few of them were statistically significant (at cultivar level). A high positive correlation between antiradical activity and flavonoids (QE) content for cultivars ‘Teresa’ and ‘Pastel’ indicated that this compound could be one of the main components responsible for antioxidant activity of these fruits. The rest of cultivars demonstrated the diversity in this respect that was especially evident in ‘Hulta’ cultivar for which the coefficient of correlation had negative value. In respect to the influence of phenolics (GAE) on the antioxidant capacity it should be regarded that this dependence was the most diverse in this study. For cvs. ‘Pastel’, ‘Teresa’ and ‘Hulta’ the impact of phenolics on the antioxidant activity was positive and amounted to 0.42, 0.34 and 0.32 respectively, while for the cvs. ‘Jota’, ‘Felina’ and ‘Feltar’ was negative. Only in cultivar ‘Hulta’ the antiradical activity of phenolics (GAE) was higher than of flavonoids. Nevertheless in this group of cultivars the comparison of antiradical activity between flavinoid and phenolic compounds showed that flavonoids (QE) determined the capacity for DPPH radicals scavenging almost 5× more then phenolics (GAE) (tab. 4). So far in the literature there is a scarce information about correlation between the antioxidant activity and antioxidant compounds content at the level of single cultivar. In Scalzo et al. [2005] study total antioxidant capacity and phenolics content were correlated negatively (for cultivars 'Don', 'Idea', 'Camarosa', 'Onda', 'Sveva', 'Patty'), whereas in Pineli et al. [2012] research for cultivars 'Osogrande' and 'Camino Real' vice versa. Positive correlations between DPPH activity and phenolic content were also observed in Meyers et al. [2003], Cheel et al. [2007], Djilas et al. [2011] and Huang et al. [2012] research. Also strong positive relationship between DPPH and phenolics (Spearmans-Rho coefficients = 0.897) and flavonoids (0.708) content were obtained by Floegel et al. [2011]. Wang and Lin [2000] reported a significant correlation between antioxidant capacity and both total phenolics and vitamin C, and estimated on the basis the high values of a determination coefficient (R^2 = 0.8093, R^2 = 0.812; respectively). In this study, the high values of R^2 (tab. 4) were obtained only in the case of cultivar 'Pastel' and 'Teresa' for flavonoids (QE) content. This means that especially in the case of the last cultivar antioxidant capacity resulted from the content of flavonoids (fig. 1). Therefore, as stated Almeida et al. [2011] and Meyers et al. [2003] the antioxidant activities in the fruits cannot be attributed solely to their phenolics contents, but also to the actions of different antioxidant compounds present in the fruits which may act additively and synergistically with others and final activity may be dependent upon relative proportions of each or presence/absence of particular compounds.

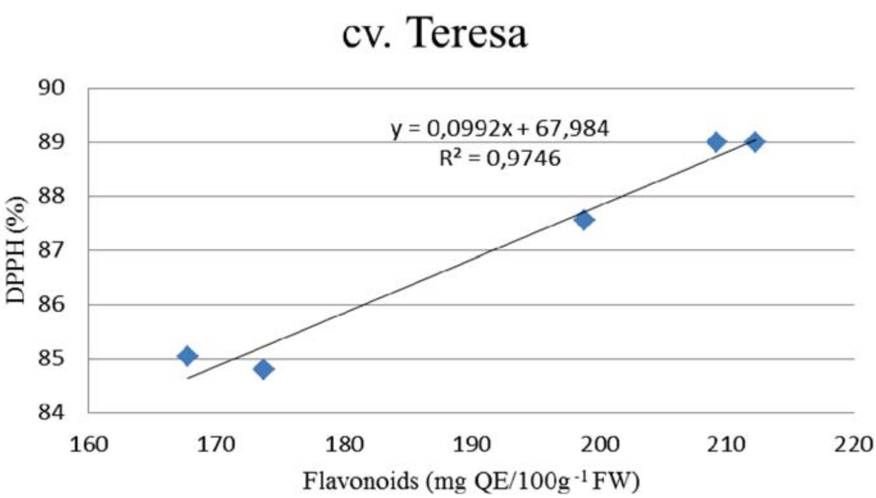

Fig. 1. Relationship between antiradical activity (DPPH) and flavonoids content in cultivar 'Teresa'

CONCLUSIONS

In our study the differences in the bioactive compounds content as well as in the antiradical activity (with DPPH) observed between cultivars resulted mainly from their genotypic diversity, since all cultivars grew under the same climatic and soil conditions using the same agricultural technology. The highest nutraceutical value showed the fruits of cv. 'Jota' due to the soluble sugars content and the highest value of antiradical activity. In this group of cultivars the antioxidant activity of bioactive compounds was mainly determined by flavonoids expressed as quercetin equivalent. In general, on the basis of the present results it should be stated that the nutraceutical fruit value depended not only on the bioactive phytochemicals content and relative proportions between them but also on the interrelated actions of different chemical compounds present in the fruits. This study also illustrated the existence of wide ranges of variations among strawberry cultivars that provides opportunities for genetic gain through hybridization and selection. Regarding an importance of the knowledge on the strawberry nutraceutical properties for consumers' health, further studies in this area aimed at the estimation of these characteristics individually for each cultivar are needed.

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NUTRACEUTYCZNA WARTOŚĆ NOWYCH ODMIAN TRUSKAWKI

Streszczenie. Biorąc pod uwagę wzrastające zainteresowanie konsumentów spożyciem owoców jagodowych ze względu na ich udowodniony korzystny wpływ na ludzkie zdrowie, w obecnych badaniach oceniano nutraceutyczne właściwości owoców siedmiu odmian truskawki: 'Felina', 'Feltar', 'Hulta', 'Jota', 'Pastel', 'Plena' i 'Teresa' wyselekcjonowanych na Uniwersytecie Przyrodniczym w Lublinie, w Katedrze Genetyki i Hodowli Roślin Ogrodniczych. W owocach zebranych w fazie pełnej dojrzałości oznaczono zawartość związków fitochemicznych, takich jak cukry, witamina C i polifenole ogółem oraz oszacowano aktywność antyoksydacyjną (z DPPH). Spośród badanych odmian, owoce odmiany 'Jota' charakteryzowały się największą zawartością glukozy i fruktozy, a także sacharozy – całkowita zawartość cukrów przekroczyła 12 g·100 g^{-1} świeżej masy (f.w.). Podobne wartości pod względem całkowitej zawartości cukrów i ich poszczególnych frakcji zawierały owoce odmiany 'Pastel'. W owocach odmian 'Feltar' i 'Teresa' stwierdzono najmniejszą zawartość sacharozy, natomiast w owocach odmian 'Pleny' i 'Feliny' – najmniejszą ilość cukrów prostych. Zawartość witaminy C w owocach badanych odmianach była bardzo zróżnicowana i wynosiła od 64.5 mg·100 g^{-1} f.w. ('Jota') do 104.33 mg·100 g^{-1} f.w. ('Plena'). Odmiany 'Jota', 'Teresa' i 'Feltar' wykazywały najwyższą zdolność do znoszenia wolnych rodników (odpowiednio 90.1, 87.1 i 86.3% DPPH). Wszystkie analizowane odmiany były uprawiane w tych samych warunkach klimatyczno-glebowych i poddawane takim samym zabiegom agrotechnicznym, stąd też na podstawie uzyskanych wyników wnioskuje się, że skład chemiczny owoców truskawki wyraźnie zależy od zróżnicowania genetycznego badanych genotypów.

Słowa kluczowe: aktywność antyoksydacyjna, DPPH, jakość owoców, polifenole, cukry, witamina C

Accepted for print: 15.02.2016

For citation: Żebrowska, J., Gawroński, J., Kaczmarska, E., Dyduch-Siemińska, M., Jackowska, I., Pabich, M. (2016). Nutraceutical value of the new strawberry cultivars. Acta Sci. Pol. Hortorum Cultus, 15(3) 71–82.