

## FRUIT QUALITY, PHENOLICS CONTENT AND ANTIOXIDANT CAPACITY OF NEW APRICOT CULTIVARS FROM SERBIA

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**Abstract.** The experiment was established at private apricot orchard near Cacak (Western Serbia) during 2010 and 2011. In the present study we wanted to determine the physico-chemical attributes, phenolics content and antioxidant capacity of three new Serbian cultivars ('Aleksandar', 'Biljana', 'Vera') grafted on Myrobalan seedlings. Results indicated that physico-chemical attributes significantly varied among cultivars. Similarly, total phenolics and flavonoids content and antioxidant capacity significantly depend on the cultivars. Generally, new Serbian cultivars had better properties evaluated than control ('Hungarian Best'), except stone weight, fruit firmness, moisture and total phenolics content. The highest values of total phenolics and flavonoids content were found in 'Aleksandar', whereas the highest antioxidant capacity was recorded in 'Vera'. Finally, new Serbian cultivars could be recommended for planting in similar conditions and apricot growing programs.

**Key words:** Acidity, chemical profiles, HPLC, *Prunus armeniaca* L., soluble solids

### INTRODUCTION

The apricot (*Prunus armeniaca* L.) fruits are widely consumed in many parts of the world. Apricot is considered by many to be one of the most delicious temperate tree fruits, and a good balance of sugars and acids and a strong apricot aroma are major determinants of exceptional fruit quality [Lo Bianco et al. 2010]. The fruit contain different level of phytochemicals such as vitamins, carotenoids and polyphenols, which contribute significantly to their taste, color and nutritive value [Dragovic-Uzelac et al. 2007]. Generally, apricot fruit has great nutritional value because of fibre, minerals (K,

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Ca, Fe, Mg, Zn, P and Se) [Wills et al. 1983], and low energy intake (50 Kcal 100 g<sup>-1</sup> fresh weight) that combined with the nutraceutical plus-value (vitamin C, A, carotenoids, phenols, thiols, thiamin, riboflavin, niacin and pantothenic acid) make apricots 'healthy & easy-to-eat' [Leccese et al. 2011].

Earlier, fruit appearance, firmness and flavor are the most important properties in markets of fresh apricot. In recent years, an increased demand is being recorded for fruit with high amount of phytochemicals and large antioxidant capacity. More studies have demonstrated that there is a positive relation between intake of antioxidant rich diets and lower incidence of degenerative diseases including cancer, heart disease, inflammation, arthritis, immune system decline, brain dysfunction and cataracts [Gordon 1996; Dauchet and Dallongeville 2008]. Along with other antioxidant components, polyphenols present in fruit and vegetable have been reported to play a major role in disease prevention due to their ability to scavenge free radicals in the biological system [Halliwell 1996]. The antioxidant profile of apricot fruit has recently been analyzed with particular reference to the total antioxidant capacity, polyphenols and/or carotenoids [Ruiz et al. 2005; Leccese et al. 2011; Schmitzer et al. 2011]. Moreover, apricot cultivars contained different amounts of phenolic compounds and flavonoids [Dragovic-Uzelac et al. 2007]. In this context, most breeding programs aim to produce new cultivars with better traits such as good flesh taste, flavor and firmness, high sugar, phenolic and flavonid content, excellent antioxidant power, big size and attractive fruit color, extensive harvesting period, and resistance to Sharka disease, as all local European cultivars are susceptible [Drogoudi et al. 2008; Schmitzer et al. 2011]. On this line, at the Faculty of Agronomy in Cacak (Serbia), three new apricot cultivars were named and released ('Aleksandar', 'Biljana' and 'Vera'). However, knowledge about their agronomic and pomological properties is modest [Milošević et al. 2012]. Additionally, the physical and chemical properties of the fruit of these cultivars are poorly tested, while the total phenolics and flavonoids content and total antioxidant capacity were not investigated.

The present investigation represents to our knowledge the first study addressing the importance of cultivars on main physical attributes and chemical profiles, especially phenolics and flavonoids content and antioxidant potential of fruit flesh of three new Serbian apricots grown under modern cultural practices. These information could be used to provide utilization of variability in these traits for nutritional and health purposes and further breeding programs.

## MATERIAL AND METHODS

**Plant material and field evaluation.** Four apricot cultivars were used: three new Serbian ('Aleksandar', 'Biljana' and 'Vera') and one old and/or traditional Hungarian cultivar ('Hungarian Best' – 'HB') as a control (standard) (fig. 1).

All of the cultivars were cultivated in the experimental orchard (Prislonica near Cacak, Western Serbia, 43°57' N, 20°26' E, 340 m above sea level) according to integrated apricot orchard management. Apricot cultivars trees were of the same age (3- and 4-years-old), grafted onto Myrobalan seedling rootstock, trained as a open vase and

spaced at 5.5 m × 3 m. All cultivars used were harvested at the commercial maturity stage on the basis of their skin color (fully colored) in 2010 and 2011. The beginning and end of harvest dates (HD) of the apricot cultivars assayed are shown in tab. 1.

For physical properties evaluation, fruits of each cultivar from five trees (ten fruit per tree) were collected, packed in cartons and transferred to laboratory facilities where they were subjected to analysis.



Fig. 1. 'Aleksandar' (left), 'Biljana' (center) and 'Vera' (right) – new Serbian apricot cultivars  
Ryc. 1 "Aleksandar" (po lewej), "Biljana" (w środku) i "Vera" (po prawej) – nowe serbskie odmiany moreli

Three replicates of ten fruits of each cultivar were randomly collected for chemical analysis. Immediately after harvest, fruits were transported in an air-conditioned car to the laboratory and analyzed the same day.

**Fruit physical measurement.** Fruit (FW) and stone weight (SW) in g was measured by a Tehnica ET-1111 technical scale (Iskra, Horjul, Slovenia) with a sensitivity of  $\pm 0.01$  g. For determining flesh/stone ratio (FSR), fruits were cut in half horizontally with a stainless-steel knife and the stones were removed and weighed. The flesh content was calculated by subtracting the SW from the whole apricot FW. Data are given in %. For moisture content (MC), samples were prepared for analysis by grinding about 100 g of fruit to pass through a sieve with circular openings of 1 mm diameter and mixed thoroughly. Two grams of the comminuted material were dried in a hot-air ST-01/02 (Instrumentaria, Zagreb, Croatia) oven at 80°C for 10 h, cooled in desiccators and weighed. Weight loss on drying to a final constant weight was recorded as moisture content of the material. Data are expressed as %. The flesh firmness (FF) was measured by using hand pentrometer (Bertuzzi FT-327, Facchini, Alfonsine, Italy) with an 8 mm cylindrical plunger. Data are given as kg 0.5 cm<sup>-2</sup>.

**Determination of soluble solids content, titratable acidity and pH juice.** Soluble solids content (SSC) and titratable acidity (TA) were determined in juice extracted using a food processor in three replicates of ten apricots. SSC was determined using a hand refractometer Milwaukee MR 200 (ATC, Rocky Mount, USA) and expressed as °Brix, and TA was analyzed in juices by titration to pH 8.1 with N/10 NaOH and expressed as malic acid content (%). On the basis of the measured data, soluble solids/titratable acidity ratio (SS/TA ratio or ripening index – RI) was calculated. The pH was measured by a pH meter (Cyber Scan 510, Nijkerk, Netherlands).

**Determination of sugars.** The fruit samples were analysed for the contents of individual sugars [sucrose (SU), glucose (GL), fructose (FR)] and total sugars (TS) by

High-Performance Liquid Chromatography (HPLC) according to the method of Šturm et al. [2003]. Contents were calculated with the help of the corresponding external standard and expressed in % of fresh weight (f.w.). Index of sweetness (IS) was calculated as the ratio between total sugars content and titratable acidity.

**Determination of total phenolics content, total flavonoids content and total antioxidant capacity.** All three components analyzed using UV-VIS spectrophotometer (MA9523-SPEKOL 211, Iskra, Horjul, Slovenia). All values are presented as means of triplicate analyses for each year.

The total phenolics content (TPC) was estimated according to the Folin-Ciocalteu method [Gutfinger 1981]. Values were expressed as gallic acid equivalents [ $\text{mg GAE g}^{-1}$  dry extract (d.e.)]. The total flavonoids content (TFC) was determined according to Brighente et al. (2007). Values were determined as rutin equivalents ( $\text{mg RU g}^{-1}$  d.e.). The total antioxidant capacity (TAC) of the methanol extracts were evaluated by the phosphor-molybdenum method [Prieto et al. 1999]. Ascorbic acid (AA) was used as standard and the total antioxidant capacity is expressed as  $\text{mg AA g}^{-1}$  of d.e.

**Statistical analysis.** Data presented for each cultivar represent the mean values determined from 3 independent homogenates. The data obtained from field and laboratory measurements were subjected to analysis of variance (ANOVA) using SAS software (SAS Institute Inc., Cary, NC, USA) and the LSD test ( $P \leq 0.05$ ) procedure was applied. The figures are performed by the Microsoft Excel software (Microsoft Corporation, Roselle, IL, USA). All data are mean of 2-year values.

## RESULTS AND DISCUSSION

**Harvest date and fruit physical attributes.** All three cultivars had earliest beginning of the maturation period than control cultivar, whereas ‘Aleksandar’ and ‘Vera’ had earlier end of harvest when compared with ‘Biljana’ and ‘HB’ (tab. 1). Relatively small variability in the harvest date indices among the studied cultivars was observed and could be classified as intermediate ripening cultivars according to local experience. These results agree with those previously reported for apricot [Dragovic-Uzelac et al. 2007; Ruiz and Egea 2008; Lo Bianco et al. 2010].

Data in tab. 1 showed that ‘Aleksandar’ and ‘Vera’ had similar and significantly higher FW than ‘Biljana’ and control cultivar. Greatest variations for this property in apricots have been previously reported [Hegedűs et al. 2010; Mratinić et al. 2011; Milošević et al. 2012]. For example, in different groups of apricot cultivars, Drogoudi et al. [2007], Ruiz and Egea [2008], and Lo Bianco et al. [2010] reported a range of FW of 36.6–105.3 g, 37.4–107.9 g and 32.9 to 77.4 g, respectively. When compared our data with results of above authors, it could be said that fruits had medium FW values. From this point, attractive medium-sized fruits are desired for apricot cultivar breeding [Guerriero et al. 2006], and important quality characteristic in respect of the harvest yield and consumer acceptance [Durmaz et al. 2010]. However, Hegedűs et al. [2010] reported that larger fruits are commonly preferred by consumers and apricot markets in recent years. SW was similar in tested cultivars, whereas FSR in all new cultivars were significantly higher than control (tab. 1). It is a well-known fact that apricot stones are used in

genotype identification [Depypere et al. 2007], and had a high utilization value. The higher FSR is a desired fruit property in apricot, as previously reported by Gezer et al. [2003].

Table 1. Harvest date, fruit and stone weight, flesh/stone ratio, moisture content and fruit firmness of apricot cultivars evaluated

Tabela 1. Termin zbioru, masa owocu i pestki, stosunek miąższ – pestka, wilgotność oraz jędrność owocu u ocenianych odmian moreli

Cultivar Odmiana	Harvest date Termin zbioru		Fruit weight Masa owocu (g)	Stone weight Masa pestki (g)	Flesh/stone ratio Stosunek miąższ/pestka (%)	Moisture content Wilgotność (%)	Fruit firmness Jędrność owocu (kg 0.5 cm <sup>-2</sup> )
	beginning początek	end koniec					
Aleksandar	10 July 10 lipca	23 July 23 lipca	55.37 a	3.09 a	94.38 a	81.15 a	0.71 b
Biljana	13 July 13 lipca	25 July 25 lipca	49.35 b	3.05 a	93.79 ab	80.67 b	1.02 a
Vera	12 July 12 lipca	23 July 23 lipca	55.10 a	3.17 a	94.22 ab	81.41 a	1.11 a
HB*	14 July 14 lipca	25 July 25 lipca	46.94 b	3.06 a	93.48 b	81.21 a	0.97 a

\*HB: 'Hungarian Best' (control cultivar – standard),(odmiana kontrolna – standard)

The same letters in columns indicate non-significant differences among means by LSD test at  $P \leq 0.05$ .

Te same litery w kolumnach wskazują na nieistotne różnice pomiędzy średnimi według testu LSD przy  $P \leq 0,05$ .

MC was significantly higher in fruits of 'Vera', 'Aleksandar' and 'HB' than in 'Biljana' (tab. 1), which is in agreement with previous studies in apricot [Wills et al. 1983; Ruiz and Egea 2008]. However, this is not coincident with results of the earlier study on apricot fruit by Kalyoncu et al.[2009] where the MC was much higher in group of Turkish cultivars. The differences between our results and those of Kalyoncu et al.[2009] could be due to the different eco-geographical groups of apricot cultivars tested and climatic conditions, especially air temperature and precipitation before and during maturity [Dragovic-Uzelac et al. 2007]. In this context, Ruiz and Egea [2008] reported that cultivars with  $\leq 83.0\%$  MC or  $\geq 17.0\%$  dry matter have a desired good fruit property for dried apricots, whereas the ones with high MC are consumed freshly [Akin et al. 2008]. In addition, drying process should be faster in the cultivars with lower MC, suggesting that all cultivars in our study are suitable for drying.

Data presented in tab. 1 showed that 'Vera' and 'Biljana' had similar FF values to those of control, whereat 'Aleksandar' had smaller value than 'HB'. According to Scandella et al. [1998] apricot cultivars with FF values between 3 and 1 kg 0.5 cm<sup>-2</sup> are suitable for consumers and the apricot industry. In the present study 'Vera', 'Biljana', somewhat control cultivar, had this characteristic. Dragovic-Uzelac et al. [2007] concluded that FF values decreased during ripening stages, and the lowest value observed

in commercial mature. Fruit maturation stage affects quality parameters, and maturation rate depends strongly on air temperature. Changes in climatic conditions, including air temperature, from year to year may therefore cause differences between indicated and real ripening times of cultivars. For this reason, flesh firmness was used as a maturity index [Lo Bianco et al. 2010] i.e. index for fixing optimum stage of maturity for harvest. In addition, in our unpublished study, similar tendency was observed for tested cultivars, but FF values were slightly higher.

**Soluble solids content, titratable acidity, ripening index and pH juice.** Considerable variations were found in SSC, TA, RI and pH juice (tab. 2). SSC and TA significantly varied among cultivars. ‘Biljana’ had the highest values of both phytochemicals than other two cultivars and/or standard. On the other hand, ‘Vera’ had higher RI and pH than others, although differences among above cultivar versus ‘Aleksandar’ and/or ‘HB’ for RI were not significant.

SSC and TA values in our study were much higher and lower, respectively, than those previously obtained [Ruiz et al. 2005; Pedryc et al. 2009; Schmitzer et al. 2011]. The differences between our results and those of above authors could be due to the different groups of apricot cultivars studied, local environmental conditions and cultural practices [Lo Bianco et al. 2010; Demirtas et al. 2010]. In this context, all cultivars in our trial might be optimally suitable for fresh consumption, drying or using them as parents in breeding programs for the modification of sugar profiles, as previously described [Hegedűs et al. 2010].

Table 2. Soluble solids content, titratable acidity, ripening index and juice pH of apricot cultivars evaluated

Tabela 2. Zawartość rozpuszczalnych ciał stałych, kwasowość, wskaźnik dojrzewania oraz pH soku ocenianych odmian moreli

Cultivar Odmiana	Soluble solids (°Brix) Rozpuszczalne ciała stałe	Titratable acidity (%) Kwasowość	Ripening index Wskaźnik dojrzewania	Juice pH pH soku
Aleksandar	16.96 b	0.61 c	27.80 ab	4.20 b
Biljana	17.41 a	0.71 a	24.52 b	4.23 b
Vera	16.73 c	0.53 d	31.57 a	4.29 a
HB*	16.91 b	0.66 b	25.62 ab	4.02 c

\*see table 1 – patrz tabela 1

Generally, the fruit maturity stage at the harvest date is the principal factor affecting fruit acidity and also the soluble solids content. Relationship between SSC and TA or RI has an important role in consumer demand of some stone fruits, including apricot [Ruiz and Egea 2008]. For example, Crisosto et al. [2004] reported that in the case of cultivars with SSC <12% and TA >0.9%, consumer acceptance was controlled by the interaction between SSC and TA rather than SSC alone. From nutritional aspects, fruits of ‘Vera’

apricot had high content of SSC and low TA and this cultivar could be interesting for baby food industry which requires raw material with low acidity [Hegedűs et al. 2010]. Also, the above cultivar can be used in a functional breeding program as a donor cultivar for high RI and low acidity. Generally, our range values for RI and pH (tab. 2) were much higher than those obtained by Drogoudi et al. [2007], Hegedűs et al. [2010] and Lo Bianco et al. [2010] and similar with results found by Pedryc et al. [2009] and Mratinić et al. [2011] suggesting that new cultivars grown under Serbian conditions had better fruit taste and aroma than some cultivars from other European apricot production areas. Also, since higher RI or SSC/TA ratio correlate well with higher eating quality, these cultivars present a choice of apricots with sweet flavors and offer the possibility to choose according to consumer and processing preferences [Ledbetter et al. 2006]. Finally, our range of SSC, TA, pH and RI values were close to data obtained by Kalyoncu et al. [2009] for some Turkish apricot cultivars.

**Sugar contents.** Content levels of each individual sugar, TS and IS are presented in tab. 3. The major sugar in flesh of apricots was SU, followed by GL, whereas FR was registered in small amounts. These proportions are in accordance with results from other studies [Wills et al. 1983; Drogoudi et al. 2007; Schmitzer et al. 2011]. However, Femenia et al. [1998] reported that glucose was dominant sugar in apricot; however, a different extraction and analytical method was used [Hegedűs et al. 2010]. In addition, other sugars such as sorbitol [Schmitzer et al. 2011], xylose, mannose, maltose [Bassi and Selli 1990] and raffinose [Ledbetter et al. 2006] were also found in apricot fruit in varying contents. In our study, SU and FR levels were greatest in 'Vera', and GL in 'Aleksandar' (tab. 3), suggested that fruits of all cultivars had higher amounts of soluble sugars than control. The highest value of TS was recorded in 'Biljana' because their high SSC, followed by 'Vera' and 'HB', although differences among them were not significant. The lowest TS value was found in 'Aleksandar' (tab. 3).

Table 3. Sugars content and index of sweetness of apricot cultivars evaluated  
Tabela 3. Zawartość cukrów oraz wskaźnik słodyczy w ocenianych odmianach moreli

Cultivar Odmiana	Sucrose Sacharoza (%)	Glucose Glukoza (%)	Fructose Fruktoza (%)	Total sugars Cukry ogółem (%)	Index of sweetness Wskaźnik słodyczy
Aleksandar	8.70 d	4.42 a	0.22 c	13.83 b	22.67 b
Biljana	10.58 b	3.89 c	0.24 b	14.86 a	20.93 c
Vera	11.37 a	3.32 d	0.54 a	14.68 ab	27.70 a
HB*	9.81 c	4.12 b	0.20 d	14.22 ab	21.54 b

\*see table 1 – patrz tabela 1

Our range of values for all sugars were slightly higher, except FR, than those obtained by Schmitzer et al. [2011] and Mratinić et al. [2011] and lower when compared with results obtained by Akin et al. [2008] for a group of Turkish apricot cultivars. The differences between our results and those of above authors could be due to the different

eco-geographical groups of apricot cultivars tested, local environmental conditions and cultural practices [Lo Bianco et al. 2010]. Generally, new cultivars in our trial had better content of soluble sugars and TS as compared with ‘HB’; it is suggested that these cultivars are good source of sugars and are suitable for new apricot orchards in Serbia and other countries with similar environmental conditions. Also, the consumer acceptance for apricot is greatly influenced by its sugar contents, constituting an important compositional property [Moreau-Rio and Roty 1998]. From nutritional and/or health context, information on the amount of individual sugars in fruits of cultivars tested can help dieticians to plan diets for diabetics [Ledbetter et al. 2006].

In terms of IS, the highest value was found in ‘Vera’, intermediate in ‘Aleksandar’ and control cultivar, and the lowest in ‘Biljana’ (tab. 3). According to Schmitzer et al. [2011], sweetness is an important factor contributing to the internal quality and one of the most important objectives in apricot breeding, cultivars with higher values of sugars should be promoted. It may be concluded that our cultivars tested and Hungarian traditional cultivars ‘HB’, well known for their good sensorial quality (data not shown) and taste, have been characterized by a balanced sugar/acid ratio. In consumer acceptance studies, these cultivars are often chosen as the most promising fruits. Finally, this choice provides possibility to select fruits according to the varied consumer requirements or special nutritional and health purposes [Wills et al. 1983; Gordon 1996; Dauchet and Dallongeville 2008].

**Total phenolic and flavonoid content and total antioxidant capacity.** ANOVA revealed that cultivar is the crucial factor in determining the apricot fruit TPC, TFC and antioxidant capacity (fig. 2–4) as it was reported for several groups of apricot cultivars [Dragovic-Uzelac et al. 2007; Pedryc et al. 2009; Leccese et al. 2011; Schmitzer et al. 2011].

Data in fig. 2 showed that ‘Aleksandar’ and control cultivar had similar and significantly higher TPC than ‘Biljana’ and ‘Vera’. On the other hand, among the cultivars analyzed, ‘Vera’ and control cultivar contained significantly lower TFC than ‘Biljana’, especially than ‘Aleksandar’ (fig. 3).

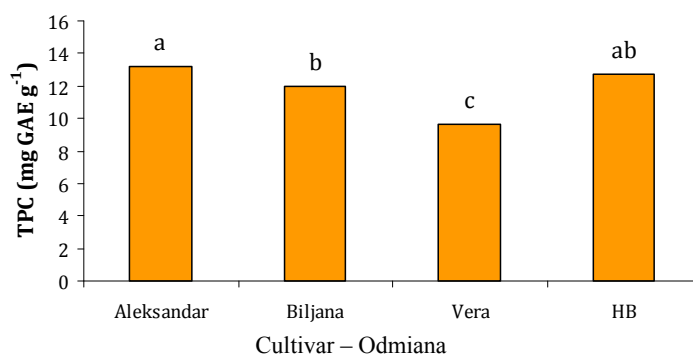


Fig. 2. Total phenolics content (TPC) in flesh of apricot cultivars tested. Statistically significant differences among means are presented over bars at  $P \leq 0.05$  by LSD test

Rys. 2. Całkowita zawartość fenoli (TPC) w miąższu badanych odmian moreli. Statystycznie istotne różnice pomiędzy średnimi pokazane są nad słupkami przy  $P \leq 0,05$  według testu LSD



For example, Dragovic-Uzelac et al. [2007] reported that polyphenol quantities of apricot decreased with ripening. Although all apricots used in the present study were grown in same location under similar cultural practices, TPC showed variability due to their different cultivars [Kalyoncu et al. 2009].

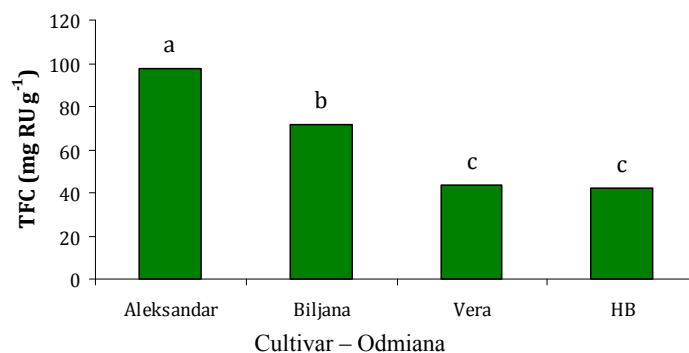


Fig. 3. Total flavonoids content (TFC) in flesh of apricot cultivars tested. Statistically significant differences among means are presented over bars at  $P \leq 0.05$  by LSD test

Rys. 3. Całkowita zawartość flawonoidów (TFC) w miąższu badanych odmian moreli. Statystycznie istotne różnice pomiędzy średnimi pokazane są nad słupkami przy  $P \leq 0,05$  według testu LSD

In different groups of apricot cultivars, Scalzo et al. [2005] and Kalyoncu et al. [2009] recorded a range of TPC of 214–266 mg GA L<sup>-1</sup> and 58.4–309.5 mg GA 100 g<sup>-1</sup> respectively. In our study, TPC of apricot fruits were much higher than that of above authors. Higher phenolic values obtained from present work compared to the reported studies may be related in the origin of cultivars, environmental conditions, length of fruit development period and maturity levels of fruits [Hegedűs et al. 2010]. Similar findings were observed by Drogoudi et al. [2007] and Hegedűs et al. [2010] Generally, phenolic compounds of apricot can change with cultivar, stage of maturity, geographical region and fruit location on the tree [Dragovic-Uzelac et al. 2007]. Also, previous results showed that sunlight, soils, season, agronomic conditions [Joshi et al. 1991] and analytical method can make up differences and amounts on phenolic compounds and other fruit quality profiles of apricot [Hegedűs et al. 2010; Leccese et al. 2011].

In the present study, cultivars ‘Aleksandar’ and ‘Biljana’ are particularly rich in TFC. Other cultivars (‘Vera’, ‘HB’) also had good content of this phytochemical. Such results seem to reveal the importance of genotype for the production of flavonoids. In this way, the benefits of biological effects on human health of this kind of components are also affected, as already reported by some authors [Scalzo et al. 2005].

TAC values are presented in fig. 4. Data showed that ‘Vera’ had the highest TAC value, ‘Biljana’ and control cultivar intermediate, whereas the lowest value was found in ‘Aleksandar’, which is in accordance with Hegedűs et al. [2010] who reported that early ripening cultivars from different apricot groups and origin had smaller antioxidant potential (tab. 1). The cultivar ‘Vera’ matured two days after ‘Aleksandar’ and produced

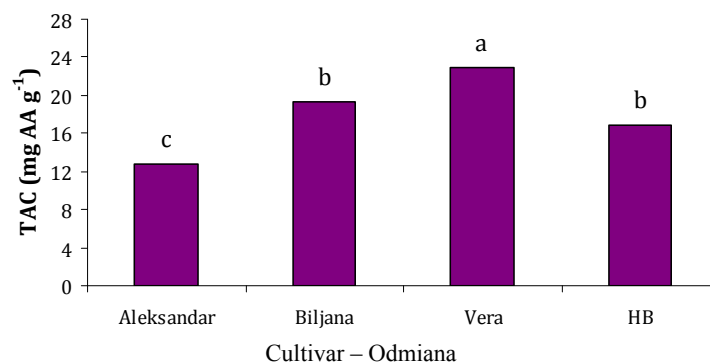


Fig. 4. Total antioxidant capacity (TAC) in flesh of apricot cultivars tested. Statistically significant differences among means are presented over bars at  $P \leq 0.05$  by LSD test

Rys. 4. Całkowita zdolność przeciwutleniająca (TAC) w miąższu badanych odmian moreli. Statystycznie istotne różnice pomiędzy średnimi pokazane są nad słupkami przy  $P \leq 0,05$  według testu LSD

a surprisingly high TAC. Similar tendency observed in other two cultivars. On this basis, well-focused breeding programs can create new cultivars specifically selected for improved antioxidant potential [Scalzo et al. 2005]. In addition, many authors reported that antioxidant power depends on the fruit species, cultivars, their origin, maturity stage, geographical conditions and cultural practices [Prieto et al. 1999; Scalzo et al. 2005; Dragovic-Uzelac et al. 2007; Leccese et al. 2011].

## CONCLUSIONS

1. The apricot cultivars analysed in this study exhibited statistically significant differences in the fruit weight, flesh/stone ratio, moisture content and fruit firmness, and no significant variations in the stone weight. Beginning and end of harvest were similar.

2. Fruit phytochemicals accumulation (soluble solids, titratable acidity, individual and total sugars), soluble solids/titratable acidity ratio and index of sweetness were non-uniform, being cultivar-dependent, and generally resulted in better values in new cultivars than in control.

3. The highest total phenolics and total flavonoids content were recorded in 'Aleksandar', whereas the best total antioxidant capacity was found in 'Vera'.

4. All three new cultivars in our trial might be optimally suitable for fresh consumption, drying, processing or using them as parents in breeding programs due to its better performances than traditional cultivar 'Hungarian Best'.

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## JAKOŚĆ OWOCÓW, ZAWARTOŚĆ FENOLI ORAZ ZDOLNOŚĆ PRZECIWUTLENIAJĄCA NOWYCH ODMIAN MORELI Z SERBII

**Streszczenie.** Eksperyment założono w sadzie morelowym w pobliżu Cacak (Zachodnia Serbia) w latach 2010 i 2011. W niniejszej pracy chcieliśmy określić własności fizyczno-chemiczne, zawartość fenoli oraz zdolność przeciwutleniającą trzech nowych odmian serbskich ('Aleksandar', 'Biljana', 'Vera') szczepionych na siewce Myrobalan. Wyniki wskazały, że cechy fizyczno-chemiczne znacząco różniły się pomiędzy odmianami. Podobnie, całkowita zawartość fenoli i flawonoidów oraz zdolność przeciwutleniająca w znacznym stopniu zależy od odmiany. Generalnie nowe odmiany serbskie miały lepiej ocenione własności niż roślina kontrolna ('Hungarian Best'), oprócz masy pestki, zawartości owocu, wilgotności i całkowitej zawartości fenoli. Najwyższe wartości całkowitej

zawartości fenoli i flawonoidów stwierdzono u odmiany ‘Aleksandar’, podczas gdy najwyższa zdolność przeciwutleniająca została zanotowana u odmiany ‘Vera’. Ostatecznie nowe odmiany serbskie można polecić do sadzenia w podobnych warunkach i programach hodowli moreli.

**Słowa kluczowe:** kwasowość, profile chemiczne, HPLC, *Prunus armeniaca* L., rozpuszczalne ciała stałe

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