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OLD APPLE VARIETIES IN CENTRAL MONTENEGRO

SUMMARY

In the two-year period, 2008-2009, old apple varieties were investigated 'in situ' in Central Montenegro. The most important biological and pomological properties of 15 old apple varieties from this area were presented in the paper. The aim of the paper was to point out which of old varieties are of interest for the production on larger scale due to their biological and economic properties.

In the observed apple varieties, maturation happens from mid-July to mid-October. The biggest fruit size was found in Ilinjača (167.50 g), Dunjka (170.15 g) and Moračka krstovača krupna (182.34 g). Majority of varieties had round-flat and round-conical shape. The main fruit skin colors in observed varieties were green, green-yellow and yellow, while additional color (red or pink) was present in different percentage.

The varieties with high content of soluble matters in fruit: Aleksandrija (16.0 %), Rebrača (15.5 %), Jolovača (14.6 %) and Dunjka (14.5%) can be recommended as good material for processing industry.

Keywords: apple, old varieties, properties, Central Montenegro.

INTRODUCTION

Apple is a perennial, woody and deciduous fruit. Fresh apple fruits are used throughout the year, especially in winter months when there is a lack of fresh fruit of other species grown in moderate continental climate zone (Mišić, 2002). Apples are not only table fruit, but also represent important raw material for different processed products (Šoškić, 2008; Milošević, 1997).

Apple is the second most important fruit in Montenegro, after plum. Apart from modern assortment, the old varieties of apples are still significantly present. As opposed to some modern apple cultivars, these varieties are long-lived and resistant to frost, heavy snow, summer droughts and pathogens. Old varieties require much less care, and yet they give fruitage regularly and generously (Zovko et al, 2010). Besides selling them as the fresh fruit, old apple varieties are suitable for processing into juice, compote, wine, vinegar, brandy, and for drying (Milenković and Lukić, 2008).

Old apple varieties are becoming much more important, considering the fact that there is an increasing demand for organically grown and biologically valuable fruit, produced without the use of pesticides (Tomić et al, 2011). The

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old plant varieties contribute to the conservation of biodiversity and stability of agroecosystems (Milenković and Bosković, 2010). Some old varieties of apples have a high degree of horizontal and race non-specific resistance to pests and diseases such as apple scab, powdery mildew and downy mildew (Ognjanov et al, 2000) and that is why they are used as resistance donors to parasites (Ognjanov, 2005).

The aim of this paper is to recognize old varieties from Central Montenegro which deserve attention for larger scale cultivation due to their biological and economic characteristics.

MATERIAL AND METHODS

In the two-year period, 2008-2009, some biological and pomological properties of old apple varieties were investigated 'in situ' in the central part of Montenegro. The study was conducted by a working group for continental fruit within the project South East European Development Network on plant genetic resources (SEEDNet). In the course of the project, the terrain of Montenegro was visited and the inventory of many old apple varieties was made. The most important biological (vigour, crown shape, flowering and ripening) and pomological characteristics (fruit size, height and width, fruit shape, skin ground color, over color, flesh color, taste, quality and soluble solid) of 15 old apple varieties from this area were presented in the paper. The visited sites belong to the municipalities of Kolašin, Nikšić and Cetinje. All varieties are scion grafted onto the wild apple. The trees are free-growing, without the use of pruning, fertilization and protection from pests and disease-causing agents.

In this research the standard methods and the "Descriptor list for apple" (Watkins and Smith, 1982) were used. ANOVA, Tukey's test for significance level $p < 0.05$ was used to determine the significance of differences among varieties for fruit weight, height and width.

RESULTS AND DISCUSSION

The examined varieties are of medium vigorous, vigorous and very vigorous trees (Table 1). Crown shape is pyramidal, wide pyramidal and wide. Milenković and Lukić (2008) and Zovko et al, (2010) indicated that the old apple varieties show variability in terms of vigor and crown shape.

The earliest full flowering was recorded in the cultivar Ilinjača, on 22 April and latest in the cultivar Aleksandrija, on 10 May.

The examined apple varieties ripened over the period of three months. The earliest maturing cultivar is Šarena petrovača which ripens in mid-July, while the latest maturing ones are Bećovača, Moračka krstovača and Ruski car and they ripen in mid-October. The presented ripening season is similar to the one presented by Zovko et al (2010) who examined the varieties in the region of Žepča. Tomic et al (2011), who examined the old varieties in western Bosnia, stated that the ripening season could be extended from 12 July to 15 November.

The size and mass of the examined fruits are shown in Table 2. The fruit mass varied from 62.23 to 182.34 g. By using the Tukey's range test, the variety Moračka Krstovača krupna, is ranked in the first group with the highest fruit mass, but it was statistically indistinguishable from varieties Ilinjača and Dunjka, which are in the second group. Varieties Bečovača, Šarena petrovača and Budimka are classified into the last group, with the lowest fruit weight and statistically different from all other varieties except the variety Kisela župljanka, which is in the next group.

Table 1. Biological properties of old apple cultivars, 2008-2009

Cultivar	Vigour	Crown shape	Flowering	Ripening
Aleksandrija	Very vigorous	Wide	10 May	First ten days in October
Bečovača	Vigorous	Wide-pyramidal	3 May	Mid-October
Budimka	Vigorous	Wide	30 April	End-September
Dunjka	Vigorous	Pyramidal	1 May	First ten days in October
Ilinjača	Vigorous	Wide	22 April	Last ten days in August
Limunjača	Vigorous	Pyramidal	2 May	End-September
Jolovača	Vigorous	Pyramidal	3 May	First ten days in October
Kisela župljanka	Vigorous	Wide	2 May	Mid-September
Kolačara	Medium	Wide-pyramidal	2 May	First ten days in October
Moračka krstovača sitna	Medium	Wide-pyramidal	23 April	Mid-October
Moračka krstovača krupna	Vigorous	Wide	23 April	End-September
Rebrača	Very vigorous	Wide-pyramidal	1 May	End-September
Ruski car	Medium	Wide-pyramidal	11 May	Mid-October
Šarena petrovača	Vigorous	Pyramidal	7 May	Mid-July
Šarenika	Medium	Pyramidal	4 May	First ten days in October

Šebek i Peković (1997) stated that most of 12 varieties that are grown in Gornje Polimlje have fruit mass of 100 to 200 g, which is similar to the data shown. At the foot of the Kopaonik Mountain, the largest number of varieties has a fruit mass under 100 g (Nenadović - Mratinić, 1988).

The maximum height of the fruit is found in large-sized Moračka Krstovača, 64.70 mm, and the smallest in the variety Budimka, 42.29 mm. Ilinjača has the widest fruits of 78.27 mm, while the fruit of Šarena petrovača is the narrowest, 54.08 mm. Fruits dimensions are mainly correlated to fruit weight, and larger fruits have larger dimensions.

Table 2. Mass and dimensions of fruit autochthonous apple cultivars, 2008-2009

Cultivar	Mass (g)	Height (mm)	Width (mm)
Aleksandrija	127.47 cde*	55.40 cd	68.92 bc
Bećovača	62.23 h	42.39 g	55.72 fg
Budimka	66.10 h	42.29 g	55.48 fg
Dunjka	170.15 ab	57.31 bc	77.66 a
Ilinjača	167.50 ab	64.10 a	78.27 a
Limunjača	97.70 fg	49.21 def	61.38 ef
Jolovača	108.61 def	44.71 fg	68.14 bcd
Kisela župljanka	78.43 gh	46.52 efg	62.20 de
Kolačara	142.20 bc	52.71 cde	75.86 a
Moračka krstovača small-sized	97.98 efg	52.47 cde	63.75 cde
Moračka krstovača large-sized	182.34 a	64.70 a	77.53 a
Rebrača	137.71 cd	61.77 ab	72.69 ab
Ruski car	128.87 cd	54.64 cd	69.04 bc
Šarena petrovača	65.43 h	52.06 cde	54.08 g
Šarenika	111.40 def	52.69 cde	64.47 cde

*Values marked with different letters are statistically relevant at the level $P=0.05\%$ (Tukey's test)

The most common fruit shape of the varieties presented in this paper was round-flat, but other shapes such as round, round-conical and long-conical fruits were noted as well (Table 3).

Table 3. Fruit properties of autochthonous apple cultivars, 2008-2009

Properties	Fruit shape	Skin ground color	Skin over color (%)
Aleksandrija	Round-flat	Yellow	Red (to 20 %)
Bećovača	Long-conical	Green	Pink (40-50 %)
Budimka	Round-flat	Green	Pink (to 5 %)
Dunjka	Round-flat	Yellow	-
Ilinjača	Round-flat	Green - yellow	Pink (to 5 %)
Limunjača	Round-flat	Yellow	Pink (to 10 %)
Jolovača	Round-flat	Green - yellow	-
Kisela župljanka	Round-flat	Green	Red (20-40 %)
Kolačara	Round-flat	Green	Red (50-80 %)
Moračka krstovača small-sized	Long-conical	Green	Red (20-30 %)
Moračka krstovača krupna	Round-conical	Green - yellow	Red (20-70 %)
Rebrača	Round-conical	Green - yellow	Red (20-50 %)
Ruski car	Round-conical	Green	Red (50-80 %)
Šarena petrovača	Round-conical	Green - yellow	Red (40-70 %)
Šarenika	Round	Green - yellow	Red (30-90 %)

Table 4. Fruit flesh properties of autochthonous apple cultivars, 2009

Cultivar	Flesh colour	Taste	Quality (1-9)	Soluble solid
Aleksandrija	Beige	Sour	7	16,0
Bečovača	White	Sour	6	13,8
Budimka	White	Sour-sweet	5	13,0
Dunjka	Green-white	Sweet-sour	6	14,5
Ilinjača	Beige	Sweet	6	13,1
Limunjača	White	Sour-sweet	6	11,8
Jolovača	Green-beige	Sweet	6	14,6
Kisela župljanka	White	Sour	4	12,5
Kolačara	White	Sour	5	12,3
Moračka krstovača small-sized	Green-beige	Sour	4	12,2
Moračka krstovača large-sized	Green-beige	Sour	6	13,5
Rebrača	White	Sweet-sour	7	15,5
Ruski car	Green-beige	Sour	6	12,5
Šarena petrovača	White	Sweet	7	11,3
Šarenika	Yellow-beige	Sweet	5	12,6

The basic color of fruit skin in the cultivars is green, yellow-green and yellow. Two varieties did not have additional colors, while others were complementary colored with pink or red in different percentage. In general, it can be said that poorly colored varieties prevail which is in accordance with the findings of Nenadović - Mratinić (1988) and Šebek and Peković (1997).

The largest number of the old apple varieties had white flesh (Table 4), but greenish-white, greenish-beige, beige and beige-yellow were detected, too. The highest share of white color of fruit flesh was also determined by Tomić et al (2011) for the varieties they studied.

In terms of taste, the varieties showed variability, and the fruits were sweet, sweet-sour, sour-sweet and sour. Fruits of varieties that ripen earlier such as Šarena petrovača and Ilinjača have sweet flesh, and later ripening varieties are mainly sour. A similar statement was given by Tomić et al (2011).

The eating quality of fresh fruits is determined by tasting. The best ranked varieties are Aleksandrija, Rebrača and Šarena petrovača. All varieties graded 6 are also interesting for fresh fruits consumption.

Soluble solids in the fruits of the examined cultivars were determined by refractometer in 2009 and it was in the range from 11.3 to 16%. High content of soluble solids in the fruits was found in Aleksandrija (16%), Rebrača (15.5%), Jolovača (14.6%) and Dunjka (14.5%), which recommends them for excellent raw material for various forms of processing.

CONCLUSIONS

The investigated apple varieties ripen over the period of three months (mid-July to mid-October). Very large fruit is a characteristic of the following cultivars: Ilinjača (167.50 g), Dunjka (170.15 g) and Moračka Krstovača krupna (182.34 g). The majority of the varieties have round-flat or round-conical shape. The main colors of fruit skin are green, yellow-green and yellow, while the additional colors (red and pink) are present in different percentage.

Early maturing varieties such as Šarena petrovača and Ilinjača and later maturing ones such as Aleksandrija, Limunjača and Rebrača can be recommended for table use. Varieties with a high content of soluble solids in the fruit: Aleksandrija (16%), Rebrača (15.5%), Jolovača (14.6%) and Dunjka (14.5%) can be recommended as good raw material for the food industry.

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STARE SORTE JABUKE U CENTRALNOJ CRNOJ GORI

SAŽETAK

U periodu 2008 - 2009. godine izvršeno je proučavanje starih sorti jabuke na području centralne Crne Gore, u „in situ“ uslovima. U ovom radu su prikazane važnije biološko-pomološke osobine 15 starih sorti jabuke sa ovog područja. Cilj rada je da ukaže koje stare sorte, zbog svojih biološko-privrednih osobina, zaslužuju pažnju za gajenje u većem obimu.

Proučavane sorte jabuke sazrijevaju u intervalu od tri mjeseca (sredina jula – sredina oktobra). Krupnoćom ploda se ističu: Ilinjača (167,50 g); Dunjka (170,15 g) i Moračka krstovača krupna (182,34 g). Najveći broj sorti ima plodove okruglasto spljoštenog i okruglasto kupastog oblika. Zelena, zeleno žuta i žuta su osnovne boje pokožice ploda ispitivanih sorti, dok je dopunska boja (crvena i roze) prisutna u različitom procentu.

Kao dobre sirovine za prehrambenu industriju mogu se preporučiti sorte sa visokim sadržajem rastvorljive suve materije u plodu: Aleksandrija (16 %), Rebrača (15,5 %), Jolovača (14,6 %) i Dunjka (14,5 %).

Ključne riječi: jabuka, stare sorte, osobine, centralna Crna Gora