

VARIABILITATEA CONȚINUTULUI ÎN ANTOCIANI ȘI SUBȘTANȚE TANOIDE A FRUCTELOR UNOR GENOTYPURI DE *Lonicera caerulea* var. *kamschatica*, *Aronia melanocarpa* and *Berberis thunbergii* var. *atropurpurea*

VARIABILITY OF THE ANTHOCYANINS AND TANNINS IN BERRIES OF SOME *Lonicera caerulea* var. *kamchatica*, *Aronia melanocarpa* and *Berberis thunbergii* var. *atropurpurea* GENOTYPES

Paulina Mladin¹, Gh. Mladin¹, Eliza Oprea², Maria Rădulescu¹ and Claudia Nicola¹

¹Research Institute for Fruits Growing, Pitești, Romania

²University of Bucharest, Faculty of Chemistry, Bucharest, Romania

Abstract

Lonicera caerulea var. *kamschatica* is called popular in countries where it is cultivated „blue-honeysuckle,, and we call it „fruiting Lonicera,,. This is one of the few species of *Lonicera* with edible fruits. The blue –honeysuckle (*Lonicera caerulea* var. *kamschatica*) and chokeberry (*Aronia melanocarpa*) are interesting fruit species both for fruit producing plantations and ornamental purposes. *Berberis thunbergii* var. *atropurpurea* is the variety of barberry with ornamental purposes and a great fruiting potential, by taking advantage of abundant yield and various phytochemicals in fruit content. *Lonicera* selections fruit trees obtained at the Institute Pitesti have noted a number of features, such as early ripening fruit, winter frost resistance, adaptability to different climatic conditions, rich in anthocyanins berries and a high antioxidant activity (Oprea et al., 2002). Chockberry is a fruiting shrub, particularly important as natural source for the coloring of the foods. After some early studies, it was discovered that red barberry fruits had the highest content of total acidity in comparison with all other fruits, thus constituting an important natural source of organic acids (Mladin G. et al., 1996). Anthocyanins and tannins are biochemical compounds playing a major role in the formation of fruit color, taste, as well as the quality of fruits derivatives. Also, they have in the same time, beneficial effects for human health due to the antioxidant activities and protecting blood vessels. This study aimed to evaluate a genetic material (consisting of selections from these three species) in terms of biochemical compounds content in fruits, in order to complete the biochemical characterization of the genotypes and identifying those with hig, medium or lower content giving fruit taste as pleasant, with moderate to low astringency. In the period 2004-2007 were studied 24 blue-honeysuckle selections, three selections of barberry and one variety of chockberry. Methods for determining these compounds were the usual spectrophotometric for anthocyanins (by the method of Fuleki and Francis, 1968) and HPTLC, for four *Lonicera* selections and by the Lowenthal -Neubaur , 1977, procedure for tannins. Total anthocyanin content in the fruits of *Lonicera* varied widely, from 206.0 mg% to 579.0 mg%. Nero chokeberry variety accumulated in fruits high anthocyanins, 509, 16 mg%. Barberry selections have accumulated much smaller amounts of anthocyanins, between 71.28 mg % and 79, 43 mg%. The genotypes of *Lonicera* had tannin content between 0, 218% and 0, 429%. Barberry selections were marked by high content of tannins with an average from 0.610% to 0.990%, the cckockberry variety Nero with an average of 0.993%. The content of anthocyanins and tannins in the fruit varied from one to another genotype, as well as from one to another climatic year.

Keywords: blue honeysuckle, chokeberry, barberry, selection

Cuvinte cheie: *Lonicera albastra*, agris, genotipuri

1. Introduction

Since 1988, at the Research Institute for Fruits Growing Pitești, the evaluation and selection of new interesting minor berry species have been carried out. The edible blue honeysuckle (*Lonicera caerulea edulis*, var. *kamschatica*), chokeberry (*Aronia melanocarpa* (Eil. Michx) and barberry (*Berberis thunbergii* var. *atropurpurea*) are three species of interest for some valuable characteristics. The blue honeysuckle which was introduced from Russia, it is now cultivated on small plantations in the north of Europe, Northern and Central Russia, in Urals, Siberia, the Far East and North America (M. Antalikova et al., 2007). The main features of the blue honeysuckle are as follow as : extra-early ripening, prior to or together with the earliest strawberry, frost resistance, high adaptability to local environment conditions, high berry content in ascorbic acid and phenols, upright habit, some pest and diseases resistance. Some of the varieties exhibit negative traits such as too sour or too bitter taste, soft fruits, small size, low yield, compact canopy of the bush, etc. For the improving these traits a breeding work has been done at the Institute, first of all with the inducing the phenotype variability by open pollination, and than, with the selection of the hybrids. So, after the evaluation more than 70 of honeysuckle selections were selected.

Of these, two new varieties: Loni and Cera were released (in 2003, and respectively, 2006, by Gh. Mladin and P. Mladin). Other valuable selections are now under trial evaluation.

Chokeberry is a shrubby plant with ornamental facilities and berries interest for food industry. A shrub of Nero chokeberry variety yields an average of 3.3 kg fruits / plant and a plant trained as one trunk and canopy, 2.2 kg / plant (Mladin Gh. et al., 1996). The berries are clustered on large umbels(7-11 g). The berries contain medium vitamin C (52.80 mg % fresh fruit) and sugars (7.23 g %), high dry matter (25.67 %), low acidity (0.78 g %), high potassium, 288.50 mg% and phosphorus, 37.37 mg% and 4.49 mg% calcium (Mladin Gh. et al., 1996). Barberry *Berberis thunbergii* var. *atropurpurea* is by far, of the ornamental interest. In addition, it could be a potential source of biochemical compounds. The plants are winter resistant, medium yield (1.6-2.0 kg /bush). The red berries are very rich in acidity (2.95-5.75 g %) and dry matter (35.19 g %), medium in sugar (8.01g %) and vitamin C (63.80mg% fresh fruit). Also, they contain high potassium (358.22 mg %), phosphorus (86.36 mg %) and calcium (23.72 mg%). Beside these valuable characteristics, in this study, other compounds of the fruits, such as tannins and anthocyanins were investigated. In the last 10-15 years many studies have been conducted on the antioxidant properties of the vegetal phenolics : derivate of the caffeic and cinamic acids, flavonoids, anthocianins, cummarins, tannins, some terpens and vitamins (Oprea E., pers. com.).

The purpose of this study was to determine the levels of total anthocyanins and tannins in a range of some minor small fruits with a view to demonstrating the validity and the potential of such kind of fruits for consumption and, indirectly , for health and , finally for their introduction in culture. So, our task was the investigating of the anthocyanins and tannins levels in different berry genotypes belonging to the 3 above mentioned species in order to characterize and identify those with higher or lower content.

2. Material and method

There were evaluated 24 blue honeysuckle selections, 3 barberry selections and one variety of chokeberry, respectively Nero variety. The samples of berries (approx. 200 g) were picked up in early of June for honeysuckle, in the middle of August for chokeberry and at the end of September for barberry. The collected fruits were immediately frozen (-20° C) and tested some time later. The analysis of the anthocyanins was done in 2004 and 2006 for *Lonicera* selections and in 2004 for *Aronia* and *Berberis*. The analysis of the tannins were done during 3 years in *Lonicera* and *Aronia* (2004, 2006 and 2007) and 2 years (2006 and 2007) for *Berberis*.

The common method for the anthocyanins determination was done by spectrophotometric measurement of absorption in absorption maximum (by the method of Fuleki and Francis, 1968). The fruits were blended with acidified ethanol and then the extract was filtered in vacuum. The extinctions of the extracts, subsequently transformed in concentrations, were read with a spectrophotometer at the 535 mm wavelength. The values were expressed in mg%, that it means mg/100 g fruit.

In addition, for 4 blue honeysuckle selections, the anthocyanins were analysed by HPTLC, using in the stationary fazes silica gel 60 (Merck) plates and cellulose F plates (Merck) and for mobile fazes, the reactives: 1-butanol: acetic acid: water (60: 15: 25), hydrochloric acid: formic acid: water (30.8: 27.8: 41.4), acetic acid: water: hydrochloric acid (30: 10: 3), acetic acid : water (60: 40).

The tannins concentrations were analyzed by the Lowenthal -Neubeur procedure (1877). This method is based on the reaction of the potassium permanganate in acid medium with the tannins in the presence of the indigo-carmine indicator. The results were expressed in percentages (g/100 g fruit).

3. Results and discussions

The anthocyanins content in blue honeysuckle fruits varied considerable, with the lowest levels in SL-69 and the highest in SL-15 (Figure 1). The richest in anthocyanins were the follows blue honeysuckle selections: SL-15, SL- 17 and SL- 18. 20 selections of honeysuckle accumulated in their fruits more than 300 mg% anthocyanins and eight of these more than 400 mg %, but without significant differences between them. The high mean values of the anthocyanins content of *Lonicera* fruits (370.8 mg %) represent thus an important potential of these fruits with antioxidant properties for human health.

Using the HPTLC method, it was found out that in the wet fruits of the four selections the anthocyanins content ranged between 0.72222 g / 100 g in selection SL-22 and 0.88843 g / 100 g wet fruits, in SL-24 (Table 1). In dry fruits this content was 6.6-6.8 much higher than in wet fruits, respectively 4.9263 mg/ 100 g dry fruits in SL-22, and 5.9032 mg/ 100 g dry fruits in SL-24 (expressed in g 3-glucozil-cianidyn on 100g dry matter). Comparing with *Lonicera*, Nero variety belonging to *Aronia melanocarpa* sp. accumulated important amounts of anthocyanins (509.16 mg% mean value) (Table 2). In addition, we have to precise that the chockeberry juice had a strong and stable color during 1 week under room storage. It can be combined very well with apple or sour cherry juice. In the berry fruits of *Berberis* the anthocyanins concentration were much lower, between 71.28 and 79.43 mg%.

The tannins concentration in *Lonicera* selections ranged with significant differences from 0.218 % with SL-28, to 0.429 % with SL-55 (Figure 2). The tannins mean value in *Lonicera* fruits was 0.287%. The

richest *Lonicera* selections in tannins were SL-55 and SL-65, followed by SL-17, SL-46, SL-45, SL-22, with over 0.300%. Selections SL-29 and SL-32 which are now named as Loni and Cera varieties accumulated low tannins, 0.254 % and 0.266 % tannins, respectively. In the SL-22 the high tannins was correlated with bitter taste of the berries. Even though, high tannins content gives to the fruits an astringent flavor, today, by the discovery of their antioxidant capacity, the richness in these compounds represents an added value of such kind of fruits. In point of this aspect, chokeberry Nero and barberry SL-III, which accumulated the largest amounts of tannins, are by far the most valuable for the antioxidant property. Also, there were differences between the genotypes and the climatic years (Table 1).

4. Conclusions

This study has validated the high biochemical values of the small fruits blue honeysuckle, chokeberry and barberry, consisting in large amounts of some compounds with antioxidant action. Chokeberry Nero var. was by far the richest in anthocyanins and tannins and this content varied within the same genotype with climatic year.

Berries of barberry also proved to be rich in tannins ranged with selection and climatic year. It should emphasize the SL-III selection with the highest tannins content. Instead, all barberry selections proved to be a little poor in anthocyanins. We also appreciate the blue honeysuckle berries for some selections with higher anthocyanins content, such as SL-15, SL-17 and SL-18 and SL-55, SL-65, SL-17, SL-46, SL-45, SL-22 with high quantities of tannins.

5. References

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Tables and figures

Table 1. The anthocyanins in fruits of four blue honeysuckle selections in wet and dried berries by HPTLC method.

No.	Selection	g Anthocyanins* /100g wet fruits	Humidity of fruits %	g Anthocyanins* /100g dry fruits	Average 3-GC (%) *
1	SL-22	0.72222	85.34	4.9263	4.93
2	SL-24	0.88843	84.95	5.9032	5.90
3	SL-76	0.85642	85.39	5.8619	5.86
4	SL-34	0.75532	86.62	5.6451	5.65

(* 3-GC (%) means g 3-glucosil-cianidyn per 100g dry matter.)

Table 2. Anthocyanins and tannins berry content in chokeberry and barberry genotypes.

Species/ variety - selection	Total anthocyanins mg% (mean values)	Total tannins % in the years:			Mean value %
		2004	2006	2007	
<i>Aronia melanocarpa</i> / Nero	509.16	0.733	1.174	1.072	0.993
<i>Berberis thunbergii</i> var. <i>atropurpurea</i> / S-6-95	71.28	0.673	0.546	0.687	0.677
<i>Berberis thunbergii</i> var. <i>atropurpurea</i> / S-II	74.20	0.792	0.460	0.778	0.610
<i>Berberis thunbergii</i> var. <i>atropurpurea</i> / S-III	79.43	1.370	0.629	0.970	0.990

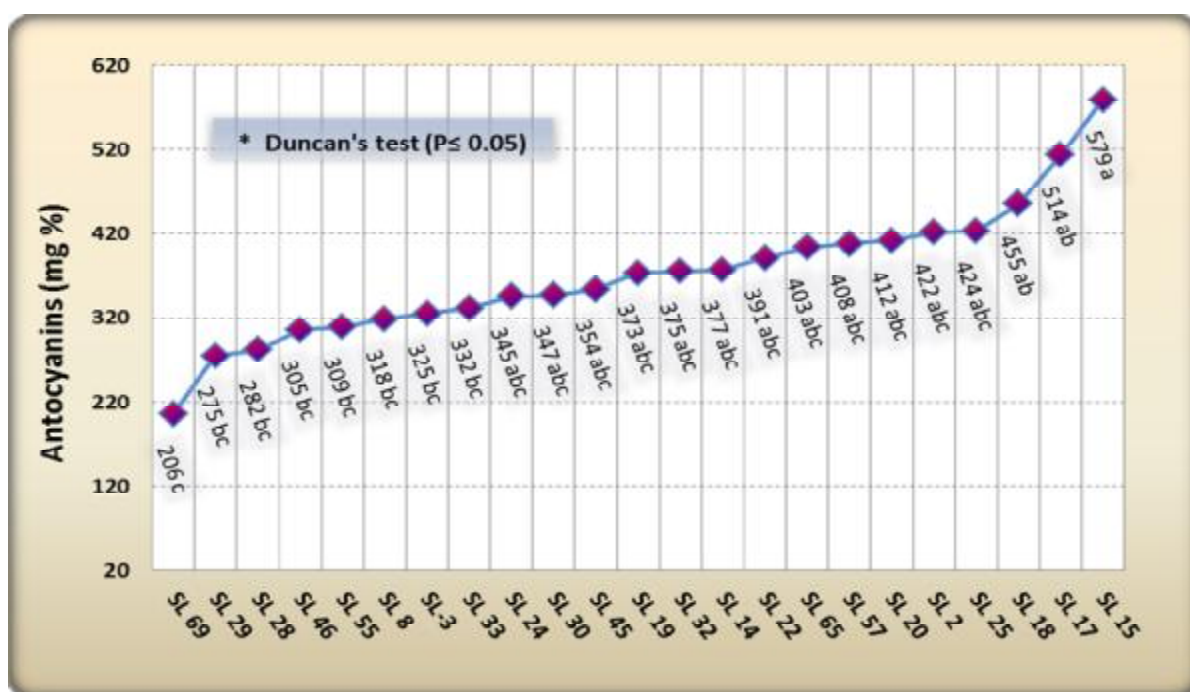


Fig.1. Variability of the anthocyanins in berries of the blue honeysuckle selections (Duncan Test < 0.05%)

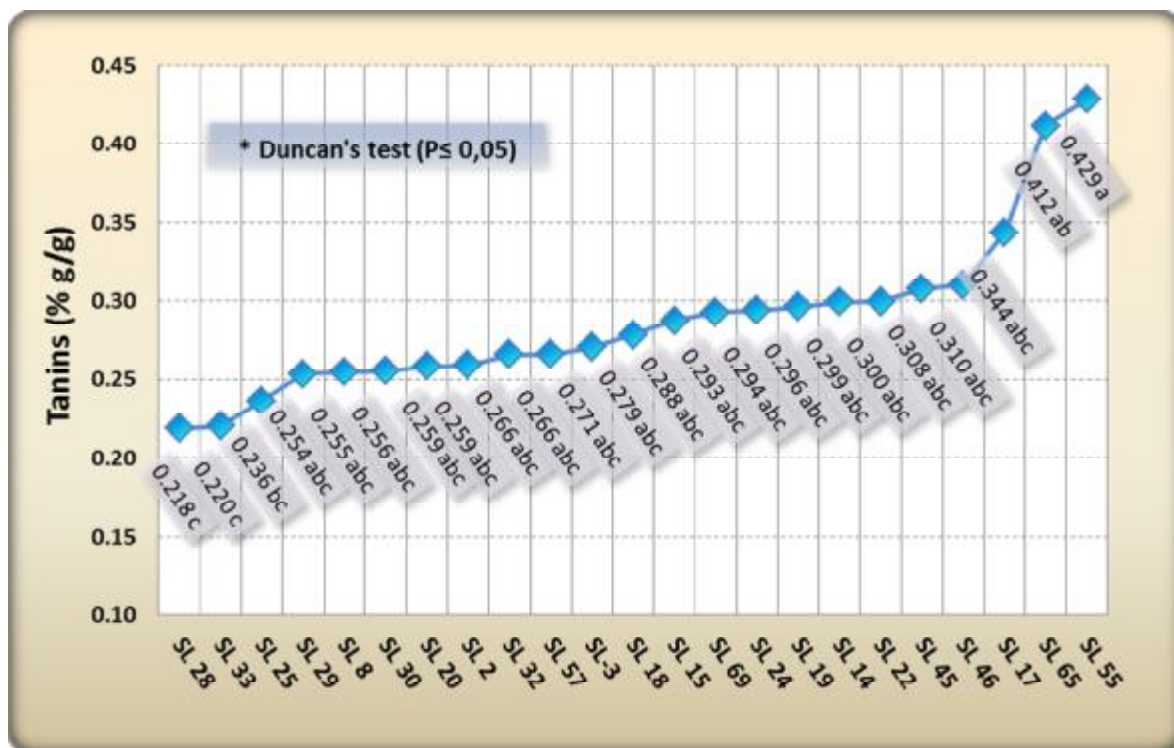


Fig.2.Variability of the tannins in the berries of blue honeysuckle selections (Duncan Test $P < 0.05\%$)