

No. 101/2017, 73–80

ISSN 1644-1818

e-ISSN 2451-2486

## PRELIMINARY ASSESSMENT OF THE QUALITY OF HERBHONEYS AND CHOKEBERRY SYRUPS USED FOR THEIR PRODUCTION

### WSTĘPNA OCENA JAKOŚCI ZIOŁOMIODÓW ARONIOWYCH I POŻYTKÓW WYKORZYSTANYCH DO ICH PRODUKCJI

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**Abstract:** This study presents results of research on the quality of chokeberry herbhoneys and syrups used to produce them. The study included evaluation of the content of water, sugars, free acids and electrical conductivity. In addition, the antiradical activity against free radicals DPPH and total phenolic content were evaluated. Also color parameters  $L^*$ ,  $a^*$ ,  $b^*$  were determined in the CIE system. Study results revealed that herbhoneys have met all quality requirements specified for the honey in the Regulation of the Minister of Agriculture. The processing of chokeberry syrup by bees to honey results in changes in: water content, sugars, and total polyphenol content. Herbhoney has a much higher ability of scavenge DPPH radicals, than chokeberry syrup.

**Keywords:** herbhoneys, physicochemical properties, antioxidant activity.

**Streszczenie:** W pracy przedstawiono wyniki badań dotyczących jakości ziołomiodów aroniowych oraz pożytków wykorzystanych do ich produkcji. Badania obejmowały oznaczenie zawartości: wody, cukrów, wolnych kwasów oraz przewodności elektrycznej właściwej. Dodatkowo oznaczono aktywność przeciwutleniającą jako siłę zmiatania wolnych rodników DPPH oraz ogólną zawartość związków fenolowych. W badanych próbkach oznaczono również parametry barwy  $L^*$ ,  $a^*$ ,  $b^*$  w systemie CIE. Uzyskane wyniki pozwoliły stwierdzić, że ziołomiody aroniowe spełniają wymagania jakościowe określone dla miodów pszczelich w rozporządzeniu MRiRW. Przetwarzanie pożytku aroniowego przez pszczoły na ziołomiody ma istotny wpływ na: zawartość wody, cukrów oraz ogólną zawartość polifenoli. Ziołomiody aroniowe charakteryzują się znacznie wyższą średnią zdolnością zmiatania wolnych rodników DPPH niż pożytki aroniowe, z których powstają.

**Słowa kluczowe:** ziołomiody, fizykochemiczne właściwości, aktywność antyoksydacyjna.

## 1. INTRODUCTION

Herbhoney is a honeylike product, with properties not found in natural honey. They combine the unique properties of two natural ingredients – honey and herbs. They are produced by bees from herbal extracts or herbal syrups, for example from chokeberries or aloe leaves. Bees treat this syrup as nectar, and the production process is the same as the process of production of natural honeys. However, herbhoney differs significantly from natural honeys. Not only they have different sensory properties, but also have a broader spectrum of therapeutic properties. Each type of herbhoney has its preventive and therapeutic effects closely related to the type of raw material used in the production process, for example, herbhoney with aloe content regulates digestion, blueberry and hawthorn support cardiovascular systems and pine expectorant effect and is recommended for colds [Juszczak et al. 2009; Noskowicz-Bieroniowa 2009; Wilczyńska 2012; Isidorov et al. 2015].

The focus of this study was to evaluate the quality of chokeberry herbhoneys as well as the chokeberry syrups used for their production and also answer the question, whether the selected quality parameters of herbhoneys meet the quality requirements specified for the honeys in the Regulation of Ministry of Agriculture.

## 2. MATERIAL AND METHODS

The research material consisted of three different types of chokeberry syrups, with different content of the extract from chokeberry and three produced from them herbhoneys. Tested samples were collected in 2015 and came directly from the beekeeper. The study included evaluation of the content of water, sugars, free acids and electrical conductivity according to Polish standard for honey [PN-A-77626:1988; Rozporządzenie MRiRW z 29 maja 2015]. In addition, the antiradical activity against free radicals DPPH and total phenolic content were evaluated. Also colour parameters  $L^*$ ,  $a^*$ ,  $b^*$  were determined in the CIE system. All performed analysis were duplicated. Statistical analysis included the calculation of basic measures (average). The one-way analysis of variance (ANOVA) was used to determine the effect of syrup quality on grade of herbhoney. Statistical hypotheses were verified at a significance level of  $p = 0.05$ . The results were statistically analyzed using Statistica 12 (StatSoft).

## 3. RESULTS AND DISCUSSION

The research has shown that honey brightness (value of  $L^*$  parameter) changes during processing chokeberry syrup by bees. Herbhoneys become brighter in comparison with the syrups used by the bees in production process, as well as their

colour saturation change – there was observed a growth in values of the a\* and b\* parameters. However, statistical analysis (Kruskal-Wallis ANOVA) showed that the treatment nutrients by bees does not significantly affect change in the colour parameters ( $p < 0.05$ ) [Tab. 1].

**Table 1.** Average values of the L\*, a\*, b\* parameters

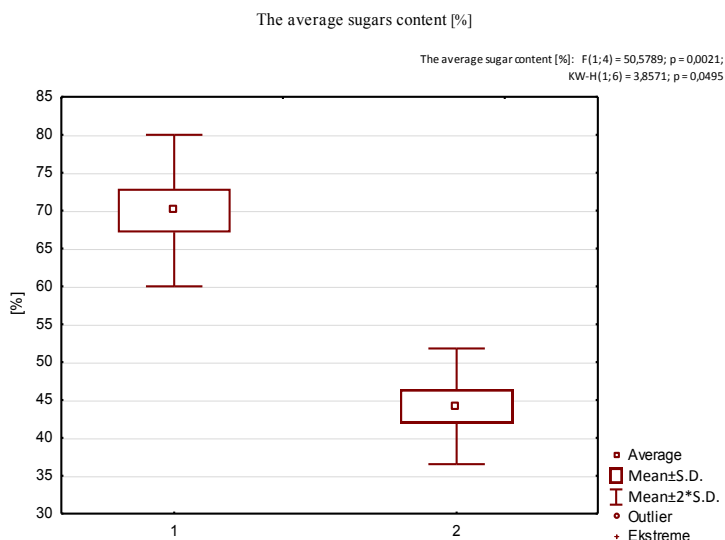
**Tabela 1.** Średnie wartości parametrów L\*, a\*, b\*

Average values of the L*, a*, b* parameters			
	L*	a*	b*
1z	33,58↑	2,56↑	4,12↑
2z	57,95↑	8,78↑	16,96↑
3z	31,63↑	2,74↓	6,03↑
1P	35,89	-0,44	2,88
2P	30,40	2,82	1,12
3P	29,89	2,99	2,2
p	0,3590	0,2814	0,1590
(F;4)	1,0721	1,548	2,9874

z – herbhoney, p – syrup, ↑ – direction of changes.

Source: own study.

Sugar content in the tested herbhoney was on average around 70%, and in chokeberry syrups, which were fed to population of bees, was at approximately 44%. Statistical analysis (Kruskal-Wallis ANOVA) proved that processing of chokeberry syrup by bees affects the increase in the average sugar content in herbhoney at a significance level ( $p < 0.05$ ) [Fig. 1].



1 – herbhoney, 2 – syrup

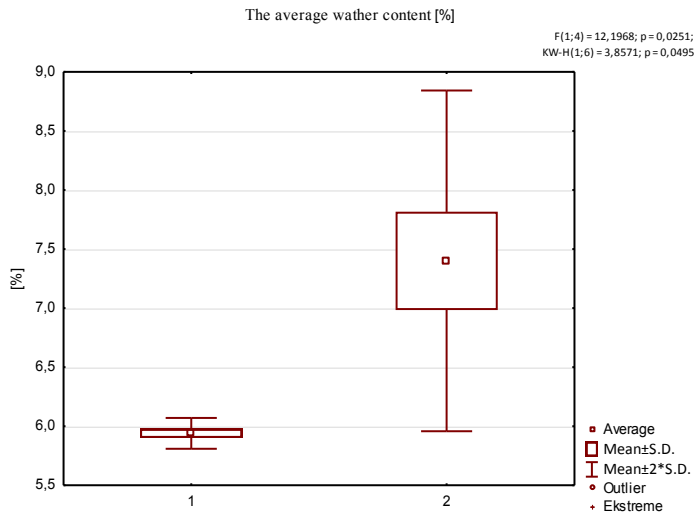
**Fig. 1.** The average sugars content

**Rys. 1.** Średnia zawartość cukrów

Source: own study.

Another parameter that has changed in statistically significant way [ $F(4) = 12.1968; p = 0.0251; KW-H(1, 6) = 3.8571; p = 0.0495$ ] in the processing of chokeberry syrup by bees into herbhoney was the water content. The average content of water in the syrups was about 7.4% and about 6% in herbhoneys [Fig. 2]. According to literature data, the average water content in herbhoneys is within 12,9–20,0%. On average, in herbhoneys is 17.1% of water, yet in case of honey it should not contain more than 20% of water [PN-A-77626:1988; Isidorov et al. 2015; Rozporządzenie MRiRW z 29 maja 2015;]. Juszczak et al. demonstrated that water content in chokeberry herbhoneys is 16.2 mg/100 g [Juszczak et al. 2009]. This may be the result of too late receiving herbhoneys from the hive and also fairly low water content in the chokeberry syrup.

The content of free acids in chokeberry herbhoneys as well as the content of it in syrups used in their production was at about 30 meq/kg. [Fig. 3.]. This figure is in line with the requirements for honey, as the standard states that the content of free acids in honeys should be no more than 50 meq/kg [PN-A-77626:1988; Rozporządzenie MRiRW z 29 maja 2015].

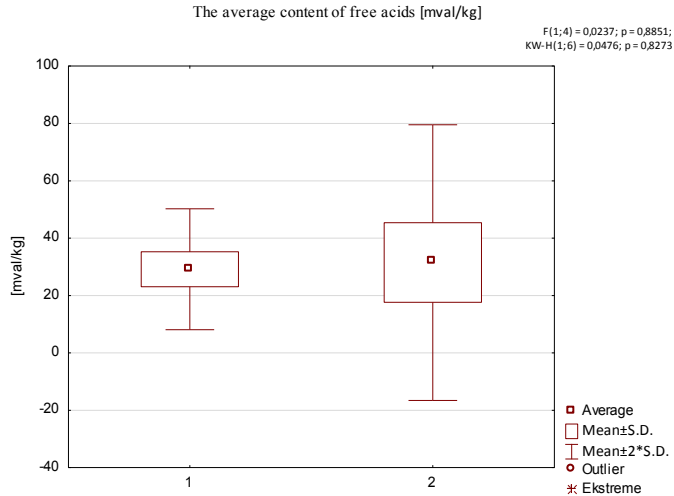


1 – herbhoney, 2 – syrup

**Fig. 2.** The average water content

**Rys. 2.** Średnia zawartość wody

Source: own study.



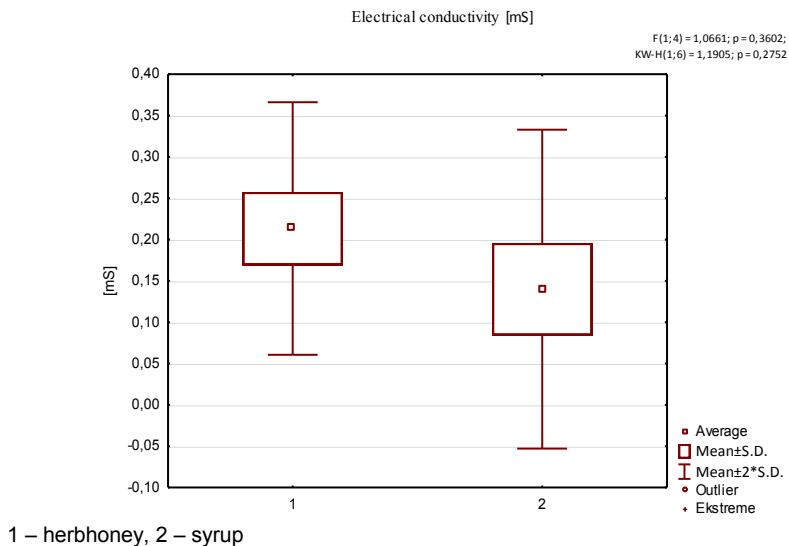
1 – herbhoney, 2 – syrup

**Fig. 3.** The average content of free acids

**Rys. 3.** Średnia zawartość wolnych kwasów

Source: own study.

In the case of electrical conductivity it was observed an increase in the value of this parameter for herbhoneys however it was not statistically significant increase ( $p < 0.05$ ) [Fig. 4]. According to research by Juszczak et al. the value of electrical conductivity parameter for chokeberry herbhoneys should be around 0.86 mS [Juszczak et al. 2009]. This could mean that investigated chokeberry herbhoneys contain less minerals.



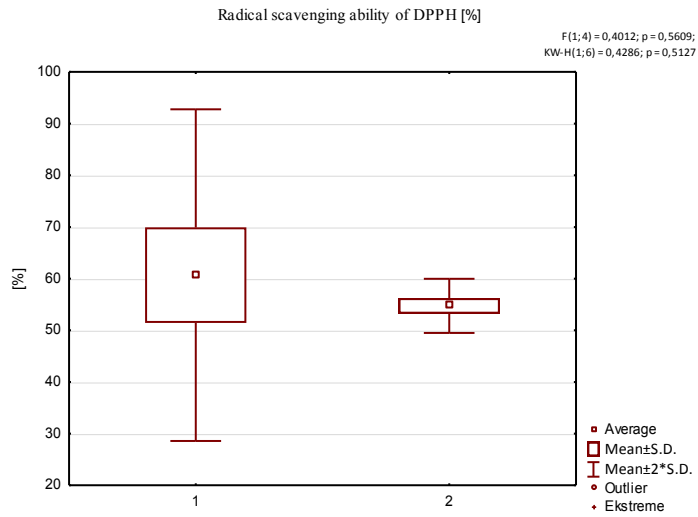
**Fig. 4.** Electrical conductivity

**Rys. 4.** Przewodność elektryczna

Source: own study.

Antioxidant activity of the tested herbhoneys and syrups are shown in Fig. 5. Chokeberry herbhoney has much higher average ability to scavenge free radicals DPPH (about 61%) than herbal syrups used for bees feeding (about 55%). However, there was not a statistically significant difference ( $p > 0.05$ ).

Chokeberry herbhoneys were characterized by a much lower total phenolics content an average of approximately 42 mg GAE/100 g than chokeberry syrups, which were used to produce them – an average of about 70 mg GAE/100 g [Fig. 6]. Statistical analysis showed that this difference was notable ( $F(1, 4) = 41.712$ ,  $p = 0.0030$   $p < 0.05$ ).

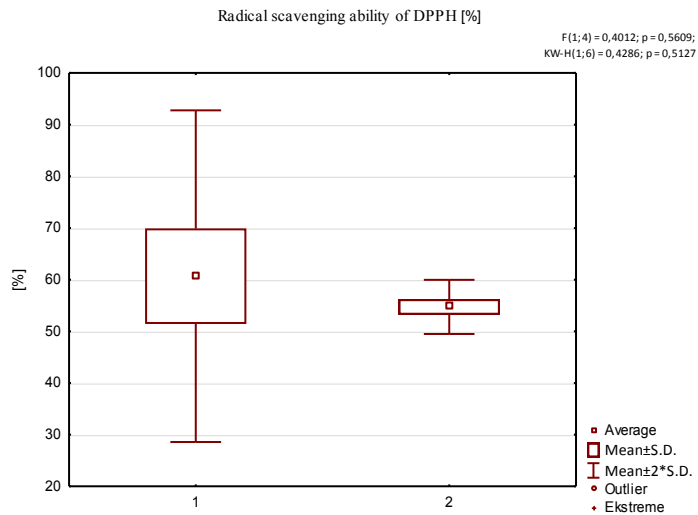


1 – herbhoney, 2 – syrup

**Fig. 5.** Radical scavenging ability of DPPH

**Rys. 5.** Zdolność zmiatania rodników DPPH

Source: own study.



1 – herbhoney, 2 – syrup

**Fig. 6.** Total content of polyphenols

**Rys. 6.** Ogólna zawartość polifenoli

Source: own study.

#### 4. CONCLUSIONS

1. Based on conducted research it was determined that chokeberry herbhoneys meet the quality requirements specified for the honeys in the Regulation of Ministry of Agriculture.
2. The production process of herbhoney from chokeberry syrup by bees has a significant impact on honey's quality parameters such as colour, water and sugar contents, as well as the total phenolics content, yet there was no effect at all on the content of free acids.
3. The chokeberry herbhoneys have a much higher average ability to scavenge free radicals DPPH than chokeberry syrup used to produce them.

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