RESULTS CONCERNING THE CONTENT OF HEAVY METALS IN LINDEN TREE AND MIXED FLOWER HONEY, IN TIMIŞ COUNTY

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Abstract .*One important point of the honey quality control is represented by the content of heavy metals. Because no specific Romanian Legislation regarding the accepted level of heavy metals in honey exists, EU Standards (European Honey Directive of the European Honey Commission) are used. The heavy metals residues could be originated from soil, plant or result from processing and environmental contamination. When the level of heavy metals in honey is monitories some other variables need to be considered such as weather, season or botanical origin of the flowers. Placing hives near roads with heavy car and trucks traffic, industrialized areas or unacceptable materials and equipment on the honey production circuit can represent other important sources for honey contamination with heavy metals. The purpose of this study is to link specific variations of the heavy metal content in Linden Tree and Mixed Flowers honey with the location of the beehives mainly from polluted areas and unpolluted ones in Timiş County. The studied locations are: Timişoara, Timişoara- near a national road, Chevereşu Mare and Sacoşu Mare. The main aim of the research was to determinate the content of heavy metals such as chromium, nikel, zinc, cooper, manganese, cadmium and iron in Linden Tree and Mixed Flowers honey samples collected directly from bee colonies.The sample analysis have followed standard methods for detecting heavy metals approved by STAS 784/2-2009 from Romania, using atomic absorption spectrometry (AAS).The results showed that the heavy metal content altered and depended on the floral sources of the honey variety and the beehives location. The highest lead content was found in Linden Tree honey, especially when the hives were located in places with heavy car traffic. The highest chromium content was established for the Mixed Flowers honey samples, content which increased for Linden Tree honey samples collected from hives placed near a national road. The highest level of iron, was measured for the Mixed Flowers honey samples, content which increased for Linden Tree honey samples collected from hives placed near a national road. An important cadmium and zinc level was measured in the Linden Tree honey samples. Placing the beehives near a polluted area increased the content of cadmium and zinc for both varieties of honey.*

Keywords*: Linden Tree honey, Mixed Flowers honey, heavy metal content, beehives location.*

INTRODUCTION

Honey and all hive products are known as natural, nutritious and healthy products. Due to the high content of sugars, amino acids, vitamins of group B and C, proteins A, phosphorus, potassium and other minerals, it provides instantly energy to the consumers[1]. According to specialized studies, honey contains simple sugars consisting of: fructose (27.5-44.2%), glucose (22-40%), maltose (2.7-16%) and sucrose (1.5-3%)[2].

The main beneficial health effects that have been already confirmed for honey are: antimicrobial, immunity boosting, anti-inflammatory, antiviral, antifungal effects and the list can go on[11,12,14]. The nutritionists recommends honey as a functional food because it has numerous health benefits. However, its safety should be carefully monitored due to possible unwanted compounds that can be found in honey.[8,9] Hydroximethylfurfurol, plant alkaloids or heavy metals are just a few components that should be monitored[6,7,10].

The presence of heavy metals in honey is of interest mainly for quality control and nutritional aspect along with the determination of environmental contamination in the research area [4]. Heavy metals can be introduced into honey either as a result of contamination during the entire circuit of

honey production, or from contaminated soil, plants or air containing heavy metals[]. From soil, heavy metals can be transfer to nectar and honeydew, by plant and by air they can contaminate directly nectar and honeydew. Heavy metals content in air can be deposited on the bees body and brought back in the beehive[5]. Mainly heavy metals present in soil and air are generated by traffic and industrial activities. Lead (Pb) and cadmium (Cd) are considered the main toxic heavy metals and therefore often studied.

Due to the fact that aromatic plants have the ability to concentrate the heavy metals, honey harvested from this kind of plants tends to contain this pollutants. The heavy metals content above the limits imposed by legalization, can be used as an indicator for environmental pollution[3]. When the level of heavy metals in honey is monitories, we need to consider some variables such us weather, season or flower's botanical origin[5]. By rain, heavy metals can be transfer into soil or plant, also the quantity of nectar flow can dilute the concentration of heavy metals.

MATERIAL AND METHODS

The motivation of this research derives from the curiosity of knowledge and assessing the impact of an contaminated environment with heavy metals on the quality of honey. The honey samples used in this study was harvested from beehives placed in Timiș County.

The main aim of the study was to determine the presence and concentration of heavy metals like Chromium (Cr), Nickel (Ni), Zinc (Zn), Lead (Pb), Manganese (Mn), Cadmium (Cd) and Iron (Fe) in linden tree and mixed flowers honey, samples collected directly from bee colonies of several places in Timis County.

The second aim of this study was to find a link between the presence of heavy metals determined in the honey samples from the polluted (possibly contaminated) areas and the honey samples from the un-polluted (pollution free) areas.

The honey samples analyzed are harvested from own apiary or they are collected from private beekeepers. The beehives were placed in areas with different extent of pollution. This placement made possible to identify if there is an influence of the pollution sources on the quality of honey by identifying heavy metals residues. The studied areas are: Timisoara, Timisoara-near a national road, Cheveresu-Mare and Sacosu Mare. The samples called P1 are close to the pollution source, Linden Tree honey P1-harvested in Timisoara and mixed honey P1-harvested in Timisoara-near a national road. The beehives used for this study were kept in the same location during this study. The honey samples were examined in the same conditions and using the same procedures.

The levels of the selected heavy metals in the honey samples were analyzed by using atomic absorption spectrometry (AAS), standard method for detecting heavy metals[4,13].

RESULTS AND DISCUSSIONS

The results obtained from honey samples harvested in Timis county showed the presence of the selected heavy metals, at residual levels in all the analyzed samples. The selected heavy metals are lead, nickel, chromium, iron, cadmium, manganese, and zinc. The variety of the studied honey samples are proceeding from linden trees and mixed flowers. The location of the beehives are in Sacosu Mare (Linden),Timisoara, near a national road (Linden P1), Cheveresu Mare (Mixed Flowers) and Timisoara, close to a pollution source (Mixed Flowers P1).The found results in the analyzed honey samples are presented in Table 1.

Table 1.

Heavy metals concentrations in linden tree and mixed flowers honey [mg/kg]

Sample	Pb	Ni	Cr	Fe	Cd	Mn	Zn
Linden	0,62	-	0,33	8,47	0,32	2,36	5,66
Linden P1	0,86	0,07	1,21	15,61	0,72	2,87	6,93
Mixed Flowers	0,31	0,01	0,44	9,16	0,27	1,53	4,59
Mixed Flowers P1	0,45	0,14	0,85	8,58	0,69	1,65	7,69

The concentration of heavy metals in the pursued honey samples, shown in table 1, are: Pb 0,31-0,86 mg/kg, Ni 0-0,14 mg/kg, Cr 0,33-1,21 mg/kg, Fe 8,47-15,61 mg/kg, Cd 0,32-0,72 mg/kg, Mn 1,53-2,87 mg/kg , Zn 4,59-7,69 mg/kg. The review of the results shows an important increase of the heavy metal content in the samples collected from areas located close to a pollution source(P1) and higher values for the Linden tree honey variety. According to the EU Standards [15], regarding the highest concentration of heavy metals residues in honey, all the analyzed samples have a higher concentration than that admissible.

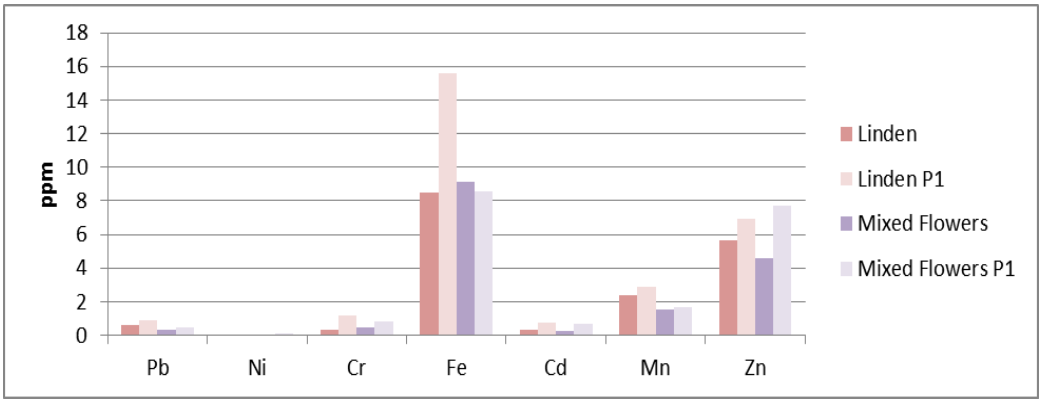

Figure1. Heavy metals content in linden tree honey and mixed flowers honey samples, from Timis county

Comparing the two types of honey analyzed, from the figure1 above, it can be noticed that in linden tree honey, the heavy metal residues are found in higher concentrations than in mixed flowers honey samples. Pursuing figure 1, an important increase of iron and zinc content in the honey samples from polluted areas was established. The concentration figures shows an increase of the Cr content representing 266% for the linden tree honey and 93% for the mixed flowers honey. The growth of the Cd level was also important being of 125% for the linden tree honey and 155% for the mixed flowers honey. The calculated lead content increase was 39% for the linden tree honey and 45% for the mixed flowers honey. A high increase was also established for iron being of 84% for the linden tree honey. The zinc content presented a lower increase being of 22% for the linden tree honey and 67% for the mixed flowers honey.

According to figure2. in linden tree honey samples, the concentrations of heavy metals are higher in the samples harvested in Timisoara (polluted area) than the samples harvested in Sacosu-Mare (unpolluted area). As figure3.shows in mixed flowers honey samples, excepting the iron

concentration, the level of heavy metals is higher in the samples harvested in Timisoara, near a national road (polluted area) than the samples harvested in Cheveresu-Mare (unpolluted area).

Except the iron concentration from mixed flowers honey samples, it can be note that the heavy metal concentrations are higher in honey harvested in the polluted areas. The presence of heavy metals in honey samples could be linked with beehives location.

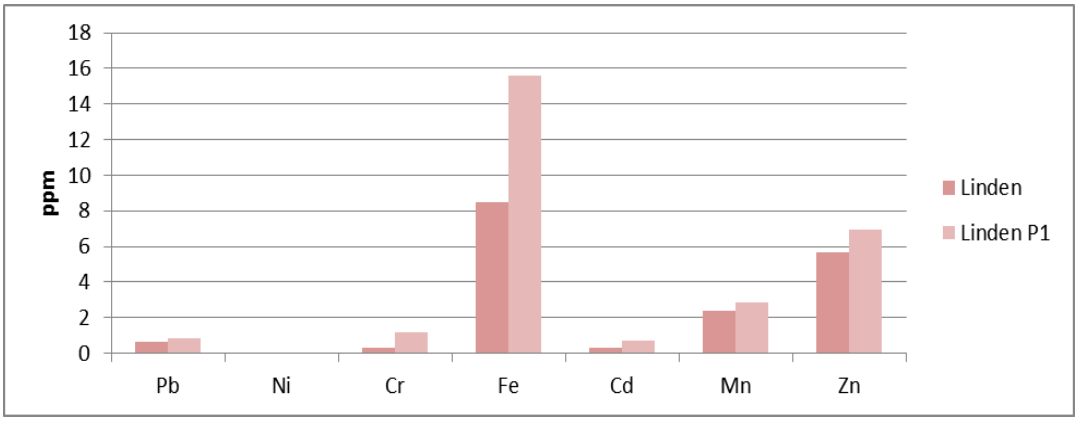

Figure 2. Heavy metals content in linden tree honey samples, from Timis county

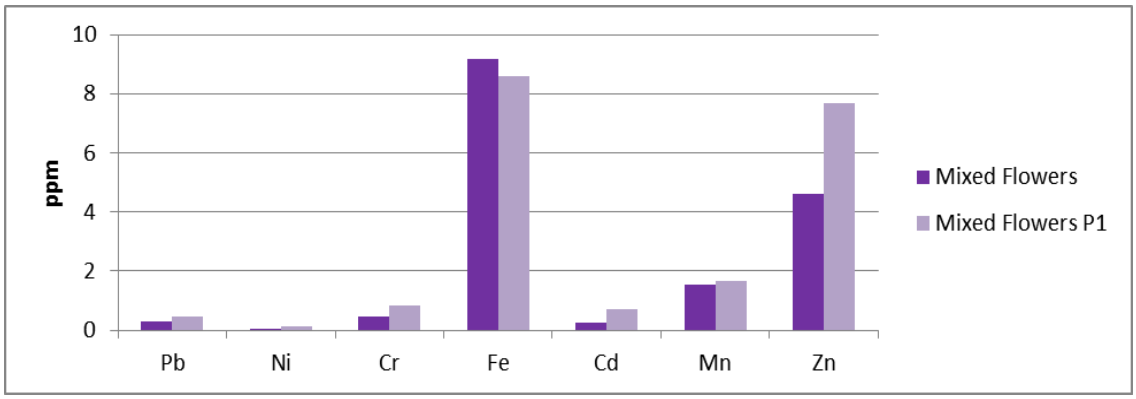

Figure 3. Heavy metals content in mixed flower honey samples, from Timis county

CONCLUSIONS

The study reported that the concentration of heavy metals in the linden tree and mixed flowers honey samples are: Pb 0,31-0,86 ppm, Ni 0-0,14 ppm, Cr 0,33-1,21 ppm, Fe 8,47-15,61 ppm, Cd 0,32-0,72 ppm, Mn 1,53-2,87 ppm, Zn 4,59-7,69 ppm. According to the EU Standards [2], regarding the highest concentration of heavy metals residues in honey, all the analyzed samples have a higher concentration than that admissible.

Except the iron concentration from mixed flowers honey samples, it can be noted that the heavy metal concentrations are higher in honey harvested in the polluted areas and also in the linden tree honey samples.

Honey produced in different regions of Timis County do not completely lack heavy metals. The presence of those toxic metals in bee honey is an evidence of micro polluting agents present in the environment.

The presence of heavy metals in honey samples could be linked with the location of the beehives.

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