

Toxicological analysis of bee honey as a tool of environment contamination assessment

Analiza toksykologiczna miodu pszczelego jako narzędzie oceny skażenia środowiska

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The aim of this research was to study the accumulation of selected toxic elements (copper, lead, cadmium, nickel and zinc) in natural bee honey collected in two areas with different anthropogenic activity. A total of 28 bee honey samples were collected, half of samples were from the ecological area and the other half from the industrial region. Contents of the toxic elements were determined using atomic absorption spectroscopy (AAS) method. Our results indicate that concentration of selected elements (except zinc) in samples of honey from the industrial region was higher in comparison to the samples from ecological region, although only in the case of cadmium the difference was statistically confirmed. Further, a significant positive correlation between the content of lead and cadmium in the samples from both areas was noted. The honey is a very popular natural food not only because of its nutritional value but also because of its healing properties, including bacteriostatic and bactericidal, stimulating the immune system and metabolism, detoxifying and regenerating [Luty 2010]. Honey intended for human consumption must meet certain requirements in terms of maximum content of selected metals, including copper, nickel, cadmium, lead and zinc. Acceptable amount of the toxic elements in natural honey is set out in the Polish Standard PN-88/A-77626. Due to increasing anthropogenic activity, it is very important to monitor the concentration of toxic elements in bee products. Therefore, while bioaccumulation and migration of toxic elements within the food chain occurs, metal contamination is a serious problem because of potential toxicity of polluted food products [Kabata-Pendias, Pendias 1999]. The material of the study was the multifloral honey collected between June and July 2015 at the two areas of the Lower Silesia with different anthropogenic activity: the ecological area which covers the largest Landscape Park “Dolina Baryczy” in Poland, protected within the framework of “Natura 2000” program and the industrial area belonging to the Legnica-Głogów Copper District. The collected honey samples were homogenized and mineralized in closed teflon vessels, to eliminate the loss of elements, using microwave oven (Multiwave 3000, Anton Paar, Austria). The content of copper, lead, cadmium, nickel and zinc was determined by atomic absorption spectroscopy (AAS). All statistics were performed using Statistica™10.0 PL software (StatSoft Inc., Tulsa, OK, USA). The concentration of examined elements (Cd, Cu, Ni and Pb) in the samples of honey collected in the Legnica-Głogów Copper District (near Legnica) was higher in comparison with the samples from National Park “Dolina Baryczy” although only in the case of cadmium the difference was statistically confirmed. The exception was Zn as mean concentration was 0.439 and 0.405 mg · kg⁻¹ for ecological and industrialized region, respectively. Additionally, there were significant positive correlations between the content of lead and cadmium in honey samples collected from both studied areas. It can clearly be stated that the level of toxic metals in honey depends on the toxicological state of environment from which the raw material for honey was taken. To summarize, we can confirm that not only a honeybee [Roman 2005, Sadeghi et al. 2013] but also a honey [Roman 1997, Porrini et al. 2014] is a good bioindicator of environment contamination.