

THE CONTENT OF MERCURY IN HONEYBEE BODY ORIGINATING FROM DIFFERENT REGION OF POLAND

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Keywords: mercury, bee body, monitor, environment

Introduction

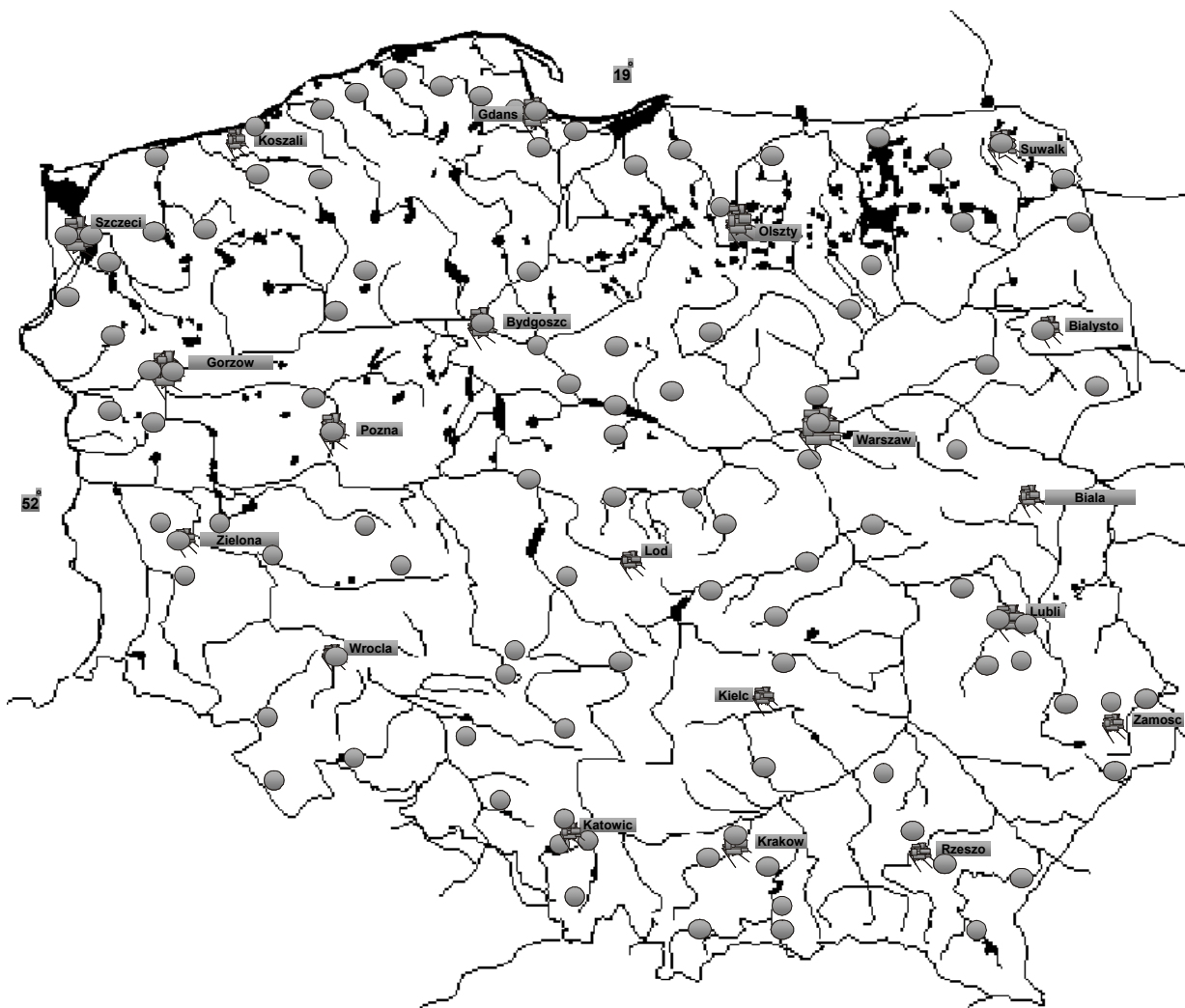
Chemical, heavy and food industries as well as the dynamic growth of automobile traffic have resulted in an increase of mercury contamination of the environment. The contamination makes its way to bees from pollen, nectar, honeydew, and whatever they feed on. At the high concentration it may be harmful both to bees and to humans. Mercury in particular has strong toxic properties for living organisms, especially for animals and for humans. Many methods have been developed to determine contamination status of the environment. Of those, making use of biological material have been increasingly more popular. Many investigators commend upon the possibility to use bees to monitor the purity of the environment (Carane 1984, Muszynska 1995, Roman 1997, 2000, Zarski et al. 1996). In many parts of the world attempts were made to use bees to assay the degree of environment pollution. Harmful compounds penetrate into the bodies of adult insects (Pratt and Sikorski 1985, Roman 2000, Zarski et al. 1996). Bees are very good quality to use to monitor the purity of environment pollution as the way of life of those insects exposes them directly and indirectly to the impact of pollution and the material is easily available. The honeybee has, at the same time, another advantage over animals living in the wild in that its forages on at a given time can be easily determined. Thus the contamination in the form of heavy metals building up in the bee's body may reflect the contamination of plants, soil, air and water in the area. According to many investigators (Guderska 1978, Muszynska 1995). Bees are good indicators of pollution in a given area and the range of their visitation is 12,5 km² (Muszynska 1995). The aim of the study was to determine the mercury content of bee bodies originating from different region of Poland.

Material and methods

The investigations were performed at Bee Division, Faculty of Animal Science, Agricultural University of Warsaw. The study material was collected in the spring of 1998 from private and state-run apiaries from across Poland (Fig. 1). All-in-all, the material

originated from 84 apiaries, randomly chose, (3 bee colonies from each apiary), a total of 252 samples.

Fig. 1 Location of apiaries



The samples were stored until the tests were conducted in the refrigerator at -12°C .

The samples were tested for mercury content at the Department of Physical and Chemical Analyses, Agriculture University in Warsaw. The biological samples were made uniform by carefully braking up and mixing each of them. Automatic analyser of the mercury traces AMA – 254 was used to measure mercury concentration of the samples.

The data were subjected to comprehensive statistical tests. LSD (Fisher) and multiple range test were used. The significance of differences was tested at 0.05 and 0.01 confidence levels. Bar graphs were used to visualise results.

Results and discussion

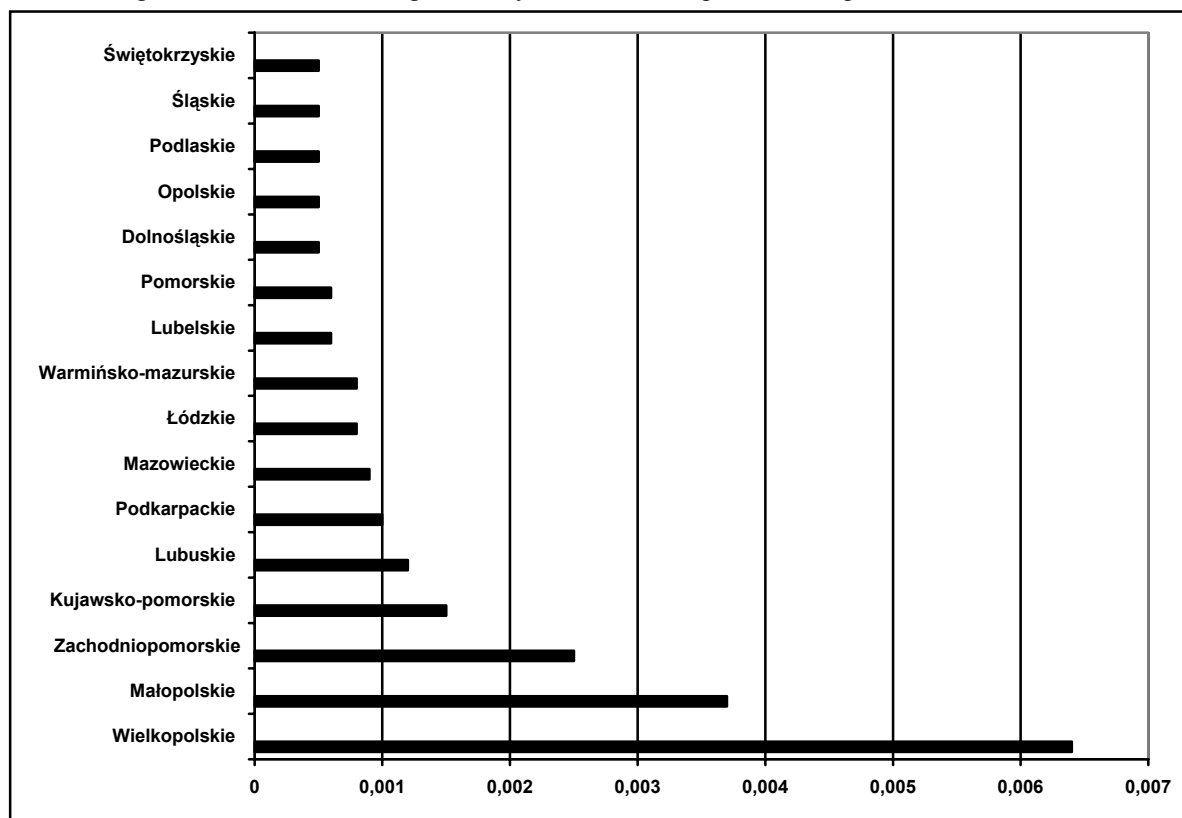
Table 1 Mercury content in tested samples broken down across the 16 provinces of Poland (mg/kg)

Province	minimum	maximum	mean	standard deviation
Dolnoslaskie	0,00001	0,00118	0,0005 a*, A**	0,0005
Kujawsko-pomorskie	0,00016	0,00372	0,0015 a, AB	0,0014
Lubelskie	0,00034	0,00165	0,0006 a, A	0,0005
Lubuskie	0,00036	0,00289	0,0012 a, A	0,0011
Lodzkie	0,00040	0,00144	0,0008 a, A	0,0005
Malopolskie	0,00017	0,00066	0,0037 ab, AB	0,0064
Mazowieckie	0,00009	0,00433	0,0009 a, A	0,0014
Opolskie	0,00010	0,00117	0,0005 a, A	0,0006
Podkarpackie	0,00065	0,00166	0,0010 a, AB	0,0006
Podlaskie	0,00027	0,00081	0,0005 a, A	0,0002
Pomorskie	0,00020	0,00183	0,0006 a, A	0,0005
Slaskie	0,00037	0,00091	0,0005 a, A	0,0002
Swietokrzyskie	0,00035	0,00077	0,0005 a, A	0,0002
Warminsko-mazurskie	0,00037	0,00279	0,0008 a, A	0,0009
Wielkopolskie	0,00025	0,02319	0,0064 b, B	0,0112
Zachodniopomorskie	0,00020	0,00521	0,0025 a, AB	0,0019
POLSKA	0,00001	0,02319	0,00067	0,0029

* means followed by different small characters are significantly different at 0,05

** means followed by different small characters are significantly different at 0,01

Fig. 2 The average mercury contents of samples from 16 province across Poland



Each examined sample contained mercury. The Nourishment quotas for children and infant of Polish Ministry of health and social care assume 0,01 mg Hg/kg. All averages results are substantially lower then those quotes. The mercury concentration in 252 samples was well

below the current limits. The highest amount of mercury was detected in province of Wielkopolskie. In 7 provinces (Swietokrzyskim, Slaskim, Podlaskim, Opolskim, Dolnoslaskim, Pomorskim, Lubelskim) the level of mercury was similarly low. Globally it was determined that the content of mercury in bees in the Poland was on the low level. The level of the content of mercury in the samples proves that examination region is ecologically clean in regard to the contamination with mercury. The mercury content of bee bodies was found to range from 0,00001 to 0,02319 mg/kg. (Table 1). The nationwide average was 0,000672 mg/kg. The data in the domestic literature on the subject were found to be similarly and higher. According to Toporcak et al. (1992) the mercury content of bee bodies varied from 0,001 to 0,003 mg/kg. May et al. (1985) found mercury content varied from 0,0017 to 0,0112 mg/kg. A higher mercury content of bee bodies was found by Zarski et al. (1996) and Roman (1997) averages were 0,00867 mg/kg.

Conclusions

1. The mercury content of samples varied with sampling site.
2. The highest mercury content was found in province Wielkopolskie, in Szydlowo (the content of mercury was 0,02319 mg/kg) and the lowest in province Dolnoslaskie is in the area Gora, (the content of mercury was 0,00001 mg/kg)
3. The mercury content of bee bodies over of provinces and over of samples in Poland did not exceed the norms.

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