

## Some Heavy Metals Assessment of Bees Pollen Grains, Alexandria, Egypt

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### Abstract

Pollen grain samples collected from pollen trap are analyzed for Pb, Cd, Zn, and Cu levels. The results showed that the levels of lead: 0.0028, 0.136, 0.0001, 0.033, 0.004, 0.0263, 0.001 and 0.0426 (ppm) in Edku (A, B), Kafr-Eldawar (A, B), Nobaria (A, B), Abis2 (A, B) respectively. The highest concentration of lead (0.136 ppm) from Edku (B) and the lowest level (0.0001ppm) from Kafr-Eldawar (A) in 2015, while 2016, the maximum content of lead was recorded in Abis 2 (A) with a mean value of 0.2120 ppm while the minimum content determined (0.007 ppm) in Edku (B).

The highest levels of Cadmium was recorded from Al-Nobaria (B) with mean value of 0.1010 ppm and the lowest mean was detected from Abis 2 (B) which had (0.0510 ppm) during 2015, while 2016 the highest concentration of cadmium (0.084 ppm) from Edku (B), the lowest level (0.0171 ppm) from Kafr-Eldawar (B).

The pollen grain samples from Edku (B) recorded the highest level of Zinc with a mean value of 1.853 and the lowest level of Zinc (1.3044 ppm) from Kafr-Eldawar (A) during 2015, in 2016 the maximum content of Zinc (2.0538 ppm) while , the minimum content of Zinc (0.8048 ppm) from Abis 2 (B) and Nobaria (B) respectively.

The highest level of copper content was recorded in pollen grain samples collected from Nobaria (A) with mean value of (3.018 ppm), the lowest level (0.614 ppm) recorded in Abis 2 (B) during 2016, while, the maximum content of copper was determined from Abis 2 (B) with a mean value of (6.299 ppm) and minimum content was recorded (2.14 ppm) in Edku (A).

*Keywords:* Bees, heavy metals, pollen grains, Egypt.

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### Introduction

Pollen grains are the major source of proteins, fatty substances, minerals and vitamins. It is essential for growth of Larvae and young adult bees. Honeybees collecting pollen when visiting flowers for getting nectar. Once at hive, workers

pack pollen into the comb, to prevent bacterial growth and delay pollen germination, phytocidal acid is added to the pollen as it is packed in to the comb.

Other enzymes produced by worker bees are also added which prevent an aerobic metabolism and fermentations there by enhancing longevity of the stored pollen. Once completely processed for

storage, the pollen comb was referred to as beebread (Al Fonsus, 1933 and Haydak, 1935)

Bee pollen is highly consumed around the world like a dietary supplement due to its nutritive value, Humans are interested in the knowledge of pollen loads botanical composition also due to their therapeutic benefits (Komosinska et al., 2015). The heavy metals contents of pollen are variable, due to the factors like difference between the plant species, geographical area, and condition drying process. The accessibility of heavy metals for plants depends on soil reaction mineral colloids, soil humidity microbiological activity and organic matter content.

Organic matter especially humus compounds can form organic-metallic compounds with high mobility in soil solutions and with high availability for plants and pollen (Kabata and Pendias, 2001).

The heavy metals like Fe, Mn, Cu, and Zn can be essential in small quantities for plants, animal and humans but became toxic on high quantities. Other heavy metals such Cr, Ni, Pb, are very toxic (Gergen et al., 2006).

This study was carried out to assess some heavy metal levels e.g. Lead (Pb), Cadmium (Cd), Zinc (Zn), and Copper (Cu) in pollen grain samples collected from eight apiaries during the period from January 2015 to December 2016.

The apiaries situated at different four regions in El-Behera and Alexandria Governorates (Edku, Kafr-Eldawar, El-Nobararia and Abis2. Every region divided into two locations (A and B) first location (A) studied apiary at middle of flora and the second apiary (B) near pollution sources.

## Material and methods

Pollen analysis was carried out on 40 pollen samples from 8 apiaries situated at different locations of EL-Behera and Alexandria Governorates (Edku, Kafr-EL-dawar, EL-Nabararia and Abis).

Every location divided into two apiaries, first apiary situated near the roads (main street) near pollution sources and the second apiary at middle of flora, pollen samples were collecting during the period from January 2015 to December 2016, this samples collected with pollen trap.

The heavy metals from bee pollen samples were analyzed by using dry ashing technique (Lssec and Kerber, 1971), one gram of sample in a crucible was placed in a preheated muffle furnace at 200-250°C for 30 min., and then the sample was

removed from the furnace and cooled down 0.5 ml of 6 N HNO<sub>3</sub> (nitric acid solution) was added.

The solution was filtered through Whatman No.42 filter paper and 0.45µm Millipore filter paper, then transferred quantitatively to a 25 ml nitric acid flask by adding distilled water.

The solution obtained were used for total heavy metals determination by Flame Atomic Absorption Spectrometry with high-resolution continuum source. Four metals were quantified for each pollen samples: Lead (Pb), Cadmium (Cd), Zinc (Zn), and Copper (Cu).

Analysis of heavy metals was made with Varian, spectra AA-220, Analytic-Jena device, by flame atomic absorption spectrometry (F-AAS) in air/acetylene (high purity; 99.99%) flame, the device working parameters (air, acetylene, optics and electronics) were adjusted for maximum absorption for each elements.

Under the optimum established parameters, standard calibration curves for metals were constructed by plotting absorbency against concentration. All the values obtained for metals contents in pollen samples were calculated in ppm.

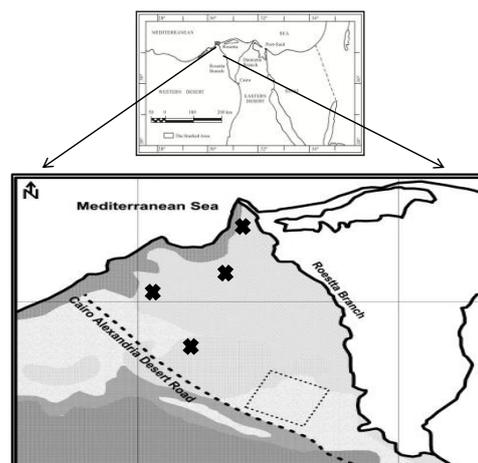


Fig. (1) Location sites of experimental apiaries

## Results and Discussion

The results of this study were summarized in Table (1) and Table (2). The highest concentrations of Pb were recorded in pollen grain sampled from Edku (B), 2015, and Abis 2 (A), 2016, with mean value of 0.1360 ppm and 0.2120 ppm respectively, meanwhile the lowest mean concentration was recorded in Kafr-Eldawar (A) with a mean value of 0.0001 ppm (2015), while (2016) was recorded in Edku (B) with a mean value of 0.007 ppm, followed by pollen

from Abis 2 (B), (0.2109 ppm), Kafr-Eldawar (A), (A), (0.0142 ppm), Kafr-Eldawar (B), (0.0091 (0.024 ppm), Edku (A), (0.0211 ppm), Nobaria ppm)and Nobaria (B), (0.0082 ppm).

Table 1: Mean values of Lead, Cadmium, Zinc, and Copper levels (ppm) in pollen grains samples from different regions of EL-Behera and Alexandria Governorates during year 2015.

Governorate	Regions	Location	Heavy Metals (ppm)			
			Pb	Cd	Zn	Cu
EL-Behera	Edku	A	0.0028	0.0079	1.4620	0.6990
		B	0.1360	0.0126	1.8530	1.2770
	Kafr-ELdawar	A	0.0001	0.095	1.3044	0.7851
		B	0.0033	0.0072	1.7672	1.1341
Alexandria	Nobaria	A	0.0004	0.0100	1.6603	3.018
		B	0.0263	0.1010	1.8229	0.0882
	Abis 2	A	0.0010	0.0097	1.3523	0.9271
		B	0.0426	0.0051	1.4970	0.6141

Table (2) Means of Lead, Cadmium, Zinc and Copper levels (ppm) in pollen grains samples of different regions from EL-Behera and Alexandria Governorates during year 2016.

Govern.	Regions	Location	Heavy Metals ppm			
			Pb	Cd	Zn	Cu
EL-Behera	Edku	A	0.0211	0.0081	1.4332	2.1400
		B	0.0070	0.0840	1.720	2.9972
	Kafr-ELdawar	A	0.0240	0.0035	1.5644	5.5313
		B	0.0091	0.0017	2.0046	5.0291
Alexandria	Nobaria	A	0.0142	0.0033	0.9264	2.4612
		B	0.0082	0.0442	0.8048	3.8462
	Abis 2	A	0.2120	0.0035	1.5459	6.0862
		B	0.2109	0.0045	2.0538	6.2992

All the values of Zn and Cu exceeded the polish permissible standard (0.4-0.5 ppm), the accepted levels of lead in food (0.3 ppm) and up to the national accepted limits in similar products (1.0 ppm) in Romania.

Lead is not an essential element for life and is considered a highly toxic trace element that causes many disturbances to plants and animals health, including man and environment (Chen et al., 2004). Some anther evaluated the degree of environmental pollution with lead on the basis of examination regarding bee and their products contaminations, including pollen. Konopacka et al. (1993) detected elevated lead concentration (1.2 ppm) in pollen collected in farm experimental apiaries localized near a busy road in the regions of Pulway. However, Conti and Botre (2001), proved relatively low lead concentration in pollen ranging from (0.020 – 0.332 ppm). Also, Harmaneseu et al. (2007) noticed that all the values obtained for lead contents were less than national accepted limits (1.0 mg/kg).

El-Naggar et al. (2013) observed that lead levels in pollen samples collected during summer from El-Mahala EL-Kobra, Kafr El-Sheikh and Kafr El-Zayat (10.53,13.85 and 10.13 ppm), respectively, considerably exceeded permissible standard, while, it was below the standard limit in Al-Fayoum (2.85 ppm).

The pollen grain samples from El-Nobaria (B) recorded the highest concentration of cadmium (0.1010 ppm), followed by samples collected from Edku (B), Nobaria (A), and Abis 2 (A).

Kafr-Eldawar (A) and Kafr-Eldawar (B) with mean values of (0.0126, 0.0100, 0.0097, 0.0095, 0.0072 ppm), respectively. While the lowest value (0.0051 ppm) was detected in samples from Alexandria location (B) in year 2015. However, in 2016 maximum content of cadmium was detected from analyzed samples collected from Edku location (B) with mean value of 0.0084 ppm , while the minimum content was recorded in Kafr-Eldawar location (B) with a mean values (0.0017 ppm).

The average concentration of the in samples (0.019 ppm) significantly exceeded permissible standard it was 10 times highest than the polish and trade norms (0.05 ppm) and about 5 times greater than the Norms and Kenya Bureau (2009) of standard limits in food products; (0.1 ppm).

The highest level of Zinc with a mean value of (1.853 ppm) was noticed in pollen grain samples collected from apiariefy in Edku (B), followed by Nobaria (B): (1.8229 ppm), Kafr-Eldawar (B) (1.7672 ppm), Nobaria (A ) (1.6603 ppm), Abis 2 (B) (1.497 ppm), Edku (A) (1.462 ppm) and Abis 2 (A) (1.3523 ppm). However, The lowest level

was recorded for in Edku location A. with mean value of 1.3044 ppm.

The estimated daily intake of Zinc for normal person not high (1.52 mg/diet) and lower than the permissible limit recommended (15 mg/kg/day) by WHO (1994).

In the year 2016, the maximum content of Zn was recorded from Abis 2 (B) with mean value of (2.0538 ppm), while the minimum was found in Nobaria (A), 0.9264 ppm.

Szezesna (2007) found that Zn was the highest in the samples from Korea with the average of (47.41 ppm), while slightly low from Poland (36.8 ppm) and the lowest in the sample from China with average of (28.9 ppm). Al-Naggar et al. (2013) recorded that, the highest in the samples collected from Al-Foyoum Governorate, Egypt, with average 1.38ppm

All values obtained for Zinc contents in the present study were within the national accepted limit for this metal in similar products (60 mg/kg) except from Romania Ministry of Public Health (Ordinancen 0.975, 1998)

In 2015, the highest concentration of copper has detected in pollen samples from Abis 2 (A) with a mean value of 0.6299 ppm. Main while, the lowest mean concentration was recorded from Edku (A), which had 0.214 ppm.

The second year 2016, the highest level of copper was recorded in Abis 2 (B) with mean value of (6.2991 ppm) and mean which the lowest mean concentration was recorded for Edku (A; 2.140 ppm).

Also, daily intake for copper by human was not high (0.318 mg/diet) and below permissible limits recommended by WHO (1994), (2-3 mg/kg/day). Comparable results for copper were reported by (Harmaneseu et al., 2007). They found that Cu levels ranged between (5.51- 12.07 ppm).

El-Naggar et al. (2013) reported the highest concentration levels of copper (24.18-22.28 ppm) and the lowest (1.96-0.95 ppm) were noticed as during spring and summer in pollen samples

collected from Kafr-El-Sheikh and Kafr –El-Zayat.

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