

Letter to Editor

Cadmium Levels in Young Coots Originating from Industrial and Agricultural Regions of North-Middle Poland

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Abstract

This paper presents results of research determining cadmium levels in livers of 48 coots (*Fulica atra*) aged 5-6 months, originating from industrial (Bydgoszcz) and agricultural (Znin) areas. Studies were carried out in 1993-1995.

The results of the investigation show a decrease in the amounts of the analysed cadmium in birds from Bydgoszcz region (from 0.04 mg/kg to 0.03 mg/kg wet mass), while there was an increase of this metal in coots nesting in the area close to Znin (from 0.03 mg/kg to 0.04 mg/kg). Increasing cadmium levels in Znin region indicate a potential threat to the birds inhabiting this area. This statement was confirmed by the fact that coots stayed in the Znin neighbourhood for 5-6 months only. The highest cadmium level in the liver was 0.05 mg/kg.

Keywords: cadmium, coot, liver

Introduction

Development of metallurgic industry, agriculture and road transport is usually coupled with increased pollution of the biocenoses with cadmium [1-5]. The level of this metal in plants is determined most of all by its content in air and soil [1, 6-8]. Cadmium content in Polish soil varies from 0.3 mg/kg e.g. in the Biatowieza Forest to 290 mg/kg in the vicinity of Skawina [9]. This element also accumu-

lates in alluvial sediments so that it is found also in aquatic plants and animals, fish most of all [3, 6, 10-14].

Pure cadmium as well as its compounds represent a considerable threat to humans and animals, most of all due to the fact that its half-life is 10-30 years. Biologically significant concentrations of this metal have been noted even in regions located far from emission sources [2, 3, 5, 9, 14-17]. Therefore, it seems important to know cadmium levels in internal organs of wild birds tropically

Table 1. Average level of cadmium in the liver of young coots shot in an industrial region (Bydgoszcz) and an agricultural region (Znin) in 1993-1995.

Year of examination	Bydgoszcz		Znin	
	number of coots	level of Cd in the liver (mg/kg wet mass) X ± SEM	number of coots	level of Cd in the liver (mg/kg wet mass) X ± SEM
1993	8	0.036 ^{aa} ± 0.004	8	0.033 ± 0.005
1994	8	0.028 ^{aa} ± 0.002	8	0.031 ± 0.003
1995	8	0.028 ^{ba} ± 0.002	8	0.036 ^{ba} ± 0.005

Values with the same superscripts are statistically significant ($p = 0.05$); X – mean, SEM – standard error mean.

connected to given biocenoses and inhabiting different ecosystems as regards human activities. The coot is an interesting bird in this context as it is connected with the aquatic environment.

Material and Methods

Studies were carried out on 48 coots (*Fulica atra*) aged 5-6 months. The birds originated from two regions located at a distance of some 50 km from each other: the vicinity of Bydgoszcz (area neighbouring west city border, chemical factory "Organika-Zachem", electric power plant and a circular highway) and the vicinity of Znin (area close to a highway, otherwise agricultural region, in which intensive farming has been carried out for the past 40 years). The birds were shot in 1993-1995 (8 birds each year, 4 females and 4 males in each area). Livers were then collected for the examination and frozen until chemical analysis.

Liver samples were collected, carefully carbonised over an electric plate, and ashed in muffle furnace at 450°C. The obtained ash was dissolved in 1 M solution of nitric acid and the samples were brought up to 25 cm³ adding distilled water. Reagent samples were prepared at the same time. Cadmium was determined using the method of flameless atomic absorption spectrometry [18]. Suprapur acids produced by Merck were used in the analysis and properly diluted (with 0.1 M nitric acid) BDH standards, concentration of which was 1 mg/cm³. Determinations were performed using an atomic absorption spectrophotometer Unicam 939 Solar connected to an ADAX data station and equipped with a system of background correction by cathode lamps. Unicam 939 Solar flameless system cooperated with a graphite furnace Unicam Gf 90 and an autosampler FS 90.

The results were given in mg/kg of wet liver mass. Arithmetic mean (X) and standard error of the mean (SEM) were determined. Statistical differences between the means were tested using the computer programme: "Statistica" version 5,97, Neutral Networks PL StatSoft at significance level $p = 0.05$.

Results and Discussion

The results presented in Table 1 show that in coots originating from an industrial region (Bydgoszcz), levels of cadmium decreased. Attention should be given to the

decrease of this element in 1994. The lowest Cd content in the livers of bird shot in this region was noted in a male; it amounted to 0.02 mg/kg (in 1993), and the highest level of 0.05 mg/kg was recorded also in 1993 in a male. Only in one bird did the content of this metal in the liver exceed 0.05 mg/kg of wet mass, higher than the level permissible for poultry liver [12, 19].

Lowering of cadmium levels in the Bydgoszcz region may be due to the decrease of production in the "Organika-Zachem" factory and with an improved system of controlling pollutant emission. In addition, road traffic has been re-directed to the circular highway which is separated by a wide forest belt from the area where the birds were collected.

The coots obtained in the agricultural region (Znin) were characterised by about a 20% increase of cadmium levels. The lowest level of this metal (0.02 mg/kg) was recorded in the liver of a male shot in 1993, and the highest, 0.06 mg/kg, in a female from 1995. As regards the birds collected in this region, two (a male and a female) had cadmium levels in their livers higher than 0.05 mg/kg.

Higher contamination by cadmium of coots from the Znin region compared to those from Bydgoszcz region and increasing trend observed in the first region suggest that this region is polluted with the analysed xenobiotic. This may be due to:

- long-term intensive use of mineral fertilizers (phosphorus),
- use of machines with Diesel engines in agriculture,
- increasing transit traffic (east-west) along the highway running in the west part of this region.

These factors resulted in higher contamination of the agricultural region (region of Znin) than industry and road traffic in the Bydgoszcz region.

Levels of cadmium found in liver of coots are higher than the respective levels observed in farm animals [7, 12]. They are, however, close to the levels of this xenobiotic in poultry reared in an extensive way [15] and in free-living animals much older than the coots in question [17, 20-22].

Conclusions

Young coots staying for 5-6 months in the same region feed on plants and partly on small crustaceans, molluscs and insects caught in water bodies where the birds are nesting. This is why they are good zooindicators of environmental contamination by cadmium. Levels of

the analysed xenobiotic in liver of these birds reflects its content in the environment and the dynamics of contamination.

The increase of cadmium levels in livers of 5-6 months old coots in the Znin region in 1993-1995 suggests:

- potential threat of the discussed xenobiotic to birds nesting in this region,
- necessity to monitor cadmium content in the Znin region.

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