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Data Article

Data on elemental composition of *Russula cyanoxantha* along an urbanization gradient in Cluj-Napoca (Romania)

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A R T I C L E I N F O

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A B S T R A C T

How far-reaching is the influence of the urban area over the mineral composition of the *Russula cyanoxantha* mushroom? To answer this question, we monitored the metal uptake behavior of this fungus relying on the soil properties. We sampled mushroom and soil from six forests according to an urbanization gradient, and two city parks in Cluj-Napoca (Romania). The elements were quantified using inductively coupled plasma - optical emission spectroscopy (ICP-OES). The concentrations of some elements differed significantly ($p < 0.05$) in the samples from the city (0.39 ± 0.35 mg kg-1 for cadmium (Cd), 0.40 ± 0.19 mg kg-1 for chromium (Cr), 69.1 ± 29.9 mg kg-1 for iron (Fe), 10.9 ± 1.3 mg kg-1 for manganese (Mn), 0.76 ± 0.45 mg kg-1 for titanium (Ti)) compared with the samples from the forests (3.15–14.1 mg kg-1 Cd, < 0.18 mg kg-1 for Cr, 22.6–34.5 mg kg-1 for Fe, 15.9–19.1 mg kg-1 for Mn, 0.19–0.36 mg kg-1 for Ti). We observed a definite negative trend in the mineral accumulation potential of this fungus along the urbanization gradient. The fungus turned from a cadmium-accumulator to a cadmium-excluder. This highlights a positive environmental influence of the urbanization over the toxic metal uptake of *R. cyanoxantha*. The hypothesis, that the urban soil pollution would increase the metal content of the mushroom was disproved. The possible explanation might be the elevated

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carbonate content of the urban soil, which is known to immobilize the metals in the soil.

Specifications Table

Subject	Chemistry
Specific subject area	Environmental chemistry
Type of data	Table
How data were acquired	Spectro Genesis ICP-OES instrument, pH measurements with combined glass electrode (WTW, Weilheim, Germany), data mining with R software, version 3.4.4.
Data format	Raw and Analyzed
Parameters for data collection	Total number of 95 mushrooms and 95 soil samples were taken for elemental analysis. All samples were washed and dried between 60 °C - 105 °C until constant weight. Digestion of the samples were accomplished with Suprapure and Chempure 65% HNO_3, 30% HCl and 30% H_2O_2.
Description of data collection	Sample solutions were measured with Spectro Genesis ICP-OES (SPECTRO Analytical Instruments GmbH, Germany). Evaluation of data and spectra were done with Smart Analyzer Vision 2.11.0630 and Microsoft Excel 2016 software.
Data source location	Sapientia Hungarian University of Transylvania, Romania
Data accessibility	The data is available with the article
Related research article	Andreea R. Zsigmond, Izolda Kántor, Zoltán May, István Urák, Károly Héberger Elemental composition of *Russula cyanoxantha* along an urbanization gradient in Cluj-Napoca (Romania) Chemosphere 238 (2020) 124566 https://doi.org/10.1016/j.chemosphere.2019.124566

Value of the data

- The dataset of elemental composition and metal ions uptake of mushroom *Russula cyanoxantha* and the influence of urban and non-urban environment on it is very important because this area is mostly unknown.
- Every researcher and expert in the field of mycology, food chemistry and environmental chemistry can benefit from this data.
- By mapping the composition, metal ions uptake and the influence of the soil on this kind of fungus, other species can be involved in to this research and other analytical methods can be applied for more complete picture.

1. Data

The seven sampling sites where mushrooms were collected from are shown in Fig. 1. The ICP-OES method detection limits (MDL) for mushroom and soil samples are summarized in Supplementary Table 1 (xlsx file). For quality assurance of ICP-OES method, certified reference materials (CRM) were also measured and recoveries are also listed in Supplementary Table 1. Concentrations of the elements obtained from ICP-OES measurement of the mushroom and soil samples are shown in Table 2 (mg kg^{-1} dry weight) [1]. The bioaccumulation fator (BAF) is a dimensionless indicator of the accumulation rate of an element in a living organism (plant, fungus), related to the soil. In our work these factors disagreed between the sampling sites suggesting a definite influence of the soil characteristics over the mineral uptake of this fungus, see Fig. 2. The two-way factorial ANOVA test for the BAFs according to the habitat types and the elements can be shown in Fig. 3a and b. Former shows the mean BAFs of some elements according to the habitat type, latter shows the weighted means for cumulated BAFs according to the habitat types. Correlations between soil properties (pH and carbonate content) and mineral element contents with the BAFs of the mushroom were tested. We found few significant correlations between the mineral content of the mushroom and the soil properties. The Spearman rank correlation coefficient values were low (Figs. 3 and 4).

2. Experimental design, materials, and methods

The seven sampling sites of the mushroom and the soil samples were as follows: S1 (a forest near Feleacu, at 7.5 km to south from the city centre), S2 (Făget, a forest close to the southern city border, at 5 km from the city centre), S3 (a forest near the Mănăștur district, which lies in the southern part of the city, at 2.5 km from the city centre), S4 (Iuliu Hațieganu Park and Botanical Garden in the centre of the city), S5 (Hoia, a forest in the north part of the city, at 2 km from the city centre), S6 (a forest near Popești, close to the northern border of the city, at 6 km from the city centre) and S7 (a forest near Deușu at 18 km to north from the city centre). A total number of 95 mushrooms and 95 soil samples were collected and were kept in plastic bags. Each mushroom sample consisted of 7–10 individuals, both small-sized and well developed. The soil samples were taken from the topsoil (0–10 cm) exactly where the mushrooms grew. Before washing the mushrooms, we separated the caps from the stipes using a ceramic knife, and we removed the debris, so that the mass of the anatomic parts could be determined separately. We used these data to determine the mean mass ratio between the cap and the stipe. Next, the mushrooms were washed with tap water, and rinsed with distilled water; they were cut in thin slices and dried at 60 °C, then at 105 °C until constant weight. The samples were grinded and sieved through a stainless steel sieve with pore-size of 315 μm. A mass of about 0.4 g was digested in glass beakers with 5 mL 65% HNO_3 (Merck, Suprapure) and 2 mL 30% H_2O_2 (Chempur, pure *p.a.*) at atmospheric pressure. The soil samples were removed from leaves, stones and living organisms and dried at 20 °C, then at 105 °C until constant weight. About 0.2 g of grinded and sieved (1 mm pore-size) soil samples were digested with 3 mL 65% HNO_3 (Merck, Suprapure) and 9 mL 30% HCl (Merck, Suprapure) in glass beakers. All solutes were diluted to 50 mL with deionized water (Merck, Millipore). The digests were stored in sealed plastic containers. All the glassware was washed before use with tap water, rinsed with distilled water and soaked in 0.1 M HNO_3 for 24 hours, then in deionized water for another 24 hours. Elemental composition of the mushroom and soil samples were determined with an ICP-OES (Spectro Genesis, SPECTRO Analytical Instruments GmbH, Germany). The instrument conditions and measurement parameters used throughout this work was described recently [2] certified reference materials were applied: NCS DC 73026 for soil (NACIS, China), SRM 1515 for apple leaves (NIST, USA) for the quality assurance of the instrumental method. The pH of the soil samples was determined in two ways: using (1) deionized water and (2) 0.01 M $CaCl_2$ solution as extracting liquids, according to Carter and Gregorich https://www.sciencedirect.com/science/article/pii/S2352340919300897, [3]. We measured the pH in the supernatant with a combined glass electrode (WTW, Weilheim, Germany).

In order to determine the organic matter and the carbonate content of the soil samples, we performed the loss-on-ignition method, according to Heiri et al. https://www.sciencedirect.com/science/article/pii/S2352340919300897, [4]. Quantities of about 2 g soil samples were placed in ceramic crucibles and dried at 105 °C to a constant weight. We placed the crucibles in an oven and incinerated the samples for 4 hours, followed by a second step at 950 °C for 2 hours. The differences in the weight gave the organic matter content (related to the lost CO_2 and water vapor at 550 °C) and the carbonate content (calculated from the lost CO_2 content at 950 °C).

The BAF for a certain element was calculated by dividing the concentration of the element in the mushroom with the concentration of this element in the soil.

The statistical analyses were carried out on a data table of 95 rows and 52 columns (containing all the data about the mushroom and soil). We tested the normality of the distributions with Shapiro-Wilk-test. For the homogeneity of the variances, we used the *F*-test for two groups, and the Levene-test for multiple groups. We used the two-sample *t*-test for independent groups (sometimes the Welch-test or the nonparametric Mann-Whitney-Wilcoxon-test) in order to compare the elemental composition of the caps and the stipes. We used the one-way ANOVA (sometimes the Welch-ANOVA or the nonparametric Kruskal-Wallis-test) to compare the mean concentrations of the elements in the seven sampling sites. When the test showed significant differences in the means, we used the proper *post-hoc* test (Tukey-HSD or Games-Howell-test or Dunn's test) to identify the actual differences between pairs. The correlation between the variables was tested with calculation of the Spearman rank-correlation coefficients. These statistical tools are regularly used in the chemometric evaluation of mineral composition of mushrooms (Brzezicha-Cirocka et al., 2019; Malinowska et al., 2004).

In order to test the existence of an urbanization gradient with regard to the elemental composition of the *R. cyanoxantha*, we used simple linear regression and factorial ANOVA. The bioaccumulation factor was taken as response variable, and the habitat distance from the city centre, was used as explanatory variable. The normal distribution of the residuals was tested with Shapiro-Wilk test. All the statistics were carried out by R software, version 3.4.4.

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2019.104572.

References

[1] A.R. Zsigmond, I. Kántor, Z. May, I. Urák, K. Héberger, Elemental composition of *Russula cyanoxantha* along an urbanization gradient in Cluj-Napoca (Romania), Chemosphere 238 (2020) 124566, https://doi.org/10.1016/j.chemosphere.2019.124566.
[2] A.R. Zsigmond, K. Varga, I. Kántor, I. Urák, Z. May, K. Héberger, Elemental composition of wild growing *Agaricus campestris* mushroom in urban and peri-urban regions of Transylvania (Romania), J. Food Compos. Anal. 72 (2018) 15–21, https://doi.org/10.1016/j.jfca.2018.05.006.
[3] M.R. Carter, E.G. Gregorich (Eds.), Soil Sampling and Methods of Analysis, Second ed., [Pinawa, Manitoba], Canadian Society of Soil Science ; CRC Press, Boca Raton, FL, 2008.
[4] O. Heiri, A.F. Lotter, G. Lemcke, Loss on ignition as a method for estimating organic and carbonate content in sediments: reproducibility and comparability of results, J. Paleolimnol. 25 (1) (2001) 101–110, https://doi.org/10.1023/A:1008119611481.