

RADIOACTIVE CAESIUM IN *CORTINARIUS CAPERATUS* MUSHROOMS

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Introduction

The first reports on radioactivity accumulated in mushrooms from the wild due to radioactive fallout from the nuclear weapons tests were published half a century ago, and an earliest showed an elevated activity of radioactive caesium (¹³⁷Cs) accumulated in fruiting bodies by species *Paxillus involutus* (Grueter, 1964). The nuclear power plant accident in Chernobyl in 1986 caused contamination with ¹³⁷Cs and other radioactive compounds a vast regions of the World and some regions in Europe were highly affected (Grodzinskaya et al., 2003; Steinhauser et al., 2014). Radiocaesium is still present in the environment and in the foraged European mushrooms as a result of atmospheric nuclear weapons tests in the 1950 - 1960's and as fallout from the Chernobyl, while fallout from the 2011 Fukushima Dai-ichi nuclear power plant accident was negligible (Falandysz et al., 2015).

Byrne (1998) reported on very high radioactivity of ¹³⁷Cs in fruiting bodies of some mushrooms from the genus *Cortinarius*. One which was highly contaminated was the species *Rozites caperata* (Pers.: Fr.) P. Karst (gypsy), which now is in the genus *Cortinarius* and its current name is *Cortinarius caperatus* (Pers.) Fr.

Cortinarius caperatus is considered as tasty and it is one of the most appreciated species of common edible mushrooms foraged in wild in Europe because of its mild flavour. It usually emerges on coniferous (mountain) forests in areas with sandy soils as well as in beech woodland at lower altitudes and not popular in leafy forest (Falandysz, 2014). In this study, we investigated the ¹³⁷Cs concentrations of *C. caperatus* from many spatially and distantly scattered background areas across northern Poland.

Methods

Cortinarius caperatus mushrooms were collected at 22 sites in 20 forested regions largely in the northern and central Poland between 2001 and 2010. Fresh fruit bodies, after cleanup with a plastic knife from any visible plant vegetation and soil debris, were air-dried for several days. Thereafter, with exception of 2 sites for which whole fruiting bodies were examined, each specimen was separated into two parts - the cap (with skin) and stipe and then dried at 65 °C to constant mass. Dried whole fruit bodies, caps and stipes were pulverized in a porcelain mortar and kept in sealed polyethylene bags under dry conditions until analysis.

Radioactivity from ¹³⁷Cs was determined by gamma spectrometry with coaxial HPGe detector with a relative efficiency of 18% and a resolution of 1.9 keV at 1.332 MeV (with associated electronics). The detector was coupled with an 8192-channel computer analyzer and GENIE 2000 software. The instrument (detector) was calibrated using a multi-isotope standard and the method was fully validated. All results were calculated for dehydrated fungal material (at 105 °C) and they were decay corrected back to the time of sampling.

Results

Cortinarius caperatus from many sites sampled in Poland showed high contamination with ¹³⁷Cs over the years 1996-2010. The ¹³⁷Cs was at 18000±140 Bq kg⁻¹ dry biomass in caps of specimens collected from the Napowidzko-Ramucka Wilderness in 2002, at 13000±99 Bq kg⁻¹ dry biomass in caps of the individuals from the Mazovia land in the localization Olszewo-Borki in 2007 and 5600±58 Bq kg⁻¹ dry biomass in caps of mushrooms from the Tuchola Pinewood in 2010. The caps of *C. caperatus* showed from 1.4 to 3.3 greater activity concentration from ¹³⁷Cs than the stipes.

Conclusion

A very slow decrease in content of ¹³⁷Cs content could be noted in *C. caperatus* collected in the 1990-2010 in the northern regions of Poland. Mushrooms collected in 2010 from the Pomerania province which was relatively less affected by the Chernobyl fallout contained ¹³⁷Cs at > 3700 Bq kg⁻¹ dry biomass.

References

- Byrne, A.R. (1998). Radioactivity in fungi in Slovenia, Yugoslavia, following the Chernobyl accident. *J. Environ. Radioact.*, 6, 177-183.
- Falandysz, J. (2014). Distribution of mercury in Gypsy *Cortinarius caperatus* mushrooms from several populations: an efficient accumulator species and estimated intake of element. *Ecotoxicol. Environ. Saf.*, 110, 68-72.
- Falandysz, J., Zalewska, T., Krasinska, G., Apanel, A., Wang, Y., Pankavec, S. (2015). Artificial (¹³⁷Cs) and natural (⁴⁰K and other) radioactivity in fungi of genus *Boletus* from central and northern regions of Europe and Yunnan Province in China. *Appl. Microbiol. Biotechnol.*, 99, 8217-8224.
- Grodzinskaya, A.A., Berreck, M., Haselwandter, K., Wasser, S.P. (2003). Radiocesium contamination of wild-growing medicinal mushrooms in Ukraine. *Int. J. Med. Mush.* 5, 61-86.
- Grueter, H. (1964). Eine selektive Anreicherung des Spaltprodukts ¹³⁷Cs in Pilzen. *Naturwissenschaften* 51, 161-162.
- Steinhauser, G., Brandl, A., Johnson, T.E. (2014). Comparison of the Chernobyl and Fukushima nuclear accidents: A review of the environmental impacts. *Sci. Total Environ.*, 470-471, 800-817.