ABOUT THE RADIOACTIVITY OF SOME AGRICULTURAL PRODUCTS FROM AREAS NEAR CRUCEA URANIUM MINE

DESPRE RADIOACTIVITATEA UNOR PRODUSE AGRICOLE DIN VECINÃTATEA MINEI DE URANIU CRUCEA

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Abstract. *Events like the nuclear accidents that occured at Cernobyl in Ukraine and Fukushima in Japan have raised public awareness to the many dangers of working with radioactive elements. When using nuclear energy it is well known that any controlable nuclear source can in certain circumstances become uncrontrollable. As a result the radiological monitoring of the enivironment has increased both in the vicinity of nuclear plants and of uranium mines. The aim of this paper is the study of local products sampled from areas near the Crucea uranium mine found in the county of Suceava. The results of our measurements show that the radioactive activity of mushrooms is significantly higher than the cosmic background showing that mushrooms have the potential of being used as bioindicators for radioactivity.*
Key words: *uranium mine, bioindicators for radioactivity*

Rezumat. *O serie de evenimente cu un puternic impact asupra oamenilor, cum a fost accidentul nuclear de la Cernobîl din Ucraina sau cel de la Fukushima din Japonia, au zguduit opinia publică prin efectele sale. Aceste accidente au arătat că există pericole în cazul utilizării energiei nucleare şi că orice sursă controlabilă poate deveni, la un moment dat, necontrolabilă. De aceea s-a intensificat controlul radioactivitatii mediului in vecinatatea centralelor nucleare ca şi în vecinătatea minelor de uraniu. Scopul acestei lucrări este studiul radiactivităţii unor produse agricole prelevate din vecinătate minei de uraniu Crucea din judeţul Suceava. Rezultatele măsurătorilor noastre arată că activitatea radioactivă a ciupercilor este semnificativ crescută în raport cu fondul natural şi acest fapt arată că ciupercile pot fi bioindicatori ai activităţii radioactive.*
Cuvinte cheie: *mina de uraniu, bioindicatori pentru radioactivitate*

INTRODUCTION

People are exposed to artificial and natural radionuclides that come from diverse environmental compartments such as air, soil, rivers, vegetables etc.; these radionuclides come from background radiation or from human activity. Events like the nuclear accidents that occured at Cernobyl in Ukraine and Fukushima in Japan have raised public awareness to the many dangers of working with radioactive elements. In both accidents, most of the radioactivity released was due

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to volatile radionuclides (noble gases, iodine, cesium, tellurium) (Thakur et al., 2013; Steinhauser et al., 2014).

Food is one of the main sources of minerals and radionuclides for humans. As such radioactivity measurements in the environment and foodstuffs have become very important in order to evaluate the radiation levels to which man is exposed to either directly or indirectly. Uranium mining, located near villages and in agriculture areas, increases the radioactivity of agriculture products and in turn the population exposure through food chain thansfer of uranium series radionuclids (Carvalho et al., 2009; Gaso et al., 2005; Neves et al., 2012). Environmental biomonitoring has demonstrated that organisms such as crustaceans, fish and mushrooms can be used to evaluate and monitor both ecosystem contamination and quality. Mushrooms stand out as they are excellent nutritional sources of proteins, fibers, vitamins and minerals, such as K, P and Fe and present low Na concentrations. On the other hand different mushroom species have the capacity to retain high concentrations of radionuclides and metals from the soil. This behaviour makes mushrooms an excellent environmental bioindicator. Some studies have revealed high concentrations of toxic elements and high radionuclide levels in various mushroom species, especially in European countries. However, little attention has been given in determining the radioactive content in mushrooms and the respective ingestion dosage (Castro et al., 2012; Guille and Baeza, 2009). The aim of this paper is the study of local products sampled from areas near the Crucea uranium mine found in the county of Suceava.

MATERIAL AND METHOD

To study the radioactivity of local products sampled from areas near the Crucea uranium mine, we collected different agricultural products and we compared the radioactivity of the following products as opposed to background radioactivity:

1. mushrooms;
2. conifer leaves
3. corn leaves
4. potato carrot, etc.

Armillaria mellea mushrooms were collected from an area in the immediate vicinity of the mine's secured area. In the case of the conifers we collected spruce (*Picea abies*) leaves as this specie is one of the main components of the forest surrounding the Crucea mine. The corn leaves as well as the carrot and potatoes were collected from farms from Crucea village. These samples were analyzed at USAMV Iasi biophysics laboratory. The measurements were performed by putting various quatities of the products in Petri dishes and measuring their radioactivity with a Numecint gamma counter. The analysis of each sample involved recording at least 10 times the background radiation for a period of 5 minutes followed by recording at least 10 times the radioactivity of the sample for a period of 5 minutes.

RESULTS AND DISCUSSIONS

Figure 1 shows a comparison between the background radioactivity and the radioactivity of the mushrooms and of the spruce leaves.

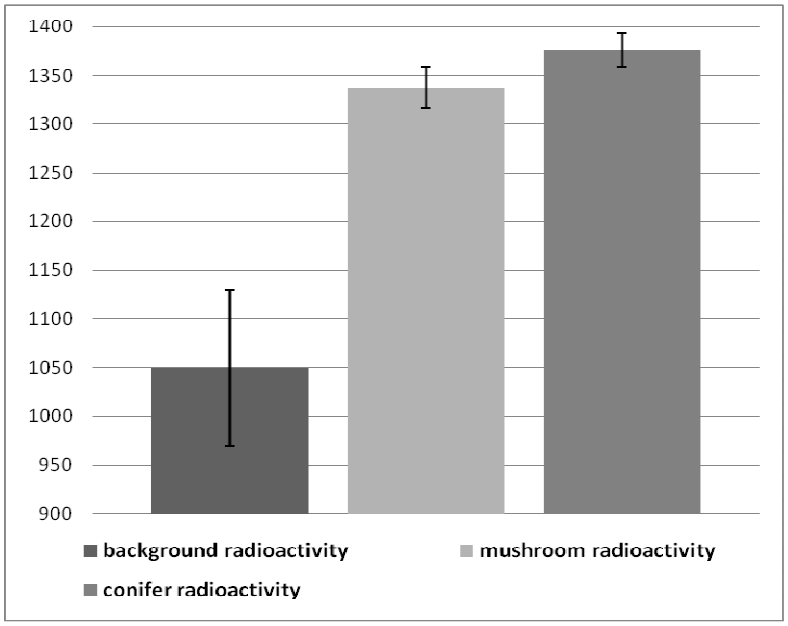

Fig. 1 –Comparison between background radioactivity and the product radioactivity

Figure 1 shows that the radioactivity of the mushrooms and of the spruce leaves is significantly higher than the background radioactivity. The error bars represent double the 95% confidence interval for 10 measurements and do not overlap (Oancea, 2007).

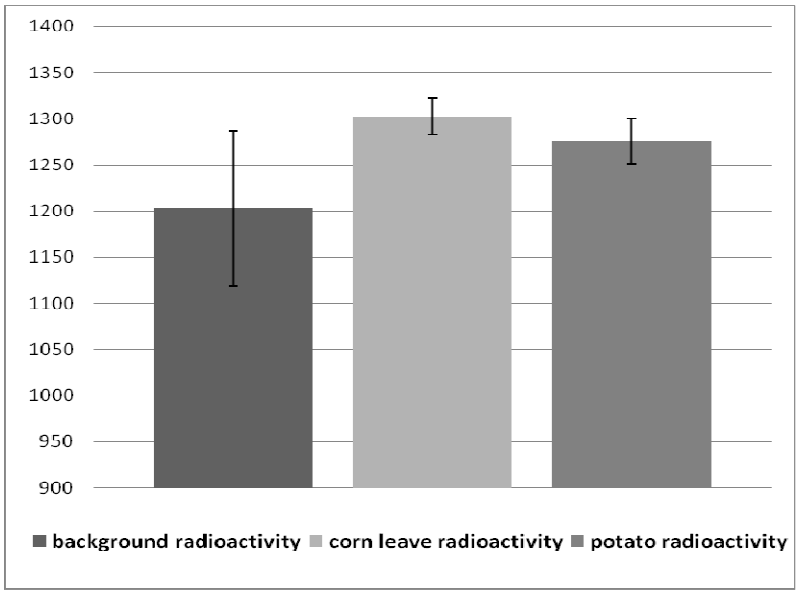

Fig. 2 – Comparison between background radioactivity and the product radioactivity

By contrary, figure 2 shows that the radioactivity of the potato is not significantly different as opposed to the background radioactivity because the errors bars overlap. The same results can be found in the case of the radioactivity of the carrot (not present in this figure). We suggest that the potato and carrot grow in soil and the maximum of absorption is for volatile radionuclids from the air, which are deposited on plant surfaces. This is the reason why the radioactivity of corn leaves is higher than the radioactivity of the potato. At the same time the radioactivity of corn leaves, which had a short exposure time of a few months, is lower than the radioactivity of the spruce leaves which had a much longer exposure time.

CONCLUSIONS

The radioactivity measurements of local products sampled from areas near the Crucea uranium mine show that the mushroom have an increased radioactivity. Mushrooms have the capacity to retain high concentrations of radionuclides especially from the atmosphere due to the great surface of absorbtion. This makes mushrooms useful in the evaluation and monitoring of environmental contamination and quality. Because mushrooms represent one of the common constituents in the nutrition of the citizens of Crucea village, the monitoring of the radioactivity of these products is necessary in order to insure the health and safety of these people.

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