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# WILD BERRY PLANTS CONTAMINATION WITH TECHNOGENIC RADIONUCLIDES IN NORTHERN BUKOVINA

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**Abstract:** *Chernivtsi region, part of Northern Bukovina, is an attractive one for development of both national and international tourism. Investigation of radionuclide migration in "soil - wild berry plants" chain was carried out in our research project in order to check safety of forest berry products in Chernivtsi region. We established that content of radionuclide — $^{137}Cs$ and $^{40}K$ stayed within acceptable levels in blueberry and cowberry from Putyla district. Hence, all berries are safe and can be eaten both raw and processed.*

**Keywords:** *radionuclides, $^{137}Cs$, $^{40}K$, forest berry, blueberry, cowberry, post-Chernobyl' period*

## 1. Introduction

Radioactive contamination of wild berry plants in post-Chernobyl' period attracts greater interest of investigators. Investigation of mentioned topic is especially valuable in Chernivtsi region that has large square woodlands and great quantity of natural mineral water sources (incl. medical ones). That makes region an attractive one for development of both national and international tourism. Tourists, primarily foreigners, are interested logically whether berried and their processed products from Chernivtsi region are edible.

Great number of publications was dedicated to this problem in recent years therefore [1, 2, 3]. Significant differences in radionuclide content are demonstrated in different country regions as well as in miscellaneous species of wild berry plants in them. Such investigations contributed into important practical conclusion about existence of tight connection between radionuclide content in certain raw type and this radionuclide contamination of the soil in each exact edatop.

## 2. Materials and Methods

Investigation of radionuclide migration in soil-wild berry plants chain was carried out in our research project. Representatives of cowberry species (*Vaccinium myrtillus, Vaccinium vitis-idaea*) and soils where they germinate were objects of our investigations. Samples collection and preparation for γ-spectrophotometric analysis were done according to standard

methods [4, 5, 6]. γ-spectrophotometric complex including scintillation detector SDU-2-23 and amplitude-to-digital spectrophotometric trans-former ADC-8K-2M was used for detection of cesium-137 and potassium-40 nuclides. γ-spectrums processing was conducted employing original AKW in software.

## 3. Results and Discussion

Results of investigation of radionuclide content in wild berry plants collected in Putyla district are demonstrated in table 1.

**Table 1**

**Content of radionuclides in wild berry plants**

| Investigation object | Specific activity, Bq/kg | | Accumulation quotient | |
|---|---|---|---|---|
| | $^{137}Cs$ | $^{40}K$ | $^{137}Cs$ | $^{40}K$ |
| Blueberries: | | | | |
| berries | 443 | 1123 | 3.04 | 2.94 |
| leaves | 764 | 997 | 5.23 | 2.61 |
| stems | 329 | 416 | 2.25 | 1.09 |
| Soil | 146 | 382 | – | – |
| Cowberries: | | | | |
| berries | 315 | 974 | 3.21 | 2.79 |
| leaves | 523 | 935 | 5.34 | 2.68 |
| stems | 227 | 408 | 2.32 | 1.17 |
| Soil | 98 | 349 | – | – |

Leaves of plants are contaminated with radioactive cesium to the biggest extent and stems are the least. Coincidence was observed between corresponding accumulation quotients for both berry plants that confirms the findings of Lviv investigators [6] about similarity of processes of radionuclides accumulation by single species plants from soils of a same type and same pollution origin.

Re-distribution of radioactive cesium-137 during period of blueberry fruiting was studied by Ukrainian investigators [7]. Radioactive cesium activity was distributed as follows: 31% of total radionuclide activity was detected in leaves, 26% - in stems, 25% in berries, and 18% — rhizomes and roots. Our investigations revealed maximal content of cesium-137 in blueberry and cowberry leaves (764 and 523 Bq/kg correspondingly), characteristic for fruiting period (pic. 1). But, radioactive Cesium content in stems was a little bit lower comparing berries in our case that did not match data of previously done investigations. Inconsistency may be caused by complex of reasons: carrying out

investigations in different seasons after accident at Chernobyl atomic station, measurements in different geographical district or under another weather conditions, employing different measuring methods etc.

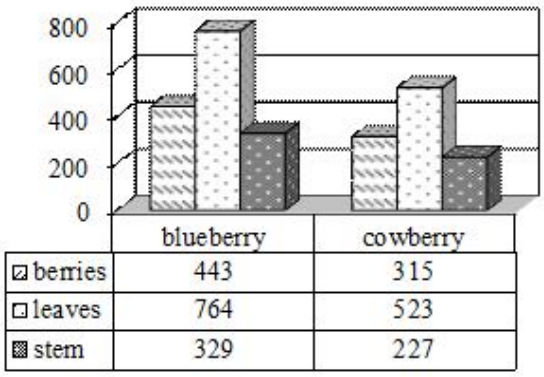


**Figure 1. Cesium-137 content (Bq/kg) in organs of investigated berry plants.**

Especial specialists' attention is attracted to intensity of radioactive cesium accumulation by berries of wild plants. A range of berry species distributed according to cesium-137 income level was provided in literature sources [8, 9]: cranberry > cowberry > blueberry > raspberry. Our results demonstrated that cowberry has slightly higher accumulation quotient (3.21) comparing blueberry (3.04).

Cooking processing of berries from Vacciniaceae family can significantly decrease specific activity of $^{137}$Cs. In partial, washing fresh berries decreases their content of radionuclide by 5-15% at the expense of its partial leaching. According to results of joint research of Belarus and radiologists-ecologists from European Union (Kenigsbers, Buglova, 1994; Kenigsberg et al., 1996) quotients of $^{137}$Cs activity changes in berries depending on type of culinary processing were determined: 0,9 for washing; 0,5 — for jam cooking; 0,65 — grinding with sugar; 9,0 — drying. Soaking the cowberries decreases $^{137}$Cs activity in them by 71%, cooking jam — by 52% [8]. B Activity of $^{137}$Cs in fruit compote decreases by 50% comparing fresh berries. Drying berries causes increase of specific activity by 7-10 times — proportionally to decrease of their weight. Obtained results may be applied practically both in food industry and in private subsistence farming for decrease of internal exposure dose got by population from forest food products.

## 4. Conclusion

As follows, our investigations demonstrate that radionuclide content in wild berry plants collected in Putyla district, Chernivtsi region does not exceed standards for fresh plants according to order of Ministry of Health Protection of Ukraine "Acceptable levels of $^{137}$Cs and Sr-90 radionuclide content in food products and water» [10], agreed with Codex Alimentarius statements [11]. Content of radionuclide — $^{137}$Cs (normal level — below 500 Bq/kg) and $^{40}$K (normal level — below 1480 Bq/kg) stayed within acceptable levels in blueberry and cowberry from Putyla district. All berries are safe and can be eaten both raw and processed.

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