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CONTEMPORARY PATTERNS OF RADIOACTIVE CONTAMINATION IN BLACK ALDER ACROSS DIFFERENT FOREST SITE CONDITIONS IN THE POLISSIA REGION OF UKRAINE

This study investigates the current distribution of ^{137}Cs in the tissues and organs of black alder (*Alnus glutinosa* (L.) Gaertn.) growing under different forest site conditions in the Polissia region of Ukraine. The most intensive uptake of the radionuclide into various parts of the trunk and crown was observed in wet, relatively fertile forest sites. The aggregated transfer factor of ^{137}Cs increased from moist to wet, relatively fertile conditions, with values changing as follows: from 0.5 to 5.2 $m^2 \cdot kg^{-1} \cdot 10^{-3}$ in leaves, from 1.7 to 8.3 $m^2 \cdot kg^{-1} \cdot 10^{-3}$ in one-year-old shoots, from 1.0 to 4.9 $m^2 \cdot kg^{-1} \cdot 10^{-3}$ in two-year-old shoots, from 0.7 to 3.9 $m^2 \cdot kg^{-1} \cdot 10^{-3}$ in fine branches, from 0.5 to 2.9 $m^2 \cdot kg^{-1} \cdot 10^{-3}$ in coarse branches, from 2.1 to 10.2 $m^2 \cdot kg^{-1} \cdot 10^{-3}$ in fruits, and from 2.5 to 14.1 $m^2 \cdot kg^{-1} \cdot 10^{-3}$ in male inflorescences. Statistically significant differences in aggregated transfer factors were observed among nearly all crown components across moist, damp, and wet site conditions. Additionally, a slight increase in the ^{137}Cs content was recorded from the base to the top of the crown in wet, relatively fertile sites.

Keywords: Alnus glutinosa (L.) Gaerth., stands, site moisture regime, radionuclides, cesium, activity concentration, density of contamination, aggregated transfer factor.

1. Introduction

Black alder (*Alnus glutinosa* (L.) Gaertn.) is one of the main forest-forming tree species in Ukraine, with stands dominated by this species accounting for approximately 6 % of the country's forested area. Large expanses of alder forests are located in the Polissia region, which experienced the most severe radioactive contamination following the Chornobyl nuclear accident. Since the accident, only a limited number of studies have focused on the uptake of radionuclides by black alder, their accumulation in various tissues and organs, and their redistribution within the forest soils where this species grows. Several factors contribute to this research gap. These include an insufficient understanding of the ecological and biological characteristics of black alder. Another factor is the broad range of soil and hydrological conditions in which it grows. There are also challenges in identifying suitable research sites that meet both ecological and radioecological criteria. Additionally, technical difficulties arise when sampling soil in waterlogged environments [1].

More than 90 % of black alder stands in Ukrainian Polissia grow on soils with semi-hydromorphic or hydromorphic moisture regimes. In the early years following the Chornobyl accident, researchers observed that under such conditions, ^{137}Cs exhibited high mobility, leading to its intensive uptake by forest vegetation in general, and by tree species in particular [2, 3]. The elevated levels of radionuclides in plants growing on waterlogged sites were attributed to the low content of mineral fine-grained soil and the reversible nature of sorption-desorption processes, which are influenced by high levels of organic matter [4, 5]. However, the sites where black alder grows are marked by considerable variability in moisture conditions. These include periodic and prolonged surface flooding, shallow groundwater, and varying levels of humus content, peat presence, and peat layer thickness [6]. Such variability directly affects radionuclide retention in the soil, its redistribution dynamics, and the rate of transfer into other components of the forest ecosystem.

In the years immediately following the Chornobyl accident, researchers focused on the patterns of radioactive contamination in the dominant tree species of the Ukrainian Polissia forests. By comparing ^{137}Cs activity concentrations in the wood of different species, black alder was identified as a species with a high capacity for accumulating this radionuclide [3]. During the same period, the fractional composition of the aboveground phytomass in *Alnetum* (*glutinosae*)-*ruboso* (*idaei*+*nessensi*)-*variaherbosum* phytocoenosis developed in a damp, relatively fertile site was analyzed, along with the distribution of total ^{137}Cs activity among its components [7]. A significant content of the radionuclide was detected in the soil layer occupied by the tree root systems, with the radionuclide penetrating to depths of 50 - 60 cm. Furthermore, it was found that the majority of ^{137}Cs activity in the aboveground components of phytocoenoses (84.5 %) was concentrated in the tree layer, which was predominantly composed of black alder. This high proportion was attributed not to the radionuclide activity concentration in the tissues and organs of the tree species, but rather to the substantial phytomass of the trees themselves. The elevated radionuclide content in the stem wood of tree species has also been corroborated by other studies [8].

Studies conducted in 2006, twenty years after the Chornobyl accident, in *Alnetum* (*glutinosae*) *thelypteridosum* community in a damp, relatively fertile forest sites revealed a significant content of ^{137}Cs in the soil at a depth of 50 cm. The study also reported considerable radioactive contamination in various plant species across the grass and shrub layer, understory, advanced growth, and tree species [9]. It was also found that the highest ^{137}Cs activity concentrations were observed in green fruits, male inflorescences, and one-year-old shoots. Some of these findings were confirmed by other research investigating ^{137}Cs accumulation in the aboveground parts of herbaceous and shrubby vegetation, as well as ferns and mosses, within the *Alnus glutinosa* + *Scirpus sylvaticus* + *Sphagnum* + *Calliergonella cuspidata* meso-eutrophic bog community in a damp, relatively fertile forest site. These studies found relatively high levels of ^{137}Cs in herbaceous and shrub-layer plants in areas with low density of soil radioactive contamination. This phenomenon was attributed to the weak fixation of ^{137}Cs in the soil, which enhances its bioavailability [10].

During the same period, data were published on the transfer intensity of ^{137}Cs from soil to tree species in various forest and wetland ecosystems of the Western Polissia region of Ukraine [11]. The research was carried out in black alder stands located in wet, relatively infertile, and damp, relatively fertile forest sites within the Rivne Nature Reserve. The study provided values of radionuclide aggregated transfer factors for different parts and organs of black alder. The results indicated that higher aggregated transfer factor values were associated with damp, relatively fertile sites, leading to the conclusion that these conditions promote more intensive uptake of ^{137}Cs by black alder. Furthermore, the highest aggregated transfer factors were recorded in «the biologically active parts and organs» of the trees.

A monograph summrizing long-term research on the biogeochemistry of ^{137}Cs in forest and wetland ecosystems of the Ukrainian Polissia presents detailed data on the distribution and migration of the radionuclide in peat across oligotrophic, mesotrophic, and eutrophic bogs [12]. The study includes information on the specific characteristics of radioactive contamination of mosses, fruiting bodies of macromycetes, vascular plants, and tissues and organs of various tree species, including black alder. The researchers provided a ranking of black alder tissues and organs based on decreasing ^{137}Cs content: green fruits > one-year-old shoots > inner bark > leaves > fine branches > outer bark > coarse branches > wood. Additionally, the study notes that approximately 5 % of the total ^{137}Cs activity within an alder stand is contained in the black alder trees themselves.

Overall, it should be noted that over the past 15 years, research on radionuclide migration in forested ecosystems – particularly in eutrophic and meso-eutrophic bogs, where black alder frequently occurs – has significantly declined. Despite this, wetlands and waterlogged areas are consistently regarded by researchers as critical zones due to the high mobility of radionuclides within them. Understanding the redistribution of radionuclides among the components of biogeocoenoses over different time periods following initial contamination is essential for predicting the future trajectory of radioactive pollution in the environment. Therefore, studies focusing on the specific patterns of ^{137}Cs uptake by plant species that serve as edificators, such as black alder, are highly relevant. Such research can greatly enhance our understanding of radionuclide behaviour and redistribution across biogeocoenotic components under varying soil moisture conditions.

2. Objects and methodology

The research was conducted during 2022 - 2023 in forest stands managed by the Branch “Luhyny Forestry” of the State Specialized Forest Enterprise “Forests of Ukraine”, located in the northern part of Zhytomyr Region, Ukraine (Fig. 1). To determine the locations of the sample plots (SPs), we used the subcompartment database developed by the Production Association “Ukrderzhlisproekt” (2017), along with updated data on radioactive contamination of forests from recent years. SPs measuring 100 × 100 m (1 ha) were established according to standard methodology [13]. These plots were located on sites with similar soil fertility (relatively fertile sites) but differing moisture conditions – classified as moist (3), damp (4), and wet (5).

Sample plot 13 (SP-13) is located in Bovsunivskyi Forestry (compartment 34, subcompartment 19; coordinates: 51°06'59.1"N, 28°29'28.5"E). The stand is characterized by the following features:

Fig. 1. Location of SPs on the map of ^{137}Cs contamination [14] (2006). SP-13 – moist, relatively fertile site (C_3); SP-8 – damp, relatively fertile site (C_4); SP-12 – wet, relatively fertile site (C_5). (See color Figure on the journal website.)

composition – 50 % black alder, 30 % silver birch, 20 % English oak, with the presence of Eurasian aspen and Scots pine; stand age – 72 years; average height – 23 m; average diameter – 26 cm; stand quality class – I; forest site type – moist, relatively fertile site (C_3); relative density of stocking – 0.65; and growing stock – 270 $m^3 \cdot ha^{-1}$. The phytocoenosis is classified as *Pineto-Querceto-Alnetum* (*glutinosae*)-*franguloso-ruboso* (*idaei*)-*majanthemosum*. The soil is a rich variant of soddy-slightly podzolic soil. The moisture regime is highly dynamic with no flooding. The average annual groundwater table is located at a depth of 100 - 110 cm.

Sample plot 8 (SP-8) is located in Luhyny Forestry (compartment 85, subcompartment 26; coordinates: 51°06'54.0"N, 28°29'23.8"E). The stand has the following characteristics: species composition – 60 % black alder and 40 % silver birch; stand age – 50 years; average height – 18 m; average diameter – 18 cm; stand quality class – II; forest site type – damp, relatively fertile site (C_4); relative density of stocking – 0.70; and growing stock – 160 $m^3 \cdot ha^{-1}$. The phytocoenosis is classified as *Betuleto (pendulae)-Alnetum (glutinosae)-caricetum acutiformis*. The soil is soddy highly podzolic, superficially peaty, and gleyed. The moisture regime is moderately flowing, with periodic spring flooding. The average groundwater level is at a depth of 5 - 10 cm.

Sample plot 12 (SP-12) is located in Luhyny Forestry (compartment 85, subcompartment 29; coordinates: 51°07'21.8"N, 28°25'37.6"E). The stand is characterized by the following parameters: species composition – 90 % black alder and 10 % silver birch, with the presence of Scots pine; stand age – 85 years; average height – 24 m; average diameter – 26 cm; stand quality class – II; forest site type – wet, relatively fertile site (C_5); relative density of stocking – 0.50; and growing stock – 200 $m^3 \cdot ha^{-1}$. The phytocoenosis is classified as *Betuleto (pendulae)-Alnetum* (*glutinosae*)-*cariceto-scirpetum* (*sylvaticus*). The soil is soddy highly podzolic and characterized as ferruginous-illuvial-humified. The moisture regime is stagnant, with periodic flooding. The groundwater level fluctuates significantly throughout the year, ranging from the soil surface to a depth of 30 - 40 cm.

The density of ^{137}Cs soil contamination was recorded as follows: 352 ± 48 $kBq \cdot m^{-2}$ (9.5 ± 1.3 $Ci \cdot km^{-2}$) in the moist, relatively fertile site (C_3); 180 ± 36 $kBq \cdot m^{-2}$ (4.8 ± 1.0 $Ci \cdot km^{-2}$) in the damp, relatively fertile site (C_4); and 245 ± 36 $kBq \cdot m^{-2}$ (6.6 ± 1.0 $Ci \cdot km^{-2}$) in wet, relatively fertile site (C_5).

Within each SP, the parameters of the average tree were determined based on a complete inventory of all trees. Subsequently, three black alder trees with characteristics closest to the calculated average were selected at each of the SPs and felled for sampling. From each tree, samples of wood, as well as inner and outer bark, were collected at three heights along the trunk: lower, middle, and upper sections. Additional samples were taken from various parts of the crown – lower, middle, and upper – including leaves, fruits, male inflorescences, one- and two-year-old shoots, and branches categorized as fine (≤ 5 cm in diameter) and coarse (> 5 cm in diameter). To assess the density of soil radioactive contamination, three composite soil samples were prepared within the crown projection area of each selected tree. Each composite sample consisted of five subsamples collected using a soil auger (5 cm in diameter) to a depth of 25 cm, applying the envelope method within the 1 × 1 m survey plot. All samples were dried, crushed, and analyzed using the SEG-001 “AKP-S” spectroanalyzer equipped with a BDEG-20R2 scintillation detector. The average relative error of radionuclide activity measurement was ± 15 % at a 95 % confidence level.

^{137}Cs aggregated transfer factor (T_{ag}, m^2·kg^{-1}·10^{-3}) was calculated as the ratio of ^{137}Cs activity concentration in a specific part or organ of black alder (A_m (the amount of radionuclide per sample unit mass), Bq·kg^{-1}) to the density of ^{137}Cs contamination (A_s (the amount of radionuclide per unit area), kBq·m^{-2}), according to the formula: $T_{ag} = A_m / A_s$. Statistical analysis of the results was performed using standard methods in Microsoft Excel (Descriptive Statistics, Anova: Single Factor).

3. Results and discussion

The studied forests were heavily contaminated by radionuclides released during the Chornobyl Nuclear Power Plant accident. In some areas, forestry operations have either been completely halted or subjected to restrictions on timber use. This forestry enterprise is representative of the Zhytomyr Polissia region, both in terms of radioactive contamination specificities and the distribution of forest site conditions and dominant forest-forming species. According to the latest forest inventory (Table 1), the enterprise still manages extensive areas of forest affected by radionuclide contamination.

The largest areas and highest levels of forest radioactive contamination were recorded in the northern part of the forestry enterprise, located within the western ‘footprint’ of radionuclide releases from the Chornobyl accident. Initial surveys of the forest stands revealed significant heterogeneity in the spatial distribution of radioactive contamination – a pattern that remains evident in the current SPs. The density of soil ^{137}Cs contamination around the studied trees varied within the following ranges: 239 - 488 kBq·m^{-2} in SP-13, 139 - 281 kBq·m^{-2} in SP-8, 180 - 332 kBq·m^{-2} in SP-12.

Table 1. **Distribution of forest land area in the Branch “Luhyny Forestry” by soil radioactive contamination density with ^{137}Cs as of 01.01.2018 [15]**

Zone	Density of radioactive contamination, kBq·m^{-2} (Ci·km^{-2})	Area, ha
3a	37.1 - 74.0 (1.01 - 2.00)	8490.1
3b	74.1 - 185.0 (2.01 - 5.00)	14009.6
2a	185.1 - 259.0 (5.01 - 7.00)	4072.3
2b	259.1 - 370.0 (7.01 - 10.00)	2941.8
2c	370.1 - 555.0 (10.01 - 15.00)	641.4
1a	555.1 and more (15.01 and more)	1011.0
Total		**31166.2**

Table 2. **^{137}Cs activity concentration in the bark and wood of black alder in the lower (stem base), middle, and upper trunk sections in different forest site conditions**

Sampling location on the trunk	Parts of bark and wood	^{137}Cs activity concentration (Bq·kg^{-1}) in forest site conditions*		
		Moist, relatively fertile site (C_3)	Damp, relatively fertile site (C_4)	Wet, relatively fertile site (C_5)
Lower trunk section	Bark (outer part)	346 ± 12	216 ± 13	299 ± 47
	Bark (inner part)	671 ± 33	521 ± 15	875 ± 115
	Wood without bark	321 ± 19	198 ± 19	322 ± 31
Middle trunk section	Bark (outer part)	675 ± 41	468 ± 15	843 ± 9
	Bark (inner part)	849 ± 30	684 ± 21	1351 ± 217
	Wood without bark	363 ± 24	234 ± 15	373 ± 40
Upper trunk section	Bark (outer part)	1145 ± 33	972 ± 54	1775 ± 181
	Bark (inner part)	1029 ± 50	792 ± 19	1377 ± 67
	Wood without bark	535 ± 19	342 ± 32	504 ± 18

* The Table shows random errors in radionuclide activity concentration measurement.

Data obtained 36 years after the Chornobyl accident (2022 - 2023) indicate that ^{137}Cs continues to accumulate in the components of the black alder trunk (Table 2). This is particularly evident from the higher radionuclide activity concentrations found in the inner bark of the lower and middle trunk sections across all SPs. Since the inner bark represents tissue formed in recent years, these findings suggest ongoing radionuclide uptake. For example, in the lower trunk section, the ^{137}Cs activity concentration in the inner bark was 1.9 times higher than in the outer bark in SP-13, 2.4 times higher in SP-8, and 2.9 times higher in SP-12. In the middle trunk section, this difference was 1.3 times in SP-13, 1.5 times in SP-8, and 1.6 times in SP-12. Across all SPs, greater differences between inner and outer bark concentrations in the lower and middle trunk sections were observed in sites with higher soil moisture. This indicates that increased soil moisture enhances the migration capacity of the radionuclide in the soil. Conversely, in the upper trunk sections, ^{137}Cs concentrations were higher in the outer bark than in the inner bark. This may suggest a gradual decline in the upward transport of the radionuclide, despite its continued uptake into the trunk.

The ^{137}Cs activity concentration in wood was significantly lower than in various parts of the bark. A clear upward trend in radionuclide concentration was observed from the base of the trunk to its top. For example, in SP-13, ^{137}Cs activity concentration in wood gradually increased from 321 ± 19 to 535 ± 19 Bq·kg^{-1}; in SP-8, from 198 ± 19 to 342 ± 32 Bq·kg^{-1}; and in SP-12, from 322 ± 31 to 504 ± 18 Bq·kg^{-1}. This pattern can be attributed to the presence of pre-accident wood in the lower and middle trunk sections. The proportion of such older wood is greatest at the base of the trunk, decreases in the middle, and is absent in the upper section. Since the wood samples were obtained by felling the trees and cutting through the entire trunk with a chainsaw, each sample contained all the annual growth layers present in that specific trunk section.

Significant variation in the ^{137}Cs activity concentration was observed among the different parts and organs of black alder crowns across all SPs (Table 3). The highest concentrations were recorded in the generative organs – specifically, male inflorescences and fruits – while the lowest levels were found in the leaves. For example, the ^{137}Cs activity concentration in male inflorescences was 5.3 times higher than in leaves in SP-13, 4.5 times higher in SP-8, and 2.7 times higher in SP-12. The difference decreased with increasing soil moisture at the SPs, suggesting that growing conditions influence the distribution of the radionuclide within crown components. The high levels of radioactive contamination in fruits restrict their use for medicinal purposes. Notably elevated activity concentrations in one-year-old shoots indicate ongoing and active uptake of ^{137}Cs. From a practical standpoint, data on radionuclide concentrations in coarse branches, often used as fuelwood, are also important. Although the ^{137}Cs activity concentration in coarse branches was the lowest among the studied crown components, their utilization still requires routine radiological monitoring. These findings are consistent with the observed patterns of radionuclide accumulation in trunk wood.

Table 3. **^{137}Cs activity concentration in parts and organs of the black alder crown in different forest site conditions**

Parts and organs of the crown	^{137}Cs activity concentration, Bq·kg^{-1}*		
	Moist, relatively fertile site (C_3)	Damp, relatively fertile site (C_4)	Wet, relatively fertile site (C_5)
Leaves	162 ± 18	379 ± 18	1276 ± 178
One-year-old shoots	606 ± 134	1274 ± 114	2044 ± 143
Two-year-old shoots	338 ± 55	1058 ± 48	1212 ± 91
Fine branches	234 ± 44	735 ± 71	959 ± 60
Coarse branches	173 ± 40	403 ± 49	727 ± 60
Fruits	735 ± 145	1784 ± 109	2507 ± 205
Male inflorescences	864 ± 157	1723 ± 47	3460 ± 309

*The Table shows random errors in radionuclide activity concentration measurement.

Table 4. **^{137}Cs aggregated transfer factor in parts and organs of black alder crown in different forest site conditions**

Parts and organs of the crown	^{137}Cs aggregated transfer factor, m^2·kg^{-1}·10^{-3}		
	Moist, relatively fertile site (C_3)	Damp, relatively fertile site (C_4)	Wet, relatively fertile site (C_5)
Leaves	0.5 ± 0.1	2.1 ± 0.3	5.2 ± 1.1
One-year-old shoots	1.7 ± 0.4	7.1 ± 1.6	8.3 ± 1.4
Two-year-old shoots	1.0 ± 0.3	5.9 ± 1.2	4.9 ± 0.8
Fine branches	0.7 ± 0.2	4.1 ± 0.9	3.9 ± 0.6
Coarse branches	0.5 ± 0.2	2.2 ± 0.5	2.9 ± 0.5
Fruits	2.1 ± 0.7	9.9 ± 2.1	10.2 ± 1.5
Male inflorescences	2.5 ± 0.8	9.6 ± 1.9	14.1 ± 2.4

The aggregated transfer factor (T_{ag}) serves as an informative indicator of the intensity of radionuclide uptake and accumulation by plant tissues. The results (Table 4) show that the highest T_{ag} values were recorded in fruits, male inflorescences, and one-year-old shoots, while the lowest values were observed in leaves and coarse branches. As ^{137}Cs is a chemical analogue of potassium, it tends to accumulate more readily in metabolically active, young tissues and organs. This explains the elevated aggregated transfer factors observed in generative organs and annual shoots. In contrast, coarse branches, composed primarily of mature woody tissue, exhibited the lowest T_{ag} values. Notably, higher T_{ag} values were recorded in SPs with greater soil moisture. For instance, compared to the moist, relatively fertile site, the wet, relatively fertile site exhibited T_{ag} increases of 10.4-fold for leaves, 4.9-fold for one-year-old shoots, 4.9-fold for two-year-old shoots, 5.6-fold for fine branches, 5.8-fold for coarse branches, 4.9-fold for fruits, and 5.6-fold for male inflorescences.

A statistically significant difference in ^{137}Cs aggregated transfer factors (T_{ag}) was observed among all parts and organs of the black alder crown under moist and damp site conditions, with F-values ranging from 16.5 to 74.1, all exceeding the critical value $F_{crit\,(0.95)} = 4.67$ and p = 0.001. A similar pattern was found when comparing moist and wet sites, where F-values ranged from 22.2 to 105.9 and exceeded $F_{crit\,(0.95)} = 4.49$, with p = 0.0002. However, between damp and wet, relatively fertile sites, significant differences in T_{ag} were identified only in black alder leaves and coarse branches, where F-values ranged from 4.9 to 26.1, surpassing $F_{crit\,(0.95)} = 4.67$, with p = 0.044.

In sample plot SP-12, additional sampling was conducted to assess ^{137}Cs activity concentrations in various crown parts at different heights (Fig. 2). The general distribution patterns of ^{137}Cs among the different crown components, previously described, were found to be consistent, regardless of the vertical position within the crown.

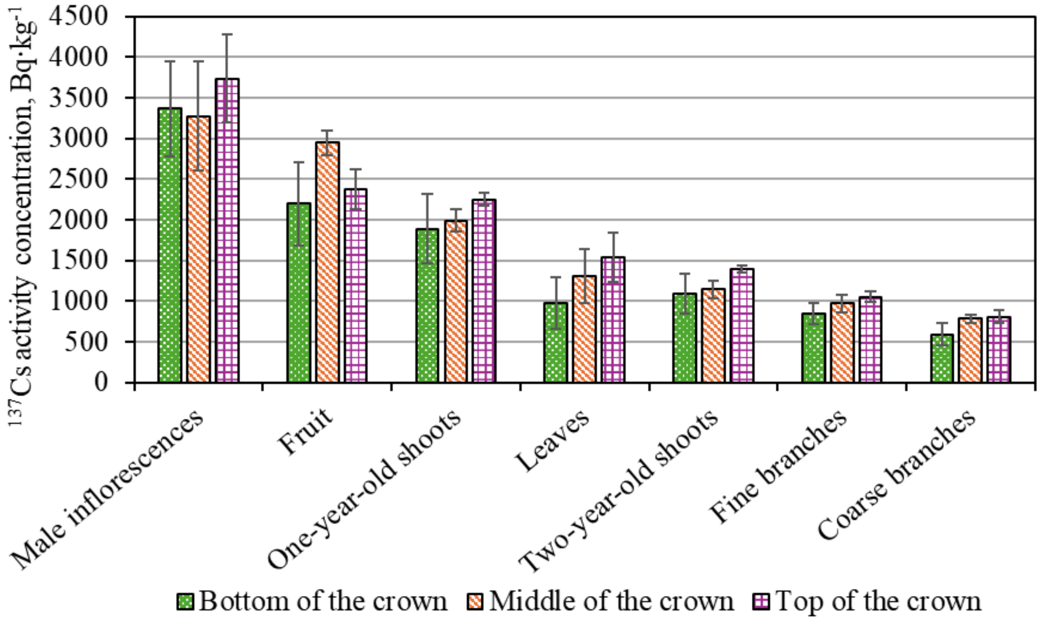

Fig. 2. Distribution of ^{137}Cs activity concentration ($Bq \cdot kg^{-1}$) in parts and organs of black alder crown at different heights in wet, relatively fertile sites (C_5). (See color Figure on the journal website.)

A slight increase in ^{137}Cs content was also observed from the bottom to the top of the crown. This pattern may be attributed to the physiological characteristics of black alder, the timing of the formation of certain parts of the crown.

4. Conclusions

Black alder grows under a range of soil moisture conditions, which significantly influence the redistribution of ^{137}Cs in soil and its subsequent uptake by forest vegetation. In wet sites, the radionuclide is more actively taken up and accumulated in various parts and organs of both the trunk and crown. The aggregated transfer factor of ^{137}Cs increases markedly from moist to wet, relatively fertile sites, as follows: from 0.5 to 5.2 $m^2 \cdot kg^{-1} \cdot 10^{-3}$ in leaves, from 1.7 to 8.3 $m^2 \cdot kg^{-1} \cdot 10^{-3}$ in one-year-old shoots, from 1.0 to 4.9 $m^2 \cdot kg^{-1} \cdot 10^{-3}$ in two-year-old shoots, from 0.7 to 3.9 $m^2 \cdot kg^{-1} \cdot 10^{-3}$ in fine branches, from 0.5 to 2.9 $m^2 \cdot kg^{-1} \cdot 10^{-3}$ in coarse branches, from 2.1 to 10.2 $m^2 \cdot kg^{-1} \cdot 10^{-3}$ in fruits, and from 2.5 to 14.1 $m^2 \cdot kg^{-1} \cdot 10^{-3}$ in male inflorescences. Lower ^{137}Cs activity was found in the outer layers of the bark compared to the inner layers, suggesting a gradual decline in the radionuclide uptake from the soil over time. Across all forest site conditions, the lowest levels of ^{137}Cs content were consistently observed in the wood, whereas the highest values were found in the fruits, male inflorescences, and one-year-old shoots.

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СУЧАСНІ ОСОБЛИВОСТІ РАДІОАКТИВНОГО ЗАБРУДНЕННЯ ВІЛЬХИ ЧОРНОЇ У РІЗНИХ ТИПАХ ЛІСОРОСЛИННИХ УМОВ ПОЛІССЯ УКРАЇНИ

Проведено дослідження щодо сучасного розподілу ^{137}Cs у тканинах та органах різних типів лісорослинних умов у деревостанах вільхи чорної (*Alnus glutinosa* (L.) Gaerth.). Встановлено, що у мокрих сугрудах відбувається найінтенсивніше надходження радіонукліда до різних частин стовбура та крони вільхи чорної. Виявлено, що величини коефіцієнта переходу збільшуються від вологих до мокрих сугрудів: у листках – від 0,5 до 5,2 $м^2·кг^{-1}·10^{-3}$; у пагонах 1-річних – від 1,7 до 8,3 $м^2·кг^{-1}·10^{-3}$; у пагонах 2-річних – від 1,0 до 4,9 $м^2·кг^{-1}·10^{-3}$; у гілках тонких – від 0,7 до 3,9 $м^2·кг^{-1}·10^{-3}$; у гілках товстих – від 0,5 до 2,9 $м^2·кг^{-1}·10^{-3}$; у супліддях – від 2,1 до 10,2 $м^2·кг^{-1}·10^{-3}$ та у суцвіттях чоловічих – від 2,5 до 14,1 $м^2·кг^{-1}·10^{-3}$. Достовірна різниця коефіцієнтів переходу спостерігається майже між усіма частинами і органами крони вільхи чорної у вологих, сирих та мокрих умовах. У мокрих сугрудах встановлено невелике збільшення вмісту ^{137}Cs від низу крони до її вершини.

Ключові слова: Alnus glutinosa (L.) Gaerth., деревостан, гігротоп, радіонуклід, цезій, питома активність, щільність радіоактивного забруднення ґрунту, коефіцієнт переходу.

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