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# INFLUENCE OF RAILWAY TRACKS ON THE DISTRIBUTION OF ADVENTIVE FLORA IN THE CHERKASY REGION

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Increasing anthropogenic influence on natural phytocenoses leads to impoverishment of the species composition of regional flora. Transformed territories became the basis for their appearance, from where they penetrate into semi-natural and natural phytocenoses, creating a threat to the existence of certain species, or even the functioning of certain ecosystems. The processes of adventitization create a real threat to the phytodiversity of the territory of Ukraine. According to the level of adventitization of the flora, Ukraine occupies a rather high place among other floras of the world, and now the spontaneous fraction of the adventitious flora of Ukraine includes more than 830 species of vascular plants.

The list of species of adventitious plants of the spontaneous flora of the Cherkasy region was compiled on the basis of data collected during floristic surveys by route-expedition method, which were carried out during May-September 2020-2022. The research covered different ecotopes in terms of the degree of transformation and the direction of economic use of the site. Special floristic studies covered areas along transport, primarily railway routes, landfills, garbage dumps, and wastelands.

The carried out fractional analysis of the flora of the territory around the railways of the Cherkasy region showed that the most numerous is the adventitious fraction (54.4%), apophytes make up 32.6%, species of natural flora – 13.0%. The adventitious fraction of the studied flora is represented by 132 species belonging to 101 genera and 30 families. According to the time of entry, 53.2% of species belong to the group of chenophytes, the rest belong to archaeophytes (46.8%).

According to the method of introduction, the adventitious fraction of the studied flora includes acolytophytes (55.7%), spontaneously introduced plant species that gradually populated anthropogenically transformed ecotopes. Analysis of the life forms of the adventitious fraction of the studied flora showed the dominance of annuals (64.8%). A much smaller number of perennial species (31.2%), which is related to the extreme conditions of their existence, and only 4,0% of species belong to trees and shrubs.

**Key words:** territories around railways, adventive flora, Cherkasy region.

**Relevance of the topic of research.** The main process of flora transformation, which is rapidly occurring in the Cherkasy region, is the enrichment of adventitious plant species. They penetrate natural phytocenoses and plant communities of anthropogenic habitats and determine their composition and structure.

One of the main sources of emergence and spread of adventitious plants in Cherkasy Oblast are railway tracks, the length of which exceeds 604.8 m. km On them, as in special ecotopes, peculiar plant groups with mainly adventive plant species are formed, which migrate to the adjacent phytocenoses and enrich the aboriginal flora.

Among adventive plants, there are many harmful and quarantine weeds, dangerous, poisonous and allergenic species, as well as plants that can be useful. Therefore, the study of the emergence of new species of adventitious plants that enter the region by railways is of extremely urgent importance today.

**The purpose of research**. Study of the territory around railways in Cherkasy region regarding the distribution of adventitious flora.

**Literature Review**. The history of the study of railway flora consists of several stages. The first stage is associated with the appearance of railways as special ties to areas where new plants were discovered. Railways, starting from the moment of their appearance, attracted the attention of botanists. Initially, railways were not distinguished by researchers into a separate type of landscape, which is characterized by specific ecological "conditions and flora" [1-3]. They were only a kind of binding of plant findings at the places of growth. The next stage of the study of flora

is characterized by the identification of the species composition of plants that grow on railways, as well as the study of some patterns of flora development [4]. At the third stage, a comprehensive, large-scale, complex, botanical study of railways takes place. Views on this issue have been developing for a long time, but a large number of studies do not reveal the variety of flora-genetic processes that occur here or reflect only some of them [5]. Therefore, it is of great interest to study the regularities of the formation of the flora of the railways of Ukraine.

One of the main components that play an important role in the formation of regional flora is the flora of railways, which is classified as anthropogenically transformed – flora and man-made ecotopes that have no natural analogues [6-8]. Any flora is a dynamic, developing, hierarchical system of subsidiary flora. Therefore, an analysis of its elements is necessary for a detailed study of the regional flora [9].

Since the railway is the main source of the appearance of new economically valuable or harmful plants capable of naturalization in the places of entry, the study of this type of flora is important. Information about the time of the initial appearance of these species is necessary for understanding the historical development of the flora, and can be useful for quarantine inspection [10].

**Materials and Methods**. In the article, we use the following research methods: deduction, induction, analysis, synthesis, explanation.

The list of species of adventitious plants of the spontaneous flora of the Cherkasy region was compiled on the basis of data collected during floristic surveys by route-expedition method, which were carried out during May-September 2020-2022. The research covered different ecotopes in terms of the degree of transformation and the direction of economic use of the site. Special floristic studies covered areas along transport, primarily railway routes, landfills, garbage dumps, and wastelands.

**Results and Discussion.** The flora of the railways of Central Ukraine was formed against the background of the regional flora as an anthropogenic inclusion. The studied territory is the Cherkasy region [11].

Cherkasy region is located in the central part of Ukraine, in the basin of the middle course of the Dnieper. It borders Kyiv Oblast to the north, Poltava Oblast to the east, Kirovohrad Oblast to the south, and Vinnytsia Oblast to the west.

The area of Cherkasy region is 20.9 thousand square meters. kilometers, which is 3.5% of the territory of the state (18th place in Ukraine).

The region stretched from southwest to northeast for 245 km, from north to south for 150 km. The extreme northern point lies near the village of Kononivka in the Drabiv district, the southern one – near the village of Kolodiste in the Talniv district, the western one – near the village of Korytnia in the Zhashkiv district, and the eastern one – near the village of Stetsivka in the Chigyryn district. According to mathematical calculations, the geographic center of the region is a point near the village of Zhuravky in the Horodyshchen district.



**Fig. 1. Map of Cherkasy region**

The climate of the region is moderately continental. Winter is mild, with frequent thaws. Summer is warm, hot in some years, westerly winds bring precipitation. The average temperature of the coldest month, January, is 5.9°C. The average temperature in summer is + 19°C.

Favorable climatic conditions contribute to the significant biodiversity of the region. The nature reserve fund includes 540 territories and objects, of which 22 are of national importance and 518 are of local importance. The indicator of the reserve is 3.1% of the area of the region. Forests grow mostly on the banks of rivers, steppe vegetation is common in watersheds. Oak-hornbeam forests (oak, hornbeam, maple, linden, ash) predominate in the Kanev region and to the southeast of it, while oak-ash and hornbeam forests prevail in the southwestern, southern, and central parts. Cherkasy Bir (pine, oak, maple, birch) is the southernmost limit of the natural distribution of the Transdnieper coniferous forests in Ukraine. The area of forestry land in the region is 338.5 thousand ha. The area of forestry land covered by forest vegetation is 318.3 thousand hectares, i.e. the forest cover is 15.2% of the area of the region [12].

In the Cherkasy region, there are 334 species of vascular plants (17% of the region's flora), which are under threat of extinction. Among them, 69 species are included in the Red Book of Ukraine, 14 are included in Appendix I of the Berne Convention, 7 are protected in Europe – the European Red List, 3 – on a global scale.

According to typological analysis, compared to the regional flora, the share of geo-, helo- and hydrophytes in the flora of railways decreases, and the number of annual, biennial, xeromesophytes, and therophytes increases. Synanthropic florocenotype significantly prevails over others. And the role of zonal species in the flora of railways (especially forest, swamp, hydrophilic) is decreasing.

Most of the species of flora are palearctic and adventive. These ratios reflect the life strategy of plants in this type of ecotope.

During the study of the flora of the railways of the region, a number of processes characteristic of modern florogenesis were revealed, which determine its genesis: introduction, distribution and naturalization of types of enrichment of adventitious elements of the flora; general adaptation of plant cover to anthropogenic influence [14].

Adaptation of vegetation cover to anthropogenic influence on railways is manifested at different levels: at the level of floral complexes, at the species level (general xerophytization of vegetation cover, selection of juvenile, anemochorous, widely distributed species without specialized underground shoots); on the population (micro evolutionary processes, hybridization, territorial changes), individual (dwarf forms of plants).

The carried out fractional analysis of the flora of the territory around the railways of the Cherkasy region showed that the most numerous is the adventitious fraction (54.4%), apophytes make up 32.6%, species of natural flora – 13.0%. The adventitious fraction of the studied flora is represented by 132 species belonging to 101 genera and 30 families. According to the time of entry, 53.2% of species belong to the group of chenophytes, the rest belong to archaeophytes (46.8%).

According to the method of introduction, the adventitious fraction of the studied flora includes acolytophytes (55.7%), spontaneously introduced plant species that gradually populated anthropogenically transformed ecotopes. Analysis of the life forms of the adventitious fraction of the studied flora showed the dominance of annuals (64.8%). A much smaller number of perennial species (31.2%), which is related to the extreme conditions of their existence, and only 4,0% of species belong to trees and shrubs [13].

**Conclusions.** The processes of adventitization create a real threat to phytodiversity on the territory

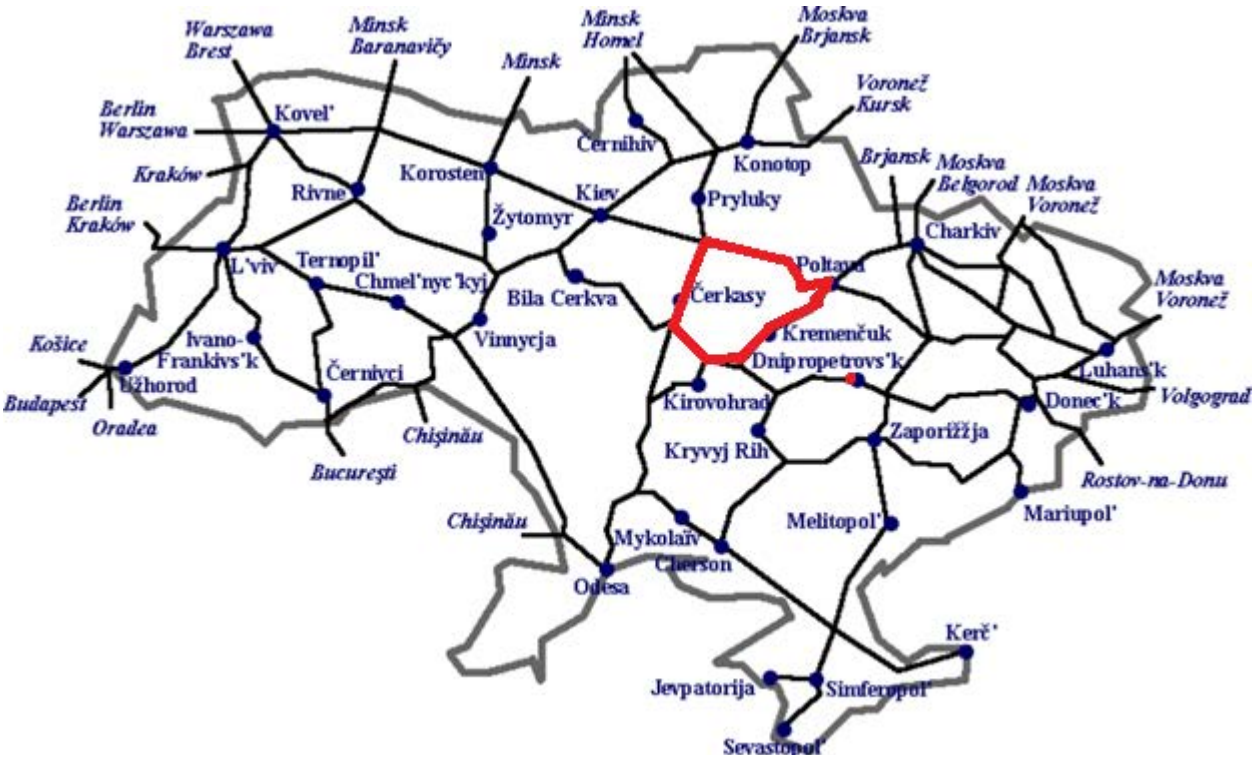



**Fig. 2. Scheme of railway tracks**

Table 1

**List of species of woody plants – representatives of the adventive flora of the Cherkasy region**

| № | Cluster | Species name | State spread |
|---|---|---|---|
| 1 | I | *Ailanthus altissima* (Mill.) Swingle | Satisfactory |
| 2 | II | *Robinia preudoacacia* L. | Satisfactory |
| 3 | I | *Amorpha fruticosa* L. | Satisfactory |
| 4 | II | *Phellodendron amurense* Rupr. | Satisfactory |
| 5 | II | *Sambucus racemosa* L. | Satisfactory |
| 6 | I | *Sambucus nigra* L. | Satisfactory |
| 7 | I | *Syringa vulgaris* L. | Satisfactory |
| 8 | I | *Ulmus pumila* L. | Satisfactory |
| 9 | II | *Salix fragilis* L. | Satisfactory |
| 10 | I | *Gleditsia traicanthos* L. | Satisfactory |
| 11 | I | *Quercus rubra* L. | Satisfactory |
| 12 | II | *Amelanchier alnifolia* Nutt. | Satisfactory |
| 13 | II | *Amelanchier spicata* (Lam.) C. Koch. | Satisfactory |
| 14 | I | *Caragana arborescens* Lam. | Satisfactory |
| 15 | I | *Acer negundo* L. | Satisfactory |
| 16 | II | *Tilia tomentosa* Moench | Satisfactory |
| 17 | II | *Mahonia aquifolium* (Pursh) Nutt. | Satisfactory |
| 18 | I | *Elaeagnus angustifolia* L. | Satisfactory |
| 19 | II | *Hippophae rhamnoides* (L.) A. Nelson | Satisfactory |
| 20 | II | *Lycium barbatum* L. | Satisfactory |
| 21 | I | *Cercis siliquastrum* L | Satisfactory |
| 22 | II | *Rosa rugosa* Thunb. | Satisfactory |
| 23 | II | *Rosa chinensis* Jacq. | Satisfactory |
| 24 | I | *Morus alba* L. | Satisfactory |
| 25 | I | *Morus nigra* L. | Satisfactory |

Table 2

**List of adventitious species of herbaceous plant fund**

| № | Cluster | Species name | State spread |
|---|---|---|---|
| 1 | I | *Ambrosia artemisiifolia* L. | Satisfactory |
| 2 | III | *Centaurea diffusa* Lam. | Unsatisfactory |
| 3 | III | *Galinsoga parviflora* Cav. | Unsatisfactory |
| 4 | I | *Grindelia squarrosa* (Pursh.) Dunal. | Satisfactory |
| 5 | I | *Solidago canadensis* L. | Satisfactory |
| 6 | III | *Cuscuta campestris* Yunck. | Satisfactory |
| 7 | III | *Artemisia annua* L. | Satisfactory |
| 8 | I | *Helianthus tuberosus* L. | Unsatisfactory |
| 9 | I | *Bidens frondosa* L. | Satisfactory |
| 10 | I | *Iva xanthiifolia* Nut. | Satisfactory |
| 11 | III | *Amaranthus albus* L. | Satisfactory |
| 12 | III | *Amaranthus retroflexus* L. | Satisfactory |

of Ukraine. Every year, the number of non-native plants increases, the range of their habitats expands, the rates of introduction, distribution and degree of naturalization increase. The flora of railways is characterized by a simplified taxonomic structure and an impoverished species composition of the aboriginal fraction. A significant number of adventive (38%) and cultivated (17%) species in the flora of the railways indicates the undoubted belonging of the flora of the railways to the synanthropic one [15].

During the study of the flora of the railways of the region, a number of processes characteristic of modern florogenesis were revealed, which determine its genesis: introduction, distribution and naturalization of types of enrichment of adventitious elements of the flora.

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# ВПЛИВ ЗАЛІЗНИЧНИХ КОЛІЙ НА РОЗПОВСЮДЖЕННЯ АДВЕНТИВНОЇ ФЛОРИ В ЧЕРКАСЬКІЙ ОБЛАСТІ

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Посилення антропічного впливу на природні фітоценози призводить до збіднення видового складу регіональних флор. Трансформовані території стали основою для їх появи, звідки вони проникають у напівприродні та природні фітоценози, створюючи загрозу існуванню окремих видів, або навіть функціонуванню окремих екосистем. Процеси адвентизації створюють реальну загрозу фіторізноманіттю території України. За рівнем адвентизації флори Україна займає досить високе місце серед інших флор світу і нині спонтанна фракція адвентивної флори України нараховує понад 830 видів судинних рослин.

Перелік видів адвентивних рослин спонтанної флори Черкаської області складено на основі даних, зібраних під час флористичних обстежень маршрутно-експедиційним методом, які проводились протягом травня-вересня

2020-2022 років. Дослідження охоплювали різні екотопи за ступенем перетвореності та напрямком господарського використання ділянки. Спеціальні флористичні дослідження охоплювали території вздовж транспортних, насамперед залізничних шляхів, звалищ, сміттєзвалищ, пустирів.

Проведений фракційний аналіз флори території навколо залізниць Черкаської області показав, що найбільш чисельною є адвентивна фракція (54,4%), апофіти становлять 32,6%, види природної флори – 13,0%. Адвентивна частка досліджуваної флори представлена 132 видами, які належать до 101 роду та 30 родин. За часом надходження 53,2 % видів належать до групи хенофітів, решта – до археофітів (46,8 %).

За способом інтродукції до адвентивної фракції досліджуваної флори належать аколітофіти (55,7%) – спонтанно інтродуковані види рослин, які поступово заселяли антропогенно трансформовані екотопи. Аналіз життєвих форм адвентивної фракції досліджуваної флори показав домінування однорічних (64,8%). Значно менша кількість багаторічних порід (31,2%), що пов'язано з екстремальними умовами їх існування, і лише 4,0% видів належать до деревно-чагарникових порід.

**Ключові слова:** території навколо залізниць, адвентивна флора, Черкаська область.

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