

Alien flora of Ukraine: structure and dynamics in a historical aspect

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Ukrainian alien flora is the most dynamic and progressing group in the flora. Its influence on the structure, dynamics, and florogenesis has increased significantly over the last centuries. Diversity of analyzed flora is determined by natural conditions of the territory and the geographical location of Ukraine, which provides transcontinental and trans-zonal transport connection. In the southern and southeastern regions of Ukraine, which are characterized by a higher degree of anthropogenic environmental transformation, synanthropization of the flora occurs faster. On the other hand, in the north and northwest, this process is much slower due to the better preservation of the natural vegetation cover.

In Ukraine, the synanthropization of flora is intensifying, which significantly affects the environment at all levels, from population-species to ecosystem levels. The current wealth of alien flora includes 1043 taxa. The following trends are visible: i) an increase in the number of alien species (in 1855 – 3%, in 1900 – 6%, in 1950 – 10%, in 2002 – 14%, in 2025 – 17.4%); ii) an expansion of the spectrum of their habitats; iii) an expansion of florogenetic relationships; iv) an increase in the degree of naturalization of species, etc. The growth of the main parameters of the flora is indicative, for example, in 2002 the synantropization index (Is) was 389, modernization index – 2.6 and unstable index (Iunst.) – 429 and in 2025: Is – 629, Im – 3.25, Iunst. – 648. The high dynamics of the development of alien flora affects the restructuring of floristic proportions and the structure of the regional flora, strengthens its xeromorphic features, geographical and florogenetic connections with the floras of arid regions of the globe, especially with the Ancient Mediterranean, the central and southwestern regions of North America, and the Chilean-Patagonian arid regions of South America. Ukraine's alien flora includes many Cosmopolitans, Hemicosmopolitans, and European-Mediterranean-Iranian-Turanianorigin species. The main changes in the taxonomic structure are caused by the appearance among the leading families of Rosaceae and the increase in the rank of Poaceae, as well as the incompleteness and instability of the spectra of the leading genera. The main reasons for such changes are: i) intensive introduction of new alien species; ii) formation of hybrids; iii) climatic influence; iv) modern nomenclatural and taxonomic revisions, etc. The ratio of individual groups of life forms of species practically did not change during the analyzed period, but their quantitative composition increased significantly. Agriophytes have the most specific spectrum of life forms, close in structure to the aboriginal flora. The predominance of taproot plants indicates the "Mediterranean" nature of the analyzed flora.

Until the second half of the 20th century, alien plant species were most often components of ruderal and segetal habitats. Subsequently, they actively began to overcome the coenotic barrier and become part of natural plant communities.

Invasive species (43) are one of the most significant groups of alien species in Ukrainian flora. All of them are distinguished by different representations in regions, participation, and role within anthropogenic and natural biotopes. They form a stable component of meadow, forest, and shrub habitats.

A group of highly active species (60) was also identified, which are characterized by: i) the specificity of the composition in each of the botanical and geographical regions of Ukraine; ii) more successful adaptation to the natural conditions of Ukraine of species with transcontinental and transzonal types of ranges, in particular of North American and East Asian origin, which are distributed mainly in western, most often forest areas; iii) a decrease in the number and activity of species, as well as the stable component, in the southern direction along the latitudinal gradient; and iv) an increase in the number of epoeocophytes in this direction. The humidity/aridity of the climate limits the spread and naturalization of invasive species. Plant invasions are intensively studied at the regional level (Ukrainian Carpathians, Bukovinian Cis-Carpathian, Black Sea Region, Middle Dniro Region, etc.); the composition of invasive species and transformer species, their features have been established, in particular i) an increased percentage of trees, shrubs, and perennials, and ii) the predominance of the mesophilic species group, etc.

Analysis Bibliography of alien species of Ukraine shows that the largest number of publications is devoted to floristic and chorological studies; somewhat less to geobotanical, ecological, taxonomic studies, and recently also population and molecular genetic studies.

The study of biology, ecological niches and mapping of distribution of alien species using GIS technologies, modeling of potential ranges using the maximum entropy method against the background of climate change under different types of scenarios (SSP1-2.6, SSP2-4.5, SSP3-7.0, SSP5-8.5) and determination of species strategy are the main tasks. Also, actual investigations are the study of alien species invasive potential and invasiveness of plant community of regional floras and monitoring and assess the general situation of these processes. Categorization of invasive status of species, harmonization of terminology, approaches and methodics and in future implementation of European are the main social tasks.

Skład chemiczny zapachu jako adaptacja do ekspansji obcych i inwazyjnych gatunków roślin

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Produkowanie przez kwiaty obcych i inwazyjnych gatunków roślin silnych substancji semiochemicznych może być kolejnym czynnikiem sprzyjającym ich szybkiej ekspansji. Dzięki szerokiej gamie wytwarzanych atraktantów, obce i inwazyjne gatunki roślin mogą odciągać zapylaczy od współwystępujących z nimi gatunków rodzimych. W efekcie sukces reprodukcyjny i konkurencyjność tych drugich spada, co może prowadzić nawet do ich wyparcia z danego obszaru. Dotyczy to szczególnie roślin rodzimych, które kwitną w tym samym czasie, co gatunki obce i są zapylane przez te same grupy owadów. Analizy profilu fitochemicznych sygnałów zapachowych wytwarzanych przez inwazyjne obce gatunki *Impatiens parviflora*, *I.*