

PREFACE

PROBLEMS OF INDUSTRIAL BOTANY IN THE 21st CENTURY

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In 1967, V.V. Tarchevsky, the founder of industrial botany, wrote: “It has been established that plants growing in the zone of industrial enterprises are characterised by significant deviations in the nature of morphogenesis, photosynthesis, biochemical composition and syngenetic changes. With good reason, this raises the question of establishing a separate research direction in the field of botany – industrial botany” [1].

Since that time, massive changes associated with environmental pollution have started to affect natural complexes worldwide. Today, it is virtually impossible to find an area of virgin nature, untouched by human activity. Mankind has entered the Anthropocene, an era of significant human impact on the Earth’s geology and ecosystems, including wildlife. This era entails global warming and globalisation processes, leading to a significant increase in the areas subjected to anthropogenic and technogenic disturbances of soil and vegetation cover.

The 1992 Earth Summit adopted an international convention on preserving the rich diversity of life for future generations. Plant conservation *in situ* and *ex situ* is a major problem in industrial botany. Primarily, this relates to the creation of a network of special protection areas as the main approach to preserving biological diversity. In industrially developed regions, botanical gardens are acquiring particular importance as sites for conserving rare and endangered plants *ex situ*.

Another consequence of the global anthropogenic transformation of flora is the introduction of alien species into natural ecosystems. A global inventory of alien species was carried out under the guidance of Professor Mark Van Kleunen from the University of Vienna in collaboration with 33 research institutes around the world, including the Kuzbass Botanical Garden of the Federal Research Centre of Coal and Coal Chemistry of the Siberian Branch of the Russian Academy of Sciences [2]. The researchers collected data on the presence of alien species in 480 thousand regions, with the surveyed areas accounting for 83% of the Earth’s surface. It was concluded that humanity is responsible for the spread of at least 13,168 plant species (about 3.9% of the world's flora) outside their native ranges. For Siberia, this problem is becoming increasingly urgent in connection with global warming and active industrial development. Invasive species are distributing extremely rapidly, thus requiring careful monitoring and study of their biology for the development of preventive measures. This direction of industrial botany is still in its nascent stage.

More than 8 billion cubic meters of industrial waste has been accumulated in Russia, most of which are dumps of mining enterprises. In the 20th century, one of the most important goals of industrial botany was the development of measures to increase the productivity of disturbed lands, referred to as ‘reclamation of disturbed lands’. Experimental studies carried out by soil researchers in Kuzbass for 40 years showed the impossibility of a complete restoration of lost soil functions in the foreseeable future. The maximum result obtained on experimental sites was soil

restoration at the level of 90 percent, while the average value of soil fertility on reclaimed lands was only 30% [3]. Therefore, it is crucial to develop novel nature-like technologies for the restoration of biological diversity in the lands disturbed by industrial extraction of minerals.

Another important global problem related to industrial botany concerns a decrease in CO₂ emission and an increase in its deposition by green plants. This is particularly important for the mining regions of Russia, including Kuzbass. During the development of Kuzbass coal deposits, about 9 billion tons of coal have been mined, which comprises 16 percent of all balance coal reserves in Kuzbass. It should be noted that 3.96 billion tons have been produced over the past 20 years. From 2000 to 2020, the volumes of coal production in Russia increased by 1.6 times. In Kuzbass, this growth rate was 2.2 times, reaching the record of 255.3 million tons in 2018, almost 60% of the all-Russian level [4]. According to expert estimates, the dump areas in Kuzbass cover 150 thousand hectares. The development of technologies for the creation of forest plantations capable of depositing CO₂ remains an extremely urgent task.

In industrially developed regions, botany in its pure form hardly exists. The influence of technogenic and anthropogenic factors can be traced in almost all floristic studies. The tasks of industrial botany are constantly expanding and acquiring great social and economic importance. Almost all botany in the 21st century is becoming industrial.

References

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