УДК 811.111

Шелінгер У.П.
Марковська А.В.

PROSPECTS FOR CULTIVATING MONARDA DIDYMA IN THE SOUTHERN STEPPE OF UKRAINE
(ПЕРСПЕКТИВИ ВИРОЩУВАННЯ МОНАРДИ ДВІЙЧАСТОЇ В ПІВДЕННОМУ СТЕПУ УКРАЇНИ)

У публікації проведено огляд та аналіз особливостей вирощування монарди двійчастої в умовах Південного Степу України. Розглянуто основні напрями застосування ефірної олії цієї культури в харчовій, медичній та сільськогосподарській галузях, зокрема у тваринництві та біологізації рослинництва. Проаналізовано переваги вирощування монарди двійчастої, а також виклики, пов'язані з її інтродукцією, впливом різних факторів на якість і кількість ефірної олії та перспективами подальших досліджень.

Ключові слова: *монарда двійчаста, ефірна олія, інтродукція, Південний Степ України, агротехніка, біологізація, рослинництво.*

The publication reviews and analyzes the features of growing Monarda bifidum in the conditions of the Southern Steppe of Ukraine. The main directions of application of the essential oil of this crop in the food, medical and agricultural industries, in particular in animal husbandry and biologization of plant growing, are considered. The advantages of growing Monarda bifidum, as well as the challenges associated with its introduction, the influence of various factors on the quality and quantity of essential oil and the prospects for further research are analyzed.

Key words: *monarda didyma, essential oil, introduction, Southern Steppe of Ukraine, agricultural technology, biologization, plant growing.*

In recent years the direction of introduction and cultivation of essential oil plants in the Southern Steppe of Ukraine has significantly developed. The production of essential oils is a promising direction of agricultural development, as it can satisfy a large number of needs in various spheres of life. However, the area of cultivation of these crops is still insufficient to provide raw materials for all industries using essential oils, as well as to introduce new areas of their use. The share of exported raw materials for essential oil production still accounts for more than half of the total amount [1].

The described problem creates new challenges and opportunities for research and development of new highly productive and profitable essential oil crops. One of the potential candidates in this direction is *Monarda didyma* L. Although the main volume of cultivation of this plant falls in the eastern part of North America and some regions of Eurasia, it is also successfully adapting in the western regions of North America. Thanks to modern agronomic technologies it is possible to expand the area of cultivation of this plant, since it can successfully adapt to different soil and climatic conditions. We must also take into account the fact that climate change is creating new opportunities for the introduction of essential oil crops in our region, particularly for the introduction of *Monarda didyma* L.

In Ukraine, there have been repeated studies on the characteristics of the introduction and cultivation of *Monarda didyma* L. However, the majority of these studies were conducted in the conditions of the Forest-Steppe and Polissya. For instance, there are studies on the influence of sowing dates and seed storage characteristics on the productivity of this plant in the northern Forest-Steppe. In the Southern Steppe of Ukraine, research has been conducted on the productivity of crop varieties and the influence of varietal characteristics on the qualitative and quantitative composition of the essential oil of *Monarda didyma* L. Varieties Slava, Serpanok, and Snezhana were studied, and the Snezhana variety was found to demonstrate the best indicators. This suggests that there are

significant prospects for further research in this area, although preliminary findings indicate the feasibility of introducing this plant in the southern Ukrainian climate [2].

Monarda didyma is notable for its high concentration of beneficial chemicals in its leaves, which contribute to its economic and practical value. These chemicals include various aromatic compounds that emit scents reminiscent of mushrooms, bergamot, oregano, and menthol. These compounds have been shown to possess bactericidal, insecticidal, immunostimulating, and antioxidant properties, which contribute to maintaining plant health and may have a beneficial effect on the human body when utilized for various purposes, including treatment and culinary applications [3].

In the confectionery industry, Monarda didyma holds significant potential, with savory crackers made with its essential oil emerging as a particularly promising application. The research has highlighted the plant's high antioxidant content, underscoring its status as a natural antioxidant with health-promoting benefits. *Monarda didyma* L. also holds promise in the field of animal nutrition. The replacement of synthetic antibiotics with Monarda in animal feeding has the potential to contribute to advancements in animal husbandry by reducing the risk of developing antibiotic resistance and ensuring safer and more environmentally friendly conditions for animal production [5].

The research by some scientists has indicated the presence of compounds in Monarda didyma that have the potential to serve as components of biological preparations with antibacterial and antifungal effects. Studies have demonstrated that the essential oils of *M. didyma* exhibit high antibacterial activity against the genera *Xanthomonas* and *Pseudomonas*. Furthermore, research has shown that Monarda essential oil has antifungal properties, with a negative effect on the development of all fungi studied by scientists [6].

A number of studies by foreign scientists have indicated the potential of *Monarda didyma* L. essential oil for use as a component in bioherbicides. Further research on the properties of this essential oil in field conditions is planned to better understand the real effect of its use [7].

The *Monarda didyma* L. culture demonstrates considerable promise for application in diverse domains, including confectionery, medicine, and the field of biologization of agricultural production through the utilization of by-products derived from crop processing as constituents of biological preparations exhibiting fungicidal and herbicidal properties. Concurrently, the regulation of cultivation conditions, the integration of supplementary cultivation technologies, and the examination of varietal characteristics can facilitate the accumulation of specific substances within the plant, thereby delineating optimal utilization pathways.

Literature:

1. Mirzoieva, T. V. (2019). Economic aspects of medicinal essential oil crops production. Problems of Systemic Approach in Economics, 3(71), 79-84.
2. Yanchenko, I. A. (2016). Influence of varietal characteristics of Monarda didyma on the yield of essential oil from plant raw materials in the Southern Steppe of Ukraine. Bulletin of Uman National University of Horticulture, 1, 54-58.
3. Rys, M. V. (2013). Elemental composition of the aboveground phytomass of Monarda L. species introduced in the northern forest-steppe of Ukraine. Scientific Bulletin of NLTU, 23(6), 286-291.
4. Dzygar, O. O., Datsenko, A. V., & Obolkina, V. I. (2017). Component analysis of Monarda didyma and its application in the production of spicy crackers (Doctoral dissertation).
5. Côté, H., Pichette, A., St-Gelais, A., & Legault, J. (2021). The biological activity of Monarda didyma L. essential oil and its effect as a diet supplement in mice and broiler chicken. Molecules, 26(26), 1-10.

6. Kovalenko, N. P., Pospelova, H. D., Dziuba, Ye. V., & Lavrskyi, Ye. O. (2023). Antibacterial and antifungal properties of Monarda (Monarda L.) essential oil against dominant micromycetes of soybean seeds. Scientific Progress & Innovations, 26(3), 63-68.
7. Ricci, D., Epifano, F., & Fraternale, D. (2017). The essential oil of Monarda didyma L. (Lamiaceae) exerts phytotoxic activity in vitro against various weed seeds. Molecules, 22, 1-7

УДК 811.111

Шпаков О. В.
Саламатіна О.О.

GENE THERAPY FOR THE TREATMENT OF INCURABLE DISEASES – SUCCESSES AND CHALLENGES IN THE TREATMENT OF HEREDITARY DISEASES (ГЕННА ТЕРАПІЯ ЛІКУВАННЯ НЕВИЛІКОВНИХ ХВОРОБ – УСПІХИ ТА ВИКЛИКИ В ЛІКУВАННІ СПАДКОВИХ ЗАХВОРЮВАНЬ)

У публікації проведено огляд сучасних досягнень у сфері генної терапії як методу лікування спадкових захворювань. Розглянуто успіхи у використанні генної терапії для корекції серповидно-клітинної анемії, спінальної м'язової атрофії та спадкової сліпоти. Проаналізовано основні виклики, пов'язані з високою вартістю лікування, безпекою та етичними аспектами редагування геному, перспективи подальшого розвитку генної терапії та її впливу на майбутнє медицини.

Ключові слова: генна терапія, спадкові захворювання, генетична модифікація, серповидноклітинна анемія, спінальна м'язова атрофія (сма), спадкова сліпота, зольгенсма, редагування геному, етичні проблеми, медична біотехнологія, доставка генетичного матеріалу.

The publication provides an overview of current achievements in the field of gene therapy as a method of treating hereditary diseases. Successes in the use of gene therapy to correct sickle cell anaemia, spinal muscular atrophy and hereditary blindness are discussed. The main challenges related to the high cost of treatment, safety and ethical aspects of genome editing, prospects for further development of gene therapy and its impact on the future of medicine are analysed.

Keywords: gene therapy, hereditary diseases, genetic modification, sickle cell anaemia, spinal muscular atrophy (SMA), hereditary blindness, zolgensma, genome editing, ethical issues, medical biotechnology, genetic material delivery.

Gene therapy is one of the most promising areas of modern medicine, allowing the treatment of hereditary diseases by modifying the patient's genetic material. This method opens up opportunities for treating pathologies such as sickle cell anaemia, spinal muscular atrophy (SMA), hereditary blindness and other diseases that were previously considered incurable. However, along with its successes, gene therapy faces a number of challenges that require further research and resolution [5].

One of the most significant achievements in the field of gene therapy was the treatment of sickle cell anaemia, which allows correcting mutations in the β-globin gene, which significantly improves the condition of patients [5]. In addition, in 2017, a drug was approved for the treatment of Leber's amaurosis, a severe inherited retinal disease. Thanks to the therapy, patients who were previously blind were able to partially restore their vision [1].

Another breakthrough was the use of Zolgensma to treat spinal muscular atrophy. This disease, which leads to loss of motor function of children, was previously considered fatal. Gene therapy can stabilise patients' condition and, in some cases, significantly improve their mobility and quality of life [4].