



INVESTIGATION OF BIOLOGICALLY ACTIVE SUBSTANCES OF CASPIAN ONION (*ALLIUM CASPIUM*) GROWING IN KARAKALPAKSTAN

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Abstract. Medicinal plants have long been recognized as valuable sources of biologically active substances that play a vital role in pharmaceutical, nutritional, and ecological applications. Among them, the Caspian onion (*Allium caspium*) represents a significant plant species native to the regions of Central Asia, including Karakalpakstan. This article investigates the biologically active compounds of *Allium caspium*, emphasizing its phytochemical composition, ecological importance, and potential use in medicine and nutrition. Furthermore, special attention is given to its role in traditional practices and its adaptability to the climatic conditions of Karakalpakstan. The findings contribute to a deeper understanding of the species and highlight the prospects for further scientific exploration.

Keywords: *Allium caspium*, biologically active substances, Karakalpakstan, medicinal plants, phytochemistry.

Introduction. Medicinal plants have always occupied an important place in human life, not only as food sources but also as natural remedies. One of the most widely studied genera in this regard is *Allium*, which includes garlic (*Allium sativum*), onion (*Allium cepa*), and several wild species. Among these, the Caspian onion (*Allium caspium*) is particularly interesting due to its unique growth conditions in the arid and semi-arid zones of Karakalpakstan. In recent years, researchers have increasingly focused on studying the biologically active substances of local plants, since they often possess unique compounds adapted to harsh ecological environments. Therefore, an investigation of the phytochemical properties of *Allium caspium* growing in Karakalpakstan is highly relevant. Moreover, this species is not only part of the natural ecosystem but also represents a potential source of raw material for pharmaceutical and nutritional purposes.

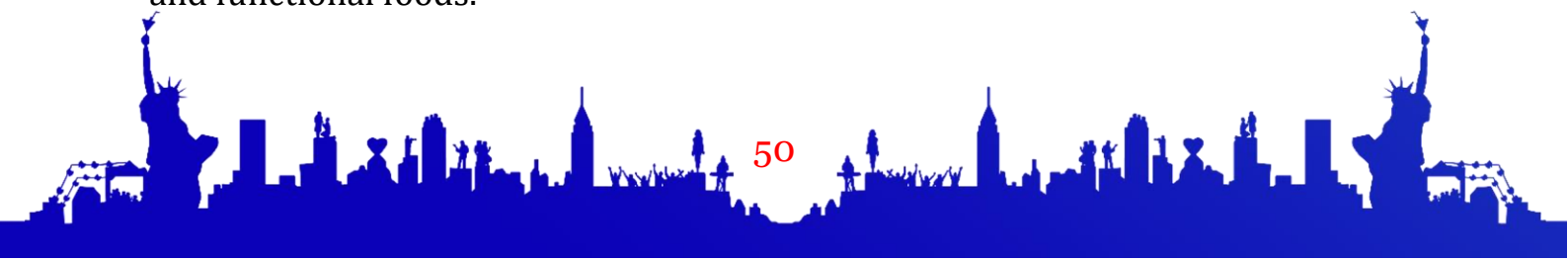




To begin with, the Caspian onion is native to Central Asia and is commonly found in Kazakhstan, Turkmenistan, and Uzbekistan. In Karakalpakstan, it grows in sandy soils, steppe regions, and semi-desert landscapes. The plant is well adapted to saline and dry conditions, which makes it particularly resilient compared to cultivated onion species. Furthermore, due to its ecological adaptability, *Allium caspium* plays an important role in stabilizing soil and supporting biodiversity. Its presence in Karakalpakstan not only enriches the local flora but also ensures the continuation of traditional knowledge related to the medicinal uses of wild plants. Therefore, ecological studies of *Allium caspium* are strongly linked with phytochemical investigations [2].

Like many representatives of the *Allium* genus, the Caspian onion contains a wide range of biologically active substances. These include sulfur-containing compounds (allicin, alliin, diallyl sulfide), flavonoids, saponins, essential oils, and various vitamins and minerals. First of all, sulfur-containing compounds are considered the main active agents. They are responsible for antimicrobial, antifungal, and antioxidant activities. In addition, flavonoids provide anti-inflammatory and cardioprotective effects. Moreover, the essential oils extracted from *Allium caspium* demonstrate antibacterial and antifungal properties, making them valuable in both medicine and food preservation [4, 3-10]. On the other hand, the concentration of these compounds may vary depending on ecological conditions. Since Karakalpakstan has a dry and saline climate, the stress factors often increase the synthesis of secondary metabolites in plants. As a result, *Allium caspium* grown in this region may exhibit stronger biological activity compared to the same species in other areas.

Historically, wild onions have been used in folk medicine by local populations. In Karakalpakstan, *Allium caspium* has been applied to treat colds, digestive disorders, and infections. Furthermore, it was consumed as a food supplement, particularly in spring, when vitamins were scarce. Nowadays, scientific studies confirm many of these traditional practices. For instance, extracts of *Allium* species have been shown to inhibit bacterial growth and strengthen the immune system. Moreover, the antioxidant potential of these plants suggests their use in preventing chronic diseases such as cardiovascular disorders and cancer. Therefore, the Caspian onion is not only a cultural and ecological asset but also a valuable source of natural medicine. In addition, it may serve as a raw material for the pharmaceutical industry, cosmetic products, and functional foods.





Although preliminary studies highlight the great potential of *Allium caspium*, more detailed investigations are required. Future research should focus on isolating specific compounds, determining their exact pharmacological properties, and developing standardized methods of extraction. However, several challenges exist. Firstly, the population of *Allium caspium* in Karakalpakstan is limited, and overharvesting may threaten its natural habitats. Secondly, due to climatic changes, desertification and soil salinization might negatively affect the growth of this plant. Therefore, conservation strategies are essential to ensure the sustainable use of this species. In addition, collaboration between local scientists, universities, and international research centers would allow a more comprehensive understanding of the plant's potential. Thus, Karakalpakstan could become an important research hub for the study of medicinal plants in Central Asia.

Conclusion. In conclusion, the Caspian onion (*Allium caspium*) represents a valuable plant species growing in the unique ecological conditions of Karakalpakstan. It contains biologically active substances such as sulfur compounds, flavonoids, and essential oils, which possess antimicrobial, antioxidant, and anti-inflammatory properties. Moreover, traditional uses of this plant are supported by modern scientific findings, highlighting its significance for medicine, nutrition, and industry.

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