ANALYSIS OF THE CHEMICAL COMPOSITION OF POLLEN GRAINS FROM MEDICINAL PLANTS IN THE SAMARKAND REGION

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Abstract. *In recent years, there has been growing interest in the comprehensive study of medicinal plants as a source of biologically active substances with pharmacological properties. This research focuses on analyzing the chemical composition of pollen grains from medicinal plants growing in the natural and climatic conditions of the Samarkand region. This area is characterized by its diverse plant life, abundance of endemic and medicinal species, and favorable conditions for the formation of pollen with specific morphological and chemical properties.*

Keywords: *biology, medicinal, pollen, plant, herb.*

Introduction. Currently, interest in medicinal plants is steadily growing, especially in the context of the global pandemic. People are paying more attention to their health, striving to learn more about health secrets, and preferring to use natural remedies to strengthen the immune system in the elderly and those with chronic diseases. The safety and beneficial properties of natural remedies have led to a significant increase in scientific research investments in this area, as well as increased demand for medicinal plants in international markets. For example, in 2023, the global turnover of medicinal plant products amounted to one hundred and three billion dollars, with an annual growth rate of eight percent. Due to its natural and geographical features, Uzbekistan is considered a country rich in medicinal plants. In recent years, special attention has been paid in Uzbekistan to the cultivation and development of medicinal and aromatic plants, as well as the efficient and rational use of natural resources. The use of potent natural remedies, such as plant pollen, for treatment is called apitherapy. The chemical composition of the plant's generative organ, one of the most popular apitherapeutic agents, depends on factors such as climatic conditions, soil type, bee species and their activity, as well as the source and geographical origin of the plant [3,5].

The pollen of a medicinal plant contains more than 250 organic and inorganic compounds with beneficial properties.

Additionally, pollen contains vitamins and bioelements. Plant pollen is a source of fat-soluble vitamins such as A, E, and D, as well as water-soluble vitamins B1, B2, B6, and C, pantothenic and nicotinic acids, folic acid, biotin, rutin, and inositol. Vitamins and bioelements constitute approximately 0.7% of the total pollen weight.

Bioelements, including macroelements (calcium, phosphorus, magnesium, sodium, and potassium) and microelements (iron, copper, zinc, manganese, silicon, and selenium), constitute approximately 1.6%. We conducted chemical analyses of medicinal plant species distributed in the Samarkand region, including Achillea millefolium, Allium suworowii, Cynoglossum officinale, Helichrysum maracandicum, Hypericum perforatum, Inula macrophylla, Mediasia macrophylla, Potamogeton natans, Salvia officinalis, and Thymus seravschanicus.

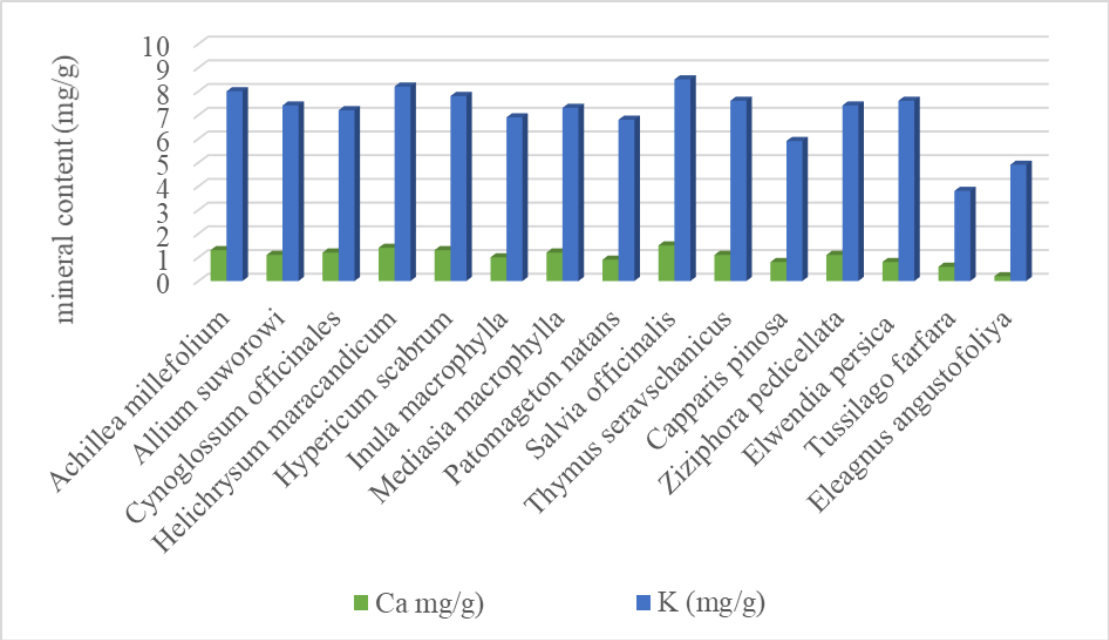


Figure-1. Graphical representation of calcium and potassium content in pollen from various medicinal plants.

The mineral content was determined either by gravimetric method or by acid digestion followed by colorimetric determination. In the gravimetric method, minerals were extracted using appropriate solvents, and the extract was evaporated to dryness, with the mineral content determined by weighing. Alternatively, acid decomposition of pollen was carried out to release minerals, and colorimetric tests were conducted using special reagents for minerals such as calcium and potassium. Color change was measured using a spectrophotometer, and concentrations were calculated using calibration curves for each mineral.

The mineral composition was determined by gravimetric method or acid decomposition method followed by colorimetric analysis. In gravimetry, minerals were extracted using suitable solvents, the extract was evaporated to a dry residue, and the mineral content was determined by mass. Alternatively, acid decomposition of pollen was performed to release mineral substances, and colorimetric tests were applied using specific reagents, for example, for calcium and potassium. Color changes were measured spectrophotometrically, and concentrations were calculated using calibration curves for each mineral.

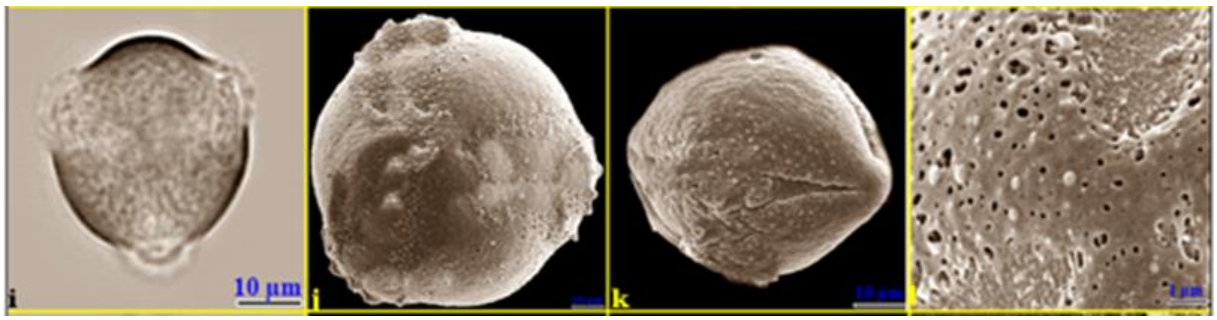


Figure 2. Images of *Capparis spinosa* pollen grains obtained using light (i) and electron (j,k,l) microscopes.

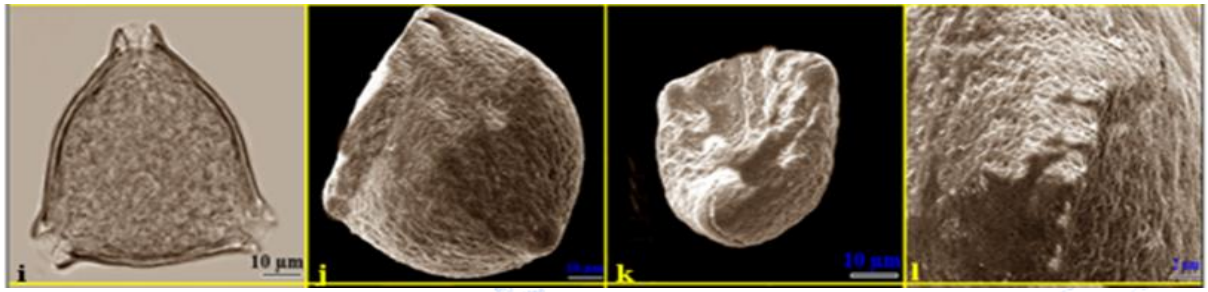


Figure 3. Images of *Elaeagnus angustifolia* pollen grains obtained using light (i) and electron (j,k,l) microscopes.

The mineral composition of the collected samples was determined by acid decomposition and colorimetric analysis to identify the content of minerals such as calcium and potassium. The results showed that Salvia officinalis contained the highest amounts of calcium (1.5 mg/g) and potassium (8.5 mg/g). Achillea millefolium contained 1.3 mg/g of calcium and 8.0 mg/g of potassium. Hypericum scabrum had a calcium content of 1.3 mg/g and a potassium content of 7.8 mg/g. In Helichrysum maracandicum samples, 1.4 mg/g of calcium and 8.2 mg/g of potassium were found, in Thymus seravschanicus - 1.1 mg/g of calcium and 7.6 mg/g of potassium, in Capparis spinosa - 0.8 mg/g of calcium and 5.9 mg/g of potassium, in Ziziphora pedicellata - 1.1 mg/g of calcium and 7.4 mg/g of potassium, in Elwendia persica - 0.8 mg/g of calcium and 7.6 mg/g of potassium. The lowest calcium content was observed in Elaeagnus angustifolia - 0.2 mg/g, while the lowest potassium content was found in Tussilago farfara - 3.8 mg/g (Figure-1).

In conclusion, the conducted research demonstrated that the chemical composition of pollen grains from medicinal plants growing in the Samarkand region is complex and rich in diverse biologically active substances. The research results confirmed the presence of proteins, lipids, carbohydrates, phenolic compounds, flavonoids, and important macro- and microelements in the pollen grains. It was determined that the quantitative and qualitative indicators of these components vary depending on the systematic affiliation, ecological conditions, and biological characteristics of the studied plant species.

The identified results indicate not only the significance of pollen grains as reproductive organs but also their potential as pharmacologically valuable natural raw materials. The relatively high levels of phenolic compounds and flavonoids detected during the study suggest that the pollen grains possess antioxidant, anti-inflammatory, and immunostimulating properties. This allows considering them as a promising source for developing phytopreparations and biologically active supplements.

Furthermore, the obtained data revealed that the chemical composition of pollen grains is closely linked to environmental factors, climatic conditions, and the growing environment. It was established that the specific natural and climatic conditions of the Samarkand region positively influence the accumulation of biologically active substances in the pollen grains of medicinal plants. This circumstance further enhances the scientific and practical significance of regional phytochemical research. The research results have important theoretical and practical significance in the fields of palynology, botany, pharmacognosy, and ecology, indicating the need for more in-depth studies of medicinal plant pollen grains. The obtained data will serve as a foundation for future deeper investigations into the biological activity of pollen grains, expanding the possibilities of their application in pharmaceutical and medical practice. Additionally, these studies serve as an important resource for developing scientifically based recommendations aimed at the rational use of medicinal plants and the conservation of their natural reserves.

References

1. Dumayeva Z.O‘., Nozimova A.B., (2023) Palyno-morphological study of allergenic flora of samarkand, Uzbekistan American Journal of Plant Sciences,2023,14,533-541 https://www.scirp.org/journal/ajps ISSNOnline:2158-2750 ISSN Print: 2158-2742
2. Erdtman, G. (1986). Pollen morphology and plant taxonomy: Angiosperms (Vol. 1). Brill Archive.
3. Djumayeva Z. O‘, Khaydarov X.Q., Muhammad Z.M., Ramadan, M. F., Ahmad, M., Aziza, N., Ochilov, U., Zebiniso, U., & Farzona, D. (2023). Comprehensive study of allergenic tree species: Palynological insights enhanced by HPLC and GC–MS profiling. Biomedical Chromatography, e5774. https:// doi.org/10.1002/bmc.577
4. Nozimova A. Samarqand shahri dorivor o‘simliklarining palinologik tahlili O’zMU xabarlari Mirzo ulug‘bek nomidagi o‘zbekiston milliy universiteti ilmiy jurnali 3/2. 2024yil
5. Djumayeva Z.O**‘.,** Haydarov X.Q., Tursunboev X.E., Nozimova A.B. O‘simlik gulchanglarining sutkalik va mavsumiy tarqalish qonuniyatlari samarqand shahri misolida. Nukus davlat pedagogika institute Ilim va Jamiyat 2023 (№2) ISSN 2010-720X
6. Джумаева З.Ў (2023) “Паленологические исследование в городе Самарканде” O‘zMU xabarlari, 2023 3/1 ISSN 2181-7324