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PROSPECTS FOR THE DEVELOPMENT OF A PHYTOPREPARATION BASED ON *LAGOCHILUS INEBRIANS* BGE

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Abstract

Lagochilus inebrians Bge. is a valuable medicinal plant belonging to the family Lamiaceae and is widely known in traditional medicine for its hemostatic, sedative, anti-inflammatory and biologically active properties. The plant is considered a promising source of natural substances due to its rich and diverse chemical composition. According to phytochemical studies, *Lagochilus inebrians* contains various groups of biologically active compounds, including tannins, flavonoids, alkaloids, saponins, diterpenoid compounds, phenolic substances, essential oils, beneficial fatty components, as well as macro- and microelements.

The present thesis discusses the prospects for the development of a phytopreparation based on *Lagochilus inebrians* Bge. Special attention is paid to the pharmacological value of the plant's chemical components and their possible contribution to therapeutic activity. The presence of tannins, flavonoids, alkaloids, saponins, diterpenoids and essential oils indicates that this plant may be used as a raw material for the creation of phytopreparations with hemostatic, sedative, anti-inflammatory, antioxidant, antimicrobial and general strengthening effects.

The results of phytochemical analysis showed that the plant raw material contains **6.84% tannins**, **1.37% flavonoids** and **0.42% alkaloids** calculated on dry plant material. In addition, the presence of saponins, diterpenoid substances, essential oils, useful lipid components, macroelements and microelements increases the scientific and practical significance of this plant. Therefore, *Lagochilus inebrians* Bge.

may be considered a promising natural source for the development of standardized herbal medicinal preparations.

Keywords: *Lagochilus inebrians*, phytopreparation, medicinal plant, bioactive compounds, tannins, flavonoids, alkaloids, saponins, diterpenoids, essential oils, macroelements, microelements.

Introduction. Phytopreparations are medicinal products obtained from plant raw materials, extracts or purified fractions. Unlike synthetic drugs that often contain a single active substance, phytopreparations usually include several groups of natural compounds. These compounds may act together and provide a complex pharmacological effect. Therefore, the study of medicinal plants with rich chemical composition is an important direction in pharmaceutical research.

One of the promising medicinal plants of Central Asia is *Lagochilus inebrians* Bge. This plant belongs to the family Lamiaceae and has long been used in traditional medicine. It is especially known for its hemostatic and sedative properties. The pharmacological activity of this plant is associated with the presence of different secondary metabolites and mineral components.

The development of a phytopreparation based on *Lagochilus inebrians* is relevant because the plant contains several important groups of biologically active substances. These include tannins, flavonoids, alkaloids, saponins, diterpenoid compounds, phenolic substances, essential oils, useful fatty components, macroelements and microelements. The complex chemical composition of the plant creates a scientific basis for its use in the development of herbal medicinal products.

Aim of the Study The aim of this thesis is to evaluate the prospects for the development of a phytopreparation based on *Lagochilus inebrians* Bge. by analyzing its chemical composition and pharmacological potential.

Chemical Composition of *Lagochilus inebrians* Bge The chemical composition of *Lagochilus inebrians* Bge. is complex and diverse. The plant contains

both organic biologically active compounds and mineral substances. Such chemical diversity increases its pharmacognostic and pharmaceutical value.

The main groups of compounds found in the plant include:tannins, flavonoids, alkaloids, saponins, diterpenoid compounds, phenolic substances, essential oils,useful fatty and lipid components, macroelements, microelements.

Among these compounds, tannins, flavonoids and alkaloids are especially important because they directly contribute to the biological activity of medicinal plant raw materials. In the studied sample, the total content of tannins was **6.84%**, flavonoids **1.37%**, and alkaloids **0.42%**. These results show that the plant is rich in biologically active substances and may serve as a promising source for phytopreparation development.

Tannins- Tannins are polyphenolic compounds with astringent properties. They are widely distributed in medicinal plants and play an important role in their pharmacological effects. In *Lagochilus inebrians*, tannins are one of the dominant groups of biologically active substances.

The high amount of tannins, **6.84%**, indicates that this plant may have significant hemostatic and astringent potential. Tannins can form protective films on tissue surfaces, reduce irritation, and support wound healing processes. They are also known for their anti-inflammatory and antimicrobial activity. Therefore, tannins may be considered one of the main chemical groups responsible for the traditional use of *Lagochilus inebrians* as a hemostatic plant.

Flavonoids are natural phenolic compounds that are widely found in medicinal plants. They are known for their antioxidant, anti-inflammatory, capillary-strengthening and hepatoprotective properties. In *Lagochilus inebrians*, flavonoids contribute to the general pharmacological value of the plant.The total flavonoid content in the studied raw material was **1.37%**. This amount shows that flavonoids are important components of the plant extract. Their antioxidant properties may help

protect cells from oxidative stress. In addition, flavonoids may strengthen blood vessels and support anti-inflammatory activity. These properties are important in the development of phytopreparations with complex therapeutic effects.

Alkaloids are nitrogen-containing organic compounds that often show strong physiological activity. Many alkaloids are used in medicine due to their sedative, analgesic, antispasmodic, antimicrobial and cardiovascular effects. Although alkaloids may be present in plants in relatively small amounts, their biological activity can be significant.

The total alkaloid content in *Lagochilus inebrians* was determined as **0.42%**. This result confirms the presence of nitrogen-containing biologically active compounds in the plant. Alkaloids may contribute to the sedative and physiological effects of the plant extract. Therefore, their identification and quantitative determination are important for evaluating both the efficacy and safety of the future phytopreparation.

Saponins are biologically active glycosides that possess surface-active properties. They are known for their ability to form foam in aqueous solutions. In medicinal plants, saponins may demonstrate anti-inflammatory, expectorant, antimicrobial and immunomodulatory effects.

The presence of saponins in *Lagochilus inebrians* increases its pharmacological potential. These compounds may enhance the biological activity of the plant extract and contribute to the complex action of the phytopreparation. Saponins may also improve the absorption of some biologically active substances, which is important in the development of herbal medicines.

Diterpenoid Compounds-Diterpenoids are an important group of secondary metabolites found in various medicinal plants. They are structurally diverse compounds and may have anti-inflammatory, antimicrobial, antioxidant and other biological activities. The genus *Lagochilus* is known to contain diterpenoid substances,

which are considered characteristic components of this plant group. In *Lagochilus inebrians*, diterpenoid compounds are of particular interest because they may be associated with the plant's pharmacological activity. These substances may contribute to sedative, anti-inflammatory and other therapeutic effects. Their presence supports the idea that *Lagochilus inebrians* may be used as a raw material for the development of biologically active phytopreparations.

Phenolic Compounds-Phenolic substances are among the most important natural antioxidants in plants. They include simple phenols, phenolic acids, flavonoids and tannins. These compounds protect plant tissues from oxidative damage and may also provide beneficial effects in the human body.The presence of phenolic compounds in *Lagochilus inebrians* contributes to its antioxidant, anti-inflammatory and antimicrobial potential. Phenolic substances may also support the stability of plant extracts and improve the biological activity of the future phytopreparation.

Essential Oils- Essential oils are volatile biologically active compounds that give plants their specific aroma and contribute to their pharmacological properties. They usually contain terpenes, terpenoids and other volatile substances. Essential oils are known for their antimicrobial, anti-inflammatory, sedative and aromatic effects.The presence of various essential oils in *Lagochilus inebrians* increases the medicinal value of the plant. These components may contribute to the sedative effect traditionally attributed to the plant. In addition, essential oils may support antimicrobial and anti-inflammatory activity. Therefore, they are important components in the development of phytopreparations based on this plant.

Useful Fatty and Lipid Components-Plant raw materials may also contain useful fatty and lipid components. These substances are important for the biological value of plants and may participate in protective, nutritional and metabolic processes. Useful oils and lipid fractions may include fatty acids, waxes, sterols and other lipophilic compounds.

In *Lagochilus inebrians*, beneficial fatty components may contribute to the overall pharmacological value of the plant. Lipophilic substances can also influence the extraction process and may be important in the development of certain dosage forms, such as ointments, gels, soft extracts or oil-based preparations.

Macro- and Microelements- In addition to organic compounds, *Lagochilus inebrians* contains mineral substances, including macroelements and microelements. These elements are important for biological processes and may contribute to the general therapeutic value of medicinal plants.

Macroelements may include calcium, potassium, magnesium, phosphorus and sodium. These elements are important for normal physiological functions, including muscle contraction, nerve impulse transmission, enzyme activity and regulation of water-electrolyte balance.

Microelements may include iron, zinc, copper, manganese, cobalt, chromium and other trace elements. They are necessary in small amounts but play important roles in enzyme systems, blood formation, antioxidant defense and metabolic processes.

The presence of macro- and microelements in *Lagochilus inebrians* increases its value as a medicinal plant raw material. These mineral components may support the general strengthening effect of the future phytopreparation.

Prospects for Phytopreparation Development. Based on the chemical composition and biological potential of *Lagochilus inebrians*, several dosage forms may be considered promising.

A liquid extract may be developed from the aerial part of the plant. This form is suitable because it can contain a wide range of biologically active compounds, including tannins, flavonoids, alkaloids, saponins and phenolic substances.

A dry extract may also be obtained by concentrating and drying the liquid extract. Dry extracts are more stable and convenient for further production of capsules, tablets or powders.

Capsules containing standardized dry extract may be one of the most suitable modern dosage forms. They allow accurate dosing and convenient use.

Herbal tea or infusion packages may also be developed because *Lagochilus inebrians* has a long history of use in traditional medicine. However, such products must be standardized and tested for safety.

Topical dosage forms, such as ointments, gels or solutions, may be promising if hemostatic, anti-inflammatory and wound-healing properties are confirmed in further studies. The presence of tannins, essential oils and useful lipid components supports this direction.

Among these forms, standardized dry extract capsules and liquid extract may be considered the most promising for pharmaceutical development because they allow better quality control and accurate determination of active substances.

Standardization and Quality Control

The development of a phytopreparation based on *Lagochilus inebrians* requires strict standardization. Standardization ensures the quality, safety and effectiveness of herbal medicines.

The main quality indicators should include:

- botanical identification of raw material;
- moisture content;
- total ash content;
- extractive substances;
- quantitative content of tannins;
- quantitative content of flavonoids;
- quantitative content of alkaloids;
- identification of saponins and diterpenoids;
- determination of essential oil components;
- analysis of macro- and microelements;

- testing for heavy metals;
- testing for microbial contamination;
- testing for pesticide residues.

Tannins may be selected as one of the main chemical markers because they are present in the highest amount. Flavonoids may also serve as important markers due to their biological activity. Alkaloids should be controlled because of their strong physiological effects.

Chromatographic methods, including thin-layer chromatography and high-performance liquid chromatography, may be used for identification and quality control. These methods help determine the chemical profile of the plant extract and ensure the stability of the future phytopreparation.

Conclusion. In conclusion, *Lagochilus inebrians* Bge. is a valuable medicinal plant with significant prospects for the development of phytopreparations. Its chemical composition is rich and diverse. The plant contains tannins, flavonoids, alkaloids, saponins, diterpenoid compounds, phenolic substances, essential oils, useful fatty components, as well as macro- and microelements.

The quantitative analysis showed that the dry plant raw material contains **6.84% tannins**, **1.37% flavonoids** and **0.42% alkaloids**. The high tannin content indicates the possibility of developing preparations with hemostatic and astringent properties. Flavonoids may contribute to antioxidant and anti-inflammatory effects, while alkaloids may support the physiological and sedative activity of the plant extract.

The presence of saponins, diterpenoids, essential oils and mineral elements further increases the scientific and practical value of *Lagochilus inebrians*. These compounds may contribute to antimicrobial, anti-inflammatory, immunomodulatory, sedative and general strengthening effects.Thus, *Lagochilus inebrians* Bge. may be considered a promising natural raw material for creating standardized phytopreparations. Further research should focus on the isolation of individual

biologically active compounds, determination of their chemical structures, pharmacological evaluation, toxicological safety studies, selection of optimal dosage forms and development of quality control standards.

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