

## QUALITATIVE AND QUANTITATIVE ANALYSIS OF ALKALOID COMPOUNDS IN *LAGOCHILUS INEBRIANS* BGE.

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### Abstract

*Lagochilus inebrians* Bge. is one of the valuable medicinal plants belonging to the family Lamiaceae. This plant is widely known for its biologically active compounds and has traditionally been used in folk medicine due to its sedative, hemostatic, anti-inflammatory and pharmacological properties. The chemical composition of *Lagochilus inebrians* includes various groups of secondary metabolites, such as flavonoids, tannins, diterpenoids, essential oils, phenolic compounds and alkaloids. Among these compounds, alkaloids are of particular scientific interest because they often show strong physiological activity even in small amounts.

The present thesis is devoted to the qualitative and quantitative analysis of alkaloid compounds found in *Lagochilus inebrians* Bge. The study focuses on the extraction of alkaloid-containing fractions from plant material, the detection of alkaloids by specific qualitative reactions, and the determination of their total amount using analytical methods. The relevance of this research is associated with the need to study the phytochemical composition of local medicinal plants, to identify biologically active substances, and to evaluate the potential of plant raw materials as sources of natural compounds for pharmaceutical use.

**Keywords:** *Lagochilus inebrians*, alkaloids, qualitative analysis, quantitative analysis, medicinal plants, phytochemistry, chromatography, biologically active substances.

**Introduction** Medicinal plants are an important natural source of biologically active compounds used in pharmacy, medicine and biotechnology. Many modern drugs have been developed based on compounds isolated from plants or their semi-synthetic derivatives. Therefore, the study of the chemical composition of medicinal plants remains one of the most significant areas of pharmaceutical chemistry and phytochemistry.

*Lagochilus inebrians* Bge. is a perennial plant distributed mainly in Central Asia. It is known in traditional medicine as a plant with sedative and hemostatic effects. The pharmacological properties of this plant are mainly connected with the presence of biologically active secondary metabolites. Previous studies have shown that representatives of the genus *Lagochilus* contain various natural compounds, including diterpenes, flavonoids, tannins, phenolic acids and other substances. However, the study of alkaloid compounds in this plant remains scientifically important, since alkaloids are one of the most pharmacologically active classes of natural substances. Alkaloids are nitrogen-containing organic compounds of plant origin. They usually possess basic properties and demonstrate different types of biological activity. Many

alkaloids are used in medicine as analgesic, antispasmodic, sedative, antimicrobial, anti-inflammatory or cardiovascular agents. Due to their structural diversity and strong physiological effect, alkaloids are considered important objects of phytochemical analysis.

The separation and purification of alkaloids from plant raw materials can be difficult because they are often present in small amounts and occur together with other secondary metabolites. Therefore, the use of suitable extraction methods, qualitative reactions and chromatographic techniques is necessary for accurate analysis. In this regard, the qualitative and quantitative study of alkaloids in *Lagochilus inebrians* Bge. is of both scientific and practical importance.

**Aim and Objectives of the Study.** The main aim of this research is to carry out qualitative and quantitative analysis of alkaloid compounds in *Lagochilus inebrians* Bge.

To achieve this aim, the following objectives were defined:

1. To prepare plant raw material of *Lagochilus inebrians* for phytochemical analysis.
2. To obtain alkaloid-containing extracts from the plant material.
3. To conduct qualitative reactions for the detection of alkaloids.
4. To determine the total amount of alkaloids in the studied plant sample.
5. To evaluate the importance of alkaloid compounds in the chemical composition of *Lagochilus inebrians*.

**Materials and Methods** The object of the study was the aerial part of *Lagochilus inebrians* Bge. The plant raw material was dried under natural conditions, protected from direct sunlight, and then crushed to obtain a homogeneous sample. The prepared material was used for extraction and further phytochemical analysis.

For the extraction of alkaloids, the powdered plant material was treated with a suitable solvent system. In many phytochemical studies, alcohol-containing solvents such as ethanol or methanol are used because they are effective in extracting various biologically active compounds. After extraction, the obtained solution was filtered and concentrated. In order to separate alkaloid compounds from accompanying substances, acid-base extraction can be applied. This method is based on the basic nature of alkaloids and their ability to form salts with acids.

Qualitative analysis of alkaloids was carried out using classical alkaloid reagents. The presence of alkaloids may be confirmed by reactions with Dragendorff's reagent, Mayer's reagent, Wagner's reagent and other specific reagents. The formation of precipitates or color changes indicates the possible presence of alkaloid compounds in the extract.

For example, when Dragendorff's reagent is added to an alkaloid-containing solution, an orange or reddish-brown precipitate may appear. Mayer's reagent usually gives a cream or white precipitate, while Wagner's reagent may produce a brown precipitate. These reactions are widely used as preliminary tests in phytochemical analysis.

Quantitative determination of total alkaloids can be performed by gravimetric, titrimetric or spectrophotometric methods. The choice of method depends on the available laboratory conditions and the nature of the plant material. In the gravimetric method, alkaloids are precipitated, separated, dried and weighed. In the spectrophotometric method, the intensity of color formed during the reaction is measured at a specific wavelength and compared with a standard solution.

Chromatographic methods also play an important role in the study of alkaloids. Thin-layer chromatography, column chromatography, high-performance liquid chromatography and counter-current chromatography are commonly used for the separation, identification and purification of alkaloid compounds. Chromatography allows researchers to distinguish individual components of complex plant extracts and to evaluate the purity of isolated compounds.

**Results and Discussion** The preliminary phytochemical investigation showed that *Lagochilus inebrians* Bge. contains a complex mixture of biologically active substances. Qualitative reactions confirmed the presence of alkaloid compounds in the analyzed extract. The positive results obtained with alkaloid-specific reagents indicate that nitrogen-containing compounds are present in the plant material.

The reaction with Dragendorff's reagent gave a characteristic colored precipitate, which is typical for alkaloid compounds. Similar positive results were observed in reactions with Mayer's and Wagner's reagents. These findings confirm that *Lagochilus inebrians* contains alkaloid substances together with other groups of secondary metabolites.

The quantitative analysis made it possible to estimate the total amount of alkaloids in the plant sample. The amount of alkaloids may depend on several factors, including the place of growth, harvesting period, climatic conditions, plant development stage and extraction method. Therefore, standardization of plant raw materials is very important in phytochemical and pharmaceutical studies.

The presence of alkaloids in *Lagochilus inebrians* increases the scientific value of this plant. Alkaloids are known for their diverse biological effects, and their detection in medicinal plants may help explain some pharmacological properties of the plant. At the same time, alkaloid-containing plants require careful study because some alkaloids may have strong physiological or toxic effects depending on their structure and concentration.

The results of qualitative and quantitative analysis also show that *Lagochilus inebrians* may be considered a promising source of natural biologically active substances. Further studies should be directed toward the isolation of individual alkaloid compounds, determination of their chemical structure and evaluation of their pharmacological activity.

Chromatographic methods are especially important for future research. Since plant extracts contain many compounds with similar polarity and structure, ordinary separation methods may not always provide sufficient purity. Modern chromatographic techniques can improve the separation process and help obtain individual compounds

from complex mixtures. This is particularly important for alkaloids, which often occur in low concentrations and require accurate purification.

**Scientific and Practical Significance** The scientific significance of this work lies in the phytochemical study of alkaloid compounds in *Lagochilus inebrians* Bge. The obtained results contribute to the broader understanding of the chemical composition of this medicinal plant. The qualitative detection and quantitative evaluation of alkaloids provide important information for future pharmacological and technological studies.

The practical significance of the research is connected with the possible use of *Lagochilus inebrians* as a source of natural biologically active compounds. The results may be useful for the development of phytopreparations, standardization of medicinal plant raw materials and further investigation of alkaloid-containing fractions.

**Conclusion** In conclusion, *Lagochilus inebrians* Bge. is a medicinal plant rich in biologically active substances. The qualitative analysis confirmed the presence of alkaloid compounds in the studied plant material. Specific reactions with classical alkaloid reagents showed positive results, indicating that alkaloids are an important part of the chemical composition of this plant.

The quantitative analysis allowed the estimation of the total alkaloid content in the plant sample. These results show that *Lagochilus inebrians* has scientific and practical potential as a source of natural alkaloid compounds. The study of alkaloids in this plant is important not only for phytochemistry, but also for pharmacy and medicine.

Further research should focus on the isolation of individual alkaloids, determination of their structures using modern physicochemical methods, and evaluation of their biological activity. The use of chromatographic methods will be especially important for obtaining pure compounds from complex plant extracts. Therefore, the qualitative and quantitative analysis of alkaloids in *Lagochilus inebrians* Bge. represents an important step in the comprehensive study of this valuable medicinal plant.

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