Tuberculosis: Pharmacognosy, Medicinal Plant Raw Materials, Medicinal Plants, Phytotherapy

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Abstract. The article delves into the crucial role that medicinal plants could play in combating tuberculosis, highlighting their vast diversity and their proven efficacy in health preservation. As the quest for effective drugs advances, there's a growing emphasis on harnessing both unique chemical compounds and natural plant-based components. This innovative approach opens up new avenues in battling the infection caused by Mycobacterium tuberculosis. The piece underscores the significance of continued investigation into the medicinal use of plants as adjunctive therapies in tuberculosis treatment. One of the key challenges identified is the complex interaction between antituberculosis medications and herbal components, an area that remains largely unexplored. The intricacies of how these interactions occur and their impact on the effectiveness of treatment are still not well understood. The article points out that meticulous and detailed research is essential for unlocking the potential of active biomolecules found in plants, which could pave the way for the development of novel therapeutic agents. Furthermore, it stresses the importance of conducting comprehensive evaluations regarding the interactions and safety of these plant-derived substances under various experimental setups. Such research is not only pivotal for enhancing our understanding of the synergistic effects between pharmaceuticals and plant-based compounds but also for ensuring the safety and efficacy of new treatments. By focusing on these aspects, the scientific community can make significant strides in identifying and utilizing natural resources in the fight against tuberculosis, potentially leading to more effective and safer treatment options.

Keywords: tuberculosis, medicinal plant raw materials, medicinal plants, pharmacotherapy, phytotherapy, pharmacognosy, resource science.

Introduction. In the modern world, medicinal plant raw materials are recognized as one of the powerful means in the fight against various diseases. The relevance of the use of medicinal plants in the pharmacotherapy of covid, postcovid, long-covid disorders is obvious. The huge arsenal of natural resources reflects the variety of plants that have been used in medicine for thousands of years. In particular, herbal medicinal forms have gained wide popularity in the field of tuberculosis treatment. We see multidisciplinary innovative nanotechnologies for finding new drugs based on medicinal plants (phytopreparations). However, the effectiveness, quality, and safety according to ICD-11 still need proper scientific confirmation [1-8].

Now, when the world is surrounded by clouds of global challenges in the field of public health, the search for new, effective methods of treatment becomes an extremely urgent task. This article calls for taking up the problem of tuberculosis, looking at it from a new point of view, focusing on the study of plant medicinal raw materials as a potential reserve for the development of effective anti-tuberculosis drugs.

Despite several millennia of use of medicinal plants for the pharmacotherapy of diseases, many of their properties remain underestimated in the context of modern medicine. The long history of the use of plants in folk medicine has created a foundation of knowledge, which now needs to be carefully reviewed and checked for compliance with modern standards of evidence-based medicine and evidence-based pharmacy [9-12].

To minimize the morbidity and mortality caused by tuberculosis, everyone who develops tuberculosis should have rapid access to diagnosis and pharmacotherapy. There are large discrepancies between the estimated number of people who develop tuberculosis each year and the

number of people who are first diagnosed with tuberculosis and officially registered as tuberculosis cases. This reflects a mixture of under-diagnosis and under-reporting to national authorities of persons diagnosed with tuberculosis. Coping practices related to the COVID-19 pandemic caused the global gap to widen significantly in 2020. The number of persons newly diagnosed with tuberculosis and officially registered as a case has decreased by 18% (from 7.1 million in 2019 to 5.8 million in 2020) [13].

After a significant recovery in global notifications of newly diagnosed tuberculosis in 2021 and 2022, the gap narrowed to pre-pandemic levels in 2022. However, it is important to highlight that some increase in the number of people newly diagnosed with tuberculosis and registered as a "new case" in 2021 and 2022. Probably reflects a lag in statistics for persons who have contracted tuberculosis in previous years. These were not “cases” but rather patients whose diagnosis was delayed due to the control methods associated with COVID-19 [14-17].

Thus, there is an urgent need for the discovery and development of new plant-derived drugs to reduce the global burden of this disease, including multidrug-resistant tuberculosis. To this end, many species of plants, as well as marine organisms and fungi, continue to be used in various systems of traditional medicine around the world for the treatment of tuberculosis [18]. In addition to their antimycobacterial activity, natural products can be useful in adjuvant therapy to enhance the effectiveness of conventional antimycobacterial treatments, reduce their adverse effects, and eliminate mycobacterial multidrug resistance due to the genetic plasticity and environmental adaptability of *Mycobacterium*. However, even if some natural products are still being investigated in preclinical and clinical studies, verification of their efficacy and safety as anti-tuberculosis agents is still far from being achieved, and therefore, according to an evidence-based approach, more randomized, high-level clinical trials are urgently needed.

The purpose of the study was to conduct the analysis of literary sources on the use of plant medicinal raw materials for the fight against tuberculosis. Through this research, we hope to establish a scientific foundation for further research that will help identify effective and safe herbal anti-tuberculosis treatment regimens.

Materials and methods. The methodology of the analysis of literary sources was based on the theoretical principles of pharmaceutical and medical law and its components: pharmaceutical and medical legislation; forensic pharmacy within forensic pharmaceutical practice; evidence-based pharmacy and evidence-based medicine. Regulatory, documentary, forensic and pharmaceutical, graphical, and tabular analysis were used as research methods.

The object of the research was medicinal plant raw materials, which have pharmacological properties of action against the mycobacterium *Mycobacterium* tuberculosis. Medicinal plant raw materials are studied on educational components by students of higher education in the specialty 226 "Pharmacy, industrial pharmacy" in institutions of higher education and by doctors on cycles of thematic improvement [4-11].

The study of the article is a fragment of the research works of the Kharkiv Medical Academy of Postgraduate Education on the topics "Improvement of the organizational and legal procedure of providing drugs to patients from the position of forensic pharmacy, organization and management of pharmacy" (state registration No. 0116U003137, implementation period 2016-2020) and "Pharmaceutical and medical law: integrated approaches to the drug circulation system from the standpoint of forensic pharmacy and the organization of the pharmaceutical case" (state registration No. 0121U000031, implementation period 2021-2026); Luhansk State Medical University "Conceptual interdisciplinary approaches to pharmaceutical provision and availability of drugs, taking into account organizational and legal, technological, analytical, pharmacognostic, forensic and pharmaceutical, clinical and pharmacological, pharmacoeconomic, marketing, social and economic competencies" (state registration number 0123U101632, terms 2023-2027); Petro Mohyla Black Sea National University on the topic "Conceptual interdisciplinary approaches to the drug circulation system, taking into account organizational and legal, technological, biopharmaceutical, analytical, pharmacognostic, forensic and pharmaceutical, clinical and pharmacological, pharmacoeconomic, pharmacotherapeutic aspects" (state registration No. 0123U100468, implementation period 2023-

2028). The study is a fragment of research works of Lviv Medical Institute LLC on the topic of "Improving the system of circulation of drugs during pharmacotherapy on the basis of evidentiary and forensic pharmacy, organization, technology, biopharmacy and pharmaceutical law" (state registration number 0120U105348, implementation period 2021-2026).

Results and discussion. The analysis of literature sources showed that tuberculosis is an infectious disease that has been declared a global emergency by the World Health Organization. Moreover, approximately one third of the world's population is latently infected with Mycobacterium tuberculosis. Pharmacotherapy of tuberculosis consists of an intensive phase and a continuation phase. The appearance of multidrug-resistant tuberculosis requires at least 20 months of pharmacotherapy with second-line drugs, more toxic and less effective (capreomycin, kanamycin, amikacin, and fluoroquinolones) [19].

WHO statistics indicate that 6,000,000 new cases of tuberculosis were reported in 2015, which is 63% of the total estimated figure. This means that almost 37% of tuberculosis patients were undiagnosed and/or unregistered. Therefore, WHO changed its strategy from "Stop tuberculosis" to "End tuberculosis " strategy [20].

Advances in the molecular biology and immunopathogenesis of mycobacterial diseases have led to extensive research in these areas and various vaccines have been introduced that can be used prophylactically or therapeutically. However, we should expect affordable and effective vaccines in the coming years. A complex scenario is the interaction of the immune system with tuberculosis bacilli after previous infection, which in most cases leads to latent tuberculosis infection. As mentioned earlier, in more than 80% of cases, the patient's body is able to contain the infection. Bacteria remain in a latent state throughout the life of infected persons [21]. It worth noting that the WHO, international organizations, scientific research institutions, charitable organizations, and volunteers are working hard to solve various aspects of this problem and achieve the projected goals in the coming decades [20].

Medicinal plants have been used for centuries to treat various diseases, including tuberculosis. Medicinal forms of infusions, macerations, tinctures, and decoctions of medicinal plant parts such as leaves, roots, stem bark, stem, flowers, and fruits have been used for centuries as traditional remedies for tuberculosis by indigenous peoples around the world. Commercial preparations of some of these agents are available and continue to be used with considerable success in affected communities.

In traditional Chinese medicine, many herbal mixtures have been used as adjunctive therapy along with conventional anti-tuberculosis chemotherapy for the treatment of *Mycobacterium* tuberculosis. Some clinical trials have shown that various herbal formulas of traditional Chinese medicine can strengthen the immune system, reduce adverse events seen with conventional tuberculosis chemotherapy, improve overall quality of life, and reduce the level of *Mycobacterium* tuberculosis in sputum culture [23].

The urgent need to develop new drugs to reduce the global burden of tuberculosis has greatly stimulated the investigation of traditional knowledge as a source of new and effective phytotherapeutic agents [22, 23].

Tuberculosis control scientists and clinicians strongly recommend training and improved reporting guidelines in high-burden areas and high-burden hospitals, as well as for pediatric patients and patients with tuberculosis pleurisy. Patient education and follow-up with diagnostic facilities can help improve timely registration for treatment, especially for migrant workers and sputum-negative patients. Similar studies to assess factors associated with underreporting and registration delay were conducted in China [23, 24].

The researchers found that evaluating the biological activity of plants against Mycobacterium and using it to restore the liver provides an effective approach to treatment. Traditionally used medicinal plants are a rich source of phytochemicals and secondary metabolites. These compounds can restore normal function, enzymatic activity, and structure of liver cells against hepatotoxicity caused by antituberculosis drugs. This review covers a comprehensive account of the various hepatoprotective and antimycobacterial plants studied over the past few decades to explore potential adjuvants for tuberculosis chemotherapy [25].

Phytochemicals are effective in the treatment of toxicity caused by taking anti-tuberculosis drugs. Basically, they affect some basic processes that are responsible for the toxicity of the drug. Phytochemicals act on cytochrome P450, free radicals or reactive oxygen species. These molecules are involved in lipid peroxidation, oxidative stress, and loss of membrane integrity, which together underlie liver damage. For example, flavonoids, tannins, and carotenoids act on reactive oxygen species. Phenolic, organosulfur compounds and electrophilic components, such as picroside II and curtcoside, have properties to absorb free radicals. Organosulfur compounds and flavonoids also affect cytochrome P450 activity, influencing drug metabolism. Phytochemicals from several plants may reduce hepatotoxicity. Detailed studies of blood components, liver function, histopathological and cellular mechanisms reveal the hepatoprotective activity of plant extracts through various mechanisms. Curcumin, silymarin, stilbenes, quercetin, berberine, and ursolic acid are some hepatoprotective natural products [26].

Researchers conducted an analysis of medicinal plant materials in Ethiopia and found that out of a total of 68 research papers that reported the use of plants for the treatment of tuberculosis, 98 plant species belonging to 82 genera and 49 families were identified. The most frequently recorded plant species belonged to the family *Lamiaceae* (n=8), *Euphorbiaceae* (n=7), *Cucurbitaceae* (n=6) and *Fabaceae* (n=6). Among the anti-tuberculosis medicinal plants, croton macrostachius, chives and African myrsine were most often mentioned. Shrubs (35.7%) and trees (29.6%) were recorded as the dominant growth forms, while plant roots (31.6%) and leaves (28.6%) were frequently used plant parts for drug preparation. The most favorable route of administration was oral (59.1%). About 87% of the preparations were made from fresh plant material. For 79.6% (78/98) of the registered plants, no experimental/clinical evidence of their antimycobacterial activity was provided. In Ethiopia, there is a huge number of herbal medicines and their use for the treatment of tuberculosis is a common practice. However, most of them have not yet been confirmed by evidence obtained from scientific experiments, and this requires further experimental and clinical verifications. In addition, testing for efficacy, toxicity and safety should be initiated and this will help to rapidly identify new anti-tuberculosis regimens and possibly lead to the development of more effective new plant-based drugs. This systematic review will serve as a reference for the selection of plants for the development of new antituberculosis regimens [27].

The author selected medicinal plant raw materials that have pharmacological properties of action against the mycobacterium *Mycobacterium* tuberculosis.

Large-leaved plantain — Plantaginis Majoris Folia.

The characteristics of medicinal plant raw materials follows.

Plant. Large plantain — Plantago Major L., family Plantains — Lantaginaceae. English name — Plantain, Rib grass, Ripplegrass, Ribwort. Perennial herbaceous plant. The stem is leafless, finely grooved, 10–60 cm tall. Leaves are ovate or elliptic, entire, glabrous, or slightly pubescent, narrowed into a wide petiole, with 3–9 longitudinal veins, collected in a basal rosette; petioles shorter than or almost equal to the lamina. The flowers are small, regular, bisexual, sessile, collected at the top of the stem in a cylindrical spike; corolla is brownish, with a cylindrical tube and a four-part bend. The fruit is a box.

Spread. It grows everywhere, except for the Far North and the desert zone. Ruderal plant and weed. It is also cultivated in Ukraine.

Description of medicinal plant raw materials. The leaf blade is green or brownish-green, with 3–9 arcuate veins, a solid or slightly toothed edge, broadly elliptic, 3–11 cm wide, narrowed into a wide petiole of various lengths, together with the petiole reaches 24 cm in length. At the fracture of the petiole, the remains of dark filamentous veins are visible. The color is green or brown-green. The smell is weak. The taste is slightly bitter.

Chemical composition. Plantain leaves contain polysaccharides, including mucilage (up to 11%), iridoids (aucubin and catalpol), steroids, flavonoids (luteolin, quercetin, apigenin derivatives), tannins, choline, adenine, carotenoids, vitamins C and K, traces alkaloids Cu, Fe, Zn, Mo, Ba, Sr are concentrated.

The chemical formulas of plantain iridoids shown on Fig. 1.

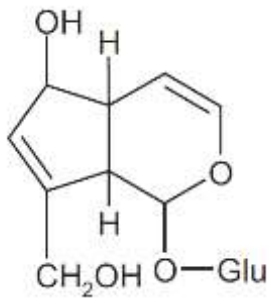
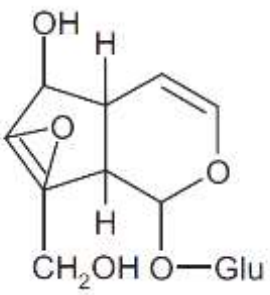
	
Aucubin	Catalpol

Fig. 1. Chemical formulas of plantain iridoids.

Quality control. Included in the State Pharmacopoeia of Ukraine, the British Pharmacopoeia.

Properties. Galenic preparations from plantain leaves have secretolytic, anti-inflammatory, analgesic, hemostatic, wound-healing, bacteriostatic, sedative (even hypnotic), hypotensive, and antiallergic effects. A decoction of plantain leaves is prescribed for bronchitis, pulmonary tuberculosis, whooping cough, pneumosclerosis and other diseases of the respiratory organs accompanied by the release of thick secretions, for catarrh of the stomach with insufficient acidity, acute gastrointestinal diseases (gastritis, enteritis, enterocolitis), acute and chronic colitis , chronic nephritis and peptic ulcer disease.

Side effect. When using plantain, it is possible to increase the acidity of gastric juice, heartburn.

Contraindication. Increased sensitivity to plantain. Hyperacid gastritis, gastric ulcer with increased acidity, reflux esophagitis.

Phytopreparations. Plantain juice; Stoptusin phyto; medical and preventive meetings No. 1, 2, 4; breast collection; breast collection No. 2; broncholytic collection; anti-allergic collection; Plantaglucid, Viburkol.

Grape fruit – Vitis Viniferae Fructus.

The characteristics of medicinal plants raw materials are provided.

Plant. Cultivated grape — Vitis vinifera L., family Grapes — Vitaceae. English the name is Grape. Creeping lignified creeper; one-year shoots with long internodes, slightly thickened at the nodes, on which leaves are oppositely located - simple, whole, dissected-lobate, or finger-dissected; inflorescences are many-flowered, flowers are small, greenish, bisexual, the fruit is a fleshy juicy berry with 1–4 seeds; there are seedless varieties among cultivated grape varieties. The fruits have a variety of colors, collected in bunches that differ in shape, size, and density of berries. About 4,000 varieties of grapes are known, of which 2,000 are cultivated in post-soviet countries.

Spread. Cultivated in many countries of the world.

Description of medicinal plant raw materials. The fruits are 1–3 cm long, from yellowish-green to dark purple in color with a wax coating.

Chemical composition. Grape fruits contain carbohydrates: glucose (7.6%), sucrose (0.5–5.5%), fructose (7.8%), pectin (0.15–0.9%); organic acids: oxalic, tartaric, citric, succinic, malic, gallic, protocatechuic, lilac; stilbenes: trans-resveratrol; hydroxycinnamic acids; flavonoids; leucoanthocyanins; anthocyanins; catechins; polyphenol compound of heterocyclic structure — enomelanin; vitamins; macro and microelements. Grape skin contains essential oils, linalool, geraniol, and α-terpineol predominate among its components.

The chemical formulas of carbohydrates and organic acids of grapes are shown on Fig. 2.

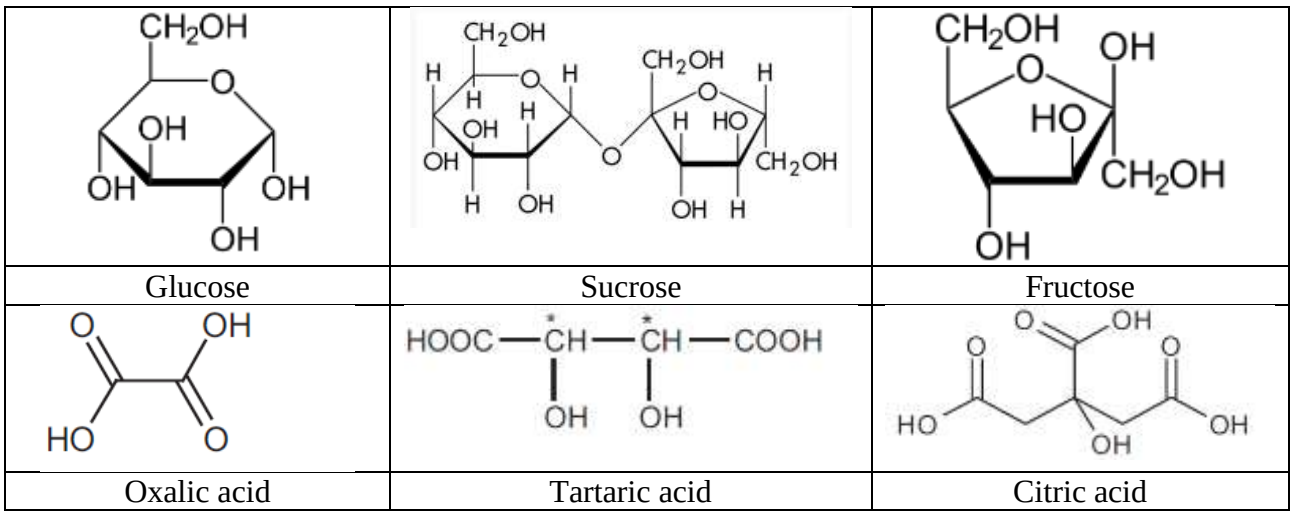


Fig. 2. Chemical formulas of carbohydrates and organic acids of grapes.

The seeds, which are part of the fruits, contain 14–15% protein (in some varieties, its content reaches 25%); fatty oil (20%); phospholipids (0.3%).

Quality control. Included in the State Pharmacopoeia of Ukraine, the European Pharmacopoeia.

Properties. Grape therapy (ampelotherapy) uses fresh grapes and grape juice to treat various diseases, mostly chronic ones. It is one of the methods of diet therapy and is used as prescribed by a doctor in combination with other types of treatment. During ampelotherapy, metabolic processes are activated, especially the water-salt metabolism, kidney function is enhanced, toxic metabolic products are removed from the body faster, the motor function of the intestines is enhanced, the secretory function of the stomach is normalized, and appetite is improved. Almost all varieties of fully ripe grapes can be used as a dietary product with high nutritional value. Ampelotherapy is used in the resorts of the Southern coast of Crimea, Georgia, Armenia, Central Asia, and Moldova. Ampelotherapy is recommended for diseases of the heart, bronchi, kidneys, and liver. Grapes are prescribed for gastrointestinal diseases accompanied by atonic and spastic constipation; with gout, chronic forms of pulmonary tuberculosis, with exhaustion of the nervous system, as a tonic after a long illness.

Side effects. Diarrhea is possible when consuming grape fruits.

Contraindication. Ampelotherapy is not used in diabetes, obesity, gastric ulcer, colitis accompanied by diarrhea, enteritis, enterocolitis, acute pleurisy, stomatitis, gingivitis, glossitis, acute phase of pulmonary tuberculosis.

Phytopreparations. It is used in functional food products.

Brassicae Oleraceae Folia.

Plant. White cabbage, garden cabbage — *Brassica oleracea* L. var. *capitata* forma *alba*, genus Cabbage — *Brassicaceae*. English the name is White cabbage. K. bilocachanna is a biennial herbaceous plant. The flowers are bisexual, regular, four-parted, collected in a tassel. The fruit is a two-nested pod. Blooms in May-June.

Spread. Cabbage is grown throughout Ukraine and in European countries as a vegetable crop.

Description of medicinal plant raw materials. During the first year of life, a low stem and a significant number of leaves are formed, folded into a dense smooth head; in the second year, a flowering stem up to 1.5 m in height develops. The leaves are large, alternate, fleshy, gray-green, or purple.

Chemical composition. White cabbage contains proteins (1.1–2.3%), organic acids (malic, citric, glucuronic, succinic, chlorogenic, ferulic, caffeic, tartronic, formic), sugars (1.9–5.3%), lipids (0.2%); amino acids, vitamins: C, carotene, U, B vitamins, thioglycoside glucobracidin.

The chemical formula of cabbage glycosides shown on Fig. 3.

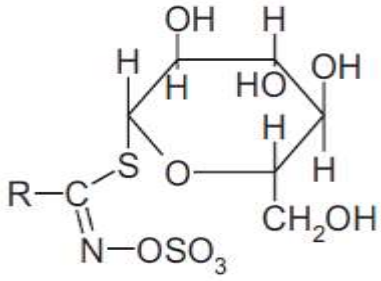


Fig. 3. Chemical formula of cabbage glycosides.

Quality control. Chromatographic methods (paper, thin-layer, gas-liquid chromatography, high-performance liquid chromatography, etc.). Reliable identification of glycosides is carried out by comparison with certain samples of known compounds ("markers").

Properties. The main active substance of cabbage is vitamin U. It exhibits antihistamine and antiserotonin properties. Improves lipid exchange, exchange of thiamine and choline, metabolism of the gastric mucosa, increasing its resistance to harmful factors and stimulating the healing process of ulcers. It has been experimentally proven that fresh cabbage juice has an antibacterial effect on Staphylococcus aureus and Mycobacterium tuberculosis, has antitussive and expectorant properties. The leaves and juice of white cabbage have anti-inflammatory, expectorant, broncholytic, diuretic, tonic effects. Experimental and clinical tests testify to the high efficiency of fresh cabbage juice in the treatment of peptic ulcer disease of the stomach and duodenum.

Side effects. Gas: Consuming large amounts of white cabbage can cause gas in the stomach and intestines, which can cause discomfort. Deterioration of liver function: Large amounts of white cabbage can be harmful to the liver, especially in the presence of liver disease. Allergic reactions: Some people experience allergic reactions to white cabbage, which may manifest as itching, rashes, or swelling.

Contraindication. Gastrointestinal problems: People with chronic gastrointestinal conditions, such as peptic ulcer disease, colitis, or irritable bowel syndrome, may be better off avoiding large amounts of white cabbage. Allergies: People with a known allergy to cabbage or other plant products from the cabbage family (Brassicaceae) are advised to avoid white cabbage.

Phytopreparations. White cabbage can be used to prepare a variety of herbal preparations, such as infusions, decoctions, and extracts, which are used to treat various diseases. For example, herbal preparations based on white cabbage can be useful for relieving relapses, reducing inflammation, and improving liver function. However, before using any herbal medicine, especially for internal use, it is recommended to consult a doctor or a qualified specialist.

Swamp common shoot – Ledi Palustris Cormi.

Plant. Common bog — Ledum palustre L., family Heathers – Ericaceae. English the name is *Marsh Labrador tea. Evergreen*, squat, dense, branched bush up to 125 cm tall. Young shoots have rather dense red pubescence. leaves are alternate, linear, leathery, short-petiolate, 2–4 cm long and 1.5–4 mm wide, with whole, folded downward edges, dark green above, shiny, covered with dense pubescence from below, especially along the midvein. The flowers are white, five-parted, collected in apical multi-flowered shields. Petioles are thin, red, pubescent, glandular. The fruit is an elongated-oval, dark, slightly glandular-pubescent capsule, 4–5 mm long. The plant has a strong, sharp, specific smell.

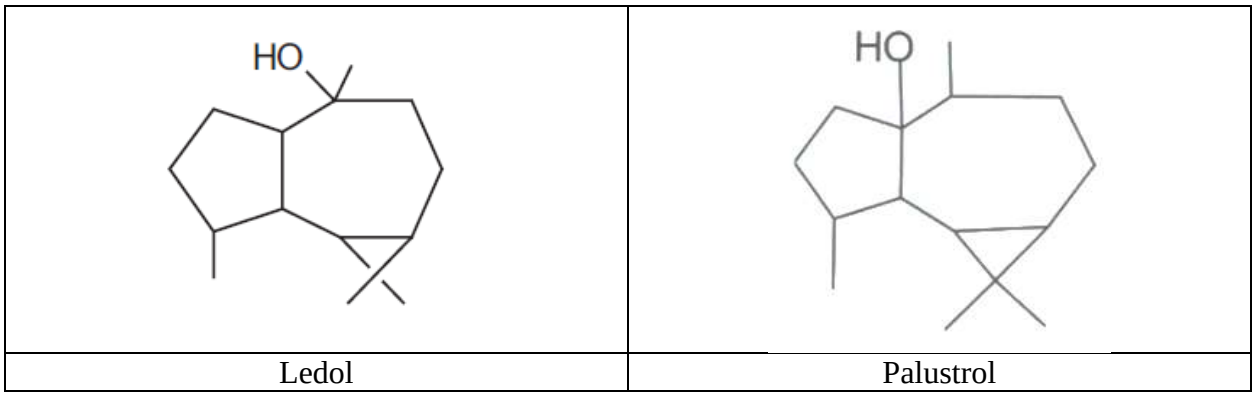
Spread. Widespread in the forest and tundra zones of the European part of the CIS, Siberia, and the Far East, in North America, Northern and Central Europe, in Asia – in Korea and Japan. In Ukraine, it is found in Polissia, Prykarpattia, in the Carpathians, grows in wet and swampy pine or oak forests, in swamps.

Description of medicinal plant raw materials. One-year shoots are harvested during fruit ripening. The raw material is a mixture of stems, leaves, and fruits. The stems have reddish-brown pubescence, the leaves are alternate, on short petioles, leathery, linear-elongated or elongated-elliptical, with the edges folded downwards. The upper side of the leaves is dark green or brown-

green, shiny; the lower one is covered with red pubescence. The fruit is a five-nested glandular capsule, the seeds are numerous, small, yellow. The smell is sharp, specific. The raw material is poisonous, the taste is not determined.

Chemical composition. The raw material of the swamp contains essential oil (0.3–2.64%), the main components of which are sesquiterpenes — ledol and palustrol. The shoots also contain arbutin (3.8%), tannins (10.1%), flavonoids and vitamin C.

The chemical formulas of bog sesquiterpenes are shown on Fig. 4.



Ledol	Palustrol

Fig. 4. Chemical formulas of bog sesquiterpenes.

Quality control. Included in the State Pharmacopoeia of Ukraine.

Properties. The raw material of the bog is used as an expectorant, antispasmodic, diaphoretic and antimicrobial agent, has a diuretic effect, as well as sedative properties, has a narcotic effect, dilates blood vessels, and lowers blood pressure. The drugs are usually prescribed internally in the form of an infusion for acute and chronic bronchitis, tracheitis, laryngitis, whooping cough, pneumonia, pulmonary tuberculosis, bronchial asthma.

Side effect. Allergic reactions: Some people may be allergic to common mud, which can manifest as itching, rashes, swelling, or even anaphylactic shock in severe cases. Skin irritations: Some people may experience skin irritation, redness, or irritation if they come into contact with the sap of the common bog. Toxicity at Large Doses: Consuming large amounts of common sagebrush can be toxic to the body, especially when taken internally.

Contraindication. Pregnancy and breast-feeding: In the absence of sufficient scientific evidence of safety, pregnant women and those who are breast-feeding are advised to refrain from consuming fennel, especially in large quantities or in herbal form. Chronic diseases: People with chronic diseases, such as liver, kidney, or heart disease, are advised to consult their doctor before using common mud. Allergies: People with a known allergy to plants from the Moraceae family, to which common mulberry belongs, are advised to avoid using this plant. Children's age: Given the lack of sufficient data on safety, it is recommended that children under a certain age refrain from using ordinary mud without consulting a doctor.

Phytopreparations. The pharmaceutical industry produces a preparation from the shoots of the Ledyn swamp in the form of tablets of 0.5 g and a collection of Fitobronchol, which are prescribed to suppress the cough reflex mechanism, and they also have a bronchodilator effect.

Conclusion. Nature has a variety of plants that are used to treat human diseases. Herbs, which are the main component of traditional medical systems, have long proven their effectiveness in maintaining health. Progress in the search for optimal drugs can be seen in the use of both chemically unique molecules and plants that can act as potential agents against Mycobacterium tuberculosis. Combining the anti-tuberculosis properties with the many health benefits of medicinal plants may prove to be an important step in the fight against tuberculosis and its side effects. Given that patients in developing countries often use both prescription drugs and herbal supplements, it is important to conduct appropriate research to ensure adequate information. The mechanism of interaction between anti-tuberculosis drugs and plant components has been little studied. There is a significant gap in our knowledge about the medical use of herbal adjuvants. The study of plants with inherited antioxidant

and antituberculosis properties can contribute to the discovery of active biomolecules and the development of modern medicines. However, to ensure the safety and effectiveness of such combinations, it is necessary to carefully study their interaction in various experimental conditions before their large-scale use in practice.

Conflict of interest. The author confirm that he is the author of this work and have approved it for publication. The author also certify that the obtained data and research were conducted in compliance with the requirements of moral and ethical principles based on the medical and pharmaceutical law, and in the absence of any commercial or financial relationships that could be interpreted as a conflict or potential conflict of interest.

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