

# MEDICINAL PLANTS AND PHYTOHERBS USED FOR LIVER AND GALLBLADDER DISEASES

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This article presents a review of scientific literature aimed at evaluating the rational selection of medicinal plants and the formulation of herbal mixtures intended for the treatment of liver and gallbladder diseases. The objects of the study included *Avena sativa* L., *Berberis vulgaris* L., and *Rosa canina* L. A systematic analysis of both domestic and international studies was conducted, focusing on biologically active compounds, pharmacological properties, and patterns of application of these medicinal plants. The findings demonstrate that these species exhibit a broad spectrum of pharmacological activities, including hepatoprotective and choleric effects, supporting their potential use in medical practice.

The results indicate that these plants represent promising raw materials for the development of phytopharmaceuticals intended for the prevention and treatment of liver and gallbladder diseases.

**Keywords:** liver, gallbladder, herbal formulations, choleric agents, *Avena sativa* L., *Berberis vulgaris* L., *Rosa canina* L., flavonoids, phenolic compounds, alkaloids, vitamins, minerals, organic acids, choleric, hepatoprotective, choleric, cholelithic, cholelithic, cholelithic effects.

**Relevance of the Study.** In recent years, a significant global increase in the incidence of gastroenterological diseases has been observed. The primary contributing factors include current environmental conditions, unhealthy dietary habits, and chronic stress. Among diseases of the digestive system, the number of patients suffering from liver and biliary tract disorders has been steadily increasing each year. According to the latest data from the World Health Organization (WHO), more than 2 billion people worldwide are affected by various liver diseases [1]. Therefore, the development and introduction of new effective and safe medicinal products based on medicinal plants, as well as the implementation of a comprehensive therapeutic approach for the treatment of liver and gallbladder diseases, remain highly relevant issues in modern medicine. Phytopreparations are considered advantageous over synthetic drugs due to their broad spectrum of pharmacological activity, low toxicity, high therapeutic efficacy, mild effect on the human body, minimal risk of allergic reactions, and the possibility of long-term administration without significant adverse effects [2–5]. At present, the range of medicinal products used for the treatment of liver and biliary tract diseases in the pharmaceutical market of Uzbekistan is continuously expanding. During the course of our research, the list of medicinal products intended for the treatment of liver and gallbladder diseases was reviewed, and their market status was analyzed. For this purpose, the State Register of Medicines, Medical Devices, and Medical Equipment Approved for Use in Medical Practice in the Republic of Uzbekistan, No. 30 dated January 1, 2026, was used as the primary source. According to the analysis, among the medicinal products included in the State Register, 32% were domestically produced, 8% originated from CIS countries, and 60% were imported

from foreign countries. Furthermore, an analysis of the registered medicinal products according to their dosage forms revealed the following distribution: capsules accounted for 32%, tablets for 12%, powders for 2%, oral solutions for 5%, and parenteral dosage forms for 49%. Although the overall assortment of medicinal products used in the treatment of liver and gallbladder diseases continues to expand, the demand for herbal medicinal products is also steadily increasing. The analysis demonstrated that, relative to the total number of medicinal products registered in the State Register for the treatment of liver and gallbladder diseases, only 10% were phytopreparations derived from medicinal plants, whereas 90% consisted of synthetic drugs. These findings indicate that the development and introduction into medical practice of high-quality domestic phytopreparations based on natural medicinal plants, possessing convenient dosage forms and capable of replacing imported products, remain highly relevant for meeting market demand. Moreover, phytopreparations possess several additional advantages, including their complex pharmacological effects, the ability to simultaneously treat multiple disorders within the body, and their suitability for use during the initial, intermediate, and recovery stages of treatment, as well as for long-term therapy without causing significant adverse effects.

Choleretic agents play an important role in the treatment of diseases of the hepatobiliary system of the liver. These agents stimulate bile formation and promote the secretion of bile into the duodenum. According to their mechanism of action and therapeutic application, choleretic medicinal plants are classified into three groups: cholergics, which enhance the production of bile acids and increase bile secretion; cholekinetics, which increase gallbladder tone and facilitate the flow of bile into the intestine; and cholelasmolytics, which reduce the tone of the bile ducts [2,6]. Phytopreparations derived from medicinal plant raw materials consist of a complex of biologically active compounds and exert a multifaceted therapeutic effect in the treatment of diseases. In particular, phytopreparations containing essential oils, flavonoids, phytosterols, phytoncides, vitamins, alkaloids, tannins, and organic acids improve liver function, stimulate bile secretion, and reduce bile viscosity. Enhanced bile excretion contributes to increased gallbladder tone while simultaneously relaxing the smooth muscles of the bile ducts, as well as the sphincters of Oddi and Lutkens [4,6,7]. In medical practice, in addition to extracts and pharmaceutical preparations obtained from medicinal plants, decoctions and infusions prepared from herbal mixtures are also widely used as choleretic agents.

Table 1 below presents several representatives of medicinal plants commonly used in the treatment of gallbladder and biliary tract diseases.

**Table 1**  
**Classification of Medicinal Plants Commonly Used in Gallbladder Diseases According to Their Physiological Effects**

<b>Name of Medicinal Plant Raw Material</b>	<b>Cholergics</b>	<b>Cholekinetics</b>	<b>Cholelasmolytics</b>
Artichoke leaves	+		
Valerian roots and rhizomes	+		+
Immortelle flowers (Helichrysum arenarium)	+	+	+
Coriander fruits	+	+	

Name of Medicinal Plant Raw Material	Choleretics	Cholekinetics	Cholespasmolytics
Volodushka leaves	+		
Turmeric (Curcuma) rhizomes	+	+	
Corn silk	+		+
Peppermint leaves	+		+
Hawthorn flowers	+	+	+
Aerial parts of wormwood	+		
Couch grass roots		+	
Rosa canina fruits	+	+	
Aerial parts of yarrow	+	+	+
Aerial parts of common oregano		+	+
Chamomile flowers		+	
Avena sativa	+		
Berberis vulgaris	+	+	+
Belladonna extract	+	+	
Calendula flowers	+		
Aerial parts of mountain basil	+		
Calamus rhizomes (essential oil)	+	+	
Pine oil (turpentine)	+		
Smoketree leaves	+		
Japanese sophora flowers	+		
Licorice roots	+		
Eucalyptus leaves	+		
Olive oil		+	
Aerial parts of shepherd's purse		+	
Succession leaves (Bidens)		+	
Mountain arnica flowers			+
Elecampane roots and rhizomes			+
Aerial parts of thyme			+
White horehound leaves and seeds	+		+

The effective use of the plant raw materials presented in Table 1 for the treatment of liver and gallbladder diseases is associated with their broad spectrum of therapeutic activity, including choleric, hepatoprotective, antispasmodic, cholekinetic, antioxidant, anti-inflammatory, and bactericidal properties. Phytopreparations and herbal formulations developed on the basis of these medicinal plants by both foreign and domestic researchers are currently widely applied in medical practice.

Among them are such preparations as Allochol, Hofitol, Karsil, Khodjimatova Herbal Collection, Legalon, Hepatophyt, Hepabene, Tanacehol, Cholagogum, Cholagol, Cholaflox, Holosas, Flacumin, Flamin, Convaflavin, Silibor, Olimetin, Urolesan, Pechenochnoye, Cholecystitnoye, Gepatitnoye, Avena-Uz, as well as several “Choleretic Herbal Collections No. 1, No. 2, and No. 3,” all of which contain combinations of various medicinal plant raw materials.

The above-mentioned plant materials contain numerous biologically active compounds, including flavonoids (such as the flavanone naringenin; 5-glycoside salipurposide and its stereoisomer hemorhizin; isosalipurposide; the flavone apigenin and its 7-glycoside; the flavonol kaempferol and its 3-glycosides; quercetin; isorhamnetin-3-rutinoside, and others), bitter glycosides, saponins, coumarins, polyphenols, polysaccharides, tannins, essential oils ( $\beta$ -thujone, borneol, pinene, L-camphor), vitamins, triterpene compounds (sterols, taraxerol, sitosterol, stigmasterol), fatty acids (palmitic, oleic, and linoleic acids), alkaloids, and organic acids (malic acid, ascorbic acid, and salicylic acid) [1,2,6,8]. When selecting the composition of phytopreparations, particular attention should be paid to the biologically active compounds present in medicinal plants.

**Purpose of the Study.** The aim of this study was to investigate the possibilities of selecting the composition of a choleretic herbal formulation based on local medicinal plant raw materials, namely *Avena sativa* L., *Berberis vulgaris* L., and *Rosa canina* L., as well as to conduct a comparative analysis of the available scientific literature.

**Research Objects and Methods.** The research objects included medicinal plants with a sufficient raw material base available within the territory of Uzbekistan, specifically *Avena sativa* L. (cultivated oat), *Berberis vulgaris* L. (common barberry), and *Rosa canina* L. (dog rose).



*Avena sativa* L. – Cultivated oat



*Berberis vulgaris* L. – Common barberry



*Rosa canina* L. – Dog rose (rosehip)

In this extended literature review, scientific data derived from various publications and academic sources were analyzed regarding the choleretic properties of the medicinal plant raw materials *Avena sativa* L. (cultivated oat), *Berberis vulgaris* L. (common barberry), and *Rosa canina* L. (dog rose), as well as their therapeutic effects on diseases affecting different organs and systems of the human body. For this purpose, studies published between 2009 and 2025 in reputable electronic databases, including Scopus, PubMed, ResearchGate, Google Scholar, and Library.ru, as well as in local scientific journals, were systematically reviewed using relevant and significant keywords.

*Avena sativa* L., commonly known as cultivated oat, is a plant species belonging to the Poaceae family. The species epithet *sativa* is derived from the Latin word meaning “to cultivate” or “to sow,” reflecting its long-standing use as an agricultural crop. The medicinal raw material obtained from this plant is *Fructus Avenae* (oat grain) [9].

Oats are considered one of the ancient cultivated crops. In the distant past, wild oat species were commonly found growing among wheat and barley fields. Due to their high adaptability and resistance to adverse environmental conditions, cultivated forms of oats gradually began to be intentionally grown by local populations. Historical records indicate that oats were known in Europe approximately 1500–1700 years before the Common Era. In the present-day Commonwealth countries, oat cultivation has been practiced since the 7th century.

Globally, the cultivation area of oats covers approximately 17.2 million hectares, with particularly widespread production in Western Europe, the United States, and Canada. Nearly 70 species of oats have been identified, including both annual and perennial forms, as well as cultivated and wild varieties. Among these, 11 species possess significant practical and economic importance.

The cultivated oat species include the following:

1. *Avena sativa* L. – common or cultivated oat.
2. *Avena byzantina* Korn. – Byzantine oat or Mediterranean oat.
3. *Avena strigosa* Schreb. – bristle oat, also known as sand oat or hairy oat.

Yovvoyi sulilardan bug’doy va boshqa donli o’simliklar orasida begona o’t sifatida o’sadigan qorako’za yoki qora suli (*A. Fatua* L va *Ludoviciana* Dur) uchraydi. Suli - mo’tadil iqlimga talabchan o’simlik, uning urug’i 2-3°C da una boshlaydi, ko’karib chiqish va to’plash davrlardagi 15-18°C eng qulay harorat hisoblanadi. Sulining po’stli xillari po’stsiz donlilarga nisbatan unib chiqish uchun ko’p nam talab etadi. Hozirgi vaqtda sulining 5 ta navi O’zbekistonda ekishga moslashtirilgan: “Toshkent-1”, “Tezpozak”, “O’zbekiskiy shirokolistniy”, “Do’stlik-85”, “Uspex” navlaridir.

Sulini bahorda va erta muddatda ekish (fevral oxiri - martning boshlarida), O’zbekistonning suvli yerlari sharoitida mo’l xosil olishda muhim ahamiyatga ega bo’lsada, kuzgi muddatda ekilganga qaraganda (don va yashil massa hosildorligi past) kam hosil beradi [10].

Suli *Avena* L. avlodiga mansub bo’lib, ro’vagi sochiq yoki zich holda bo’ladi. Suli o’simligi poyasining balandligi 50-120 sm bo’lib, tik o’suvchi, 3-4 bo’g’imlarga ega, bo’g’imlari binafsha rangli, tukli yoki tuksiz bo’ladi. Barglari – lantsetsimon, o’tkir g’adir-budur, chekkalari tuksiz yoki juda kam kiprikchalarga ega bo’ladi. Barg rangi yashil yoki to’q yashil bo’lib, barg tilchasi konussimon uzunligi 3-5mm, gulto’plami supurgisimon tarqoq ba’zan bir yonli. Boshqochalar 2-4 gulli, ba’zan bir gulli, yalang’och donli shakllarida 5-7 gulli bo’ladi, gullari ikki jinsli, tepada joylashgan gul uzun gul bargiga ega, yuqorigi guli ko’pincha rivojlanmaydi. Boshqoqcha qobiqlari pardasimon keng lantsetsimon shaklda, qiltiqsiz, 9-10 ta tomirlari bo’ladi. Tashqi gul qobig’i lantsetsimon, 5-9 ta tomirlari bo’lib, uchida ikkita qiltiqsimon o’tkir o’simta bo’ladi. Ichki gul qobig’i tashqi gul qobig’iga nisbatan kalta, ensiz, chekkalarida ikkita kipriksimon tomirlari bo’ladi. Sulining doni uzunchoq, tukli, ko’pchilik navlarida qobiqli, qobiqsiz shakllari xam mavjud. Donida oqsil, aminokislotalar, vitaminlar, yog’lar aniqlangan [9,10].

Among wild oat species, black oat or wild oat (*Avena fatua* L. and *Avena ludoviciana* Dur.) is commonly encountered as a weed growing among wheat and other cereal crops. Oat is a temperate-climate crop that requires moderate environmental conditions. Its seeds begin to germinate at temperatures of 2–3°C, while temperatures of 15–18°C are considered optimal

during the germination and tillering stages. Hulled oat varieties require more moisture for germination compared to naked-grain forms.

At present, five oat cultivars have been adapted for cultivation in Uzbekistan: “Toshkent-1,” “Tezpozak,” “O‘zbekiskiy Shirokolistniy,” “Do‘stlik-85,” and “Uspex.” Although spring and early sowing periods (late February to early March) are important for obtaining high yields under the irrigated conditions of Uzbekistan, oat crops sown during this period generally produce lower grain and green biomass yields compared to autumn-sown crops [10].

Oat belongs to the genus *Avena* L., and its inflorescence may be loose-paniculate or compact. The plant stem reaches a height of 50–120 cm, is erect in growth habit, and consists of 3–4 nodes. The nodes are purple-colored and may be either pubescent or glabrous. The leaves are lanceolate, pointed, and rough-textured, with margins that are either glabrous or possess very sparse cilia. Leaf coloration ranges from green to dark green. The ligule is cone-shaped and approximately 3–5 mm in length. The inflorescence is a diffuse panicle, occasionally one-sided in appearance.

Spikelets usually contain 2–4 florets, although single-flowered forms also occur, while naked-grain forms may contain 5–7 florets. The flowers are bisexual. The uppermost flower possesses a long lemma, whereas the upper floret is often underdeveloped. The glumes are membranous, broadly lanceolate in shape, awnless, and possess 9–10 veins. The outer lemma is lanceolate, with 5–9 veins and two awn-like pointed appendages at its apex. The inner lemma is shorter and narrower than the outer lemma and bears two ciliate veins along its margins. The oat grain is elongated and pubescent. In most cultivars, the grain is hulled, although hull-less forms are also present. Oat grains contain proteins, amino acids, vitamins, and lipids [9,10].

Due to the wide diversity of biologically active compounds present in *Avena sativa* L., this plant exhibits a broad spectrum of pharmacological effects. It plays a significant role in reducing blood cholesterol and glucose levels, restoring digestive system function, and supporting cognitive functions of the human body [11].

Cultivated oat is a rich source of biologically active substances, including:

- vitamins and minerals such as phosphorus, magnesium, potassium, zinc, and others;
- soluble and insoluble dietary fibers;
- beneficial lipids, including saturated and unsaturated fatty acids, as well as linoleic acid (an omega-6 fatty acid);
- $\beta$ -glucan, which strengthens the immune system, promotes intestinal recovery, and reduces the risk of diabetes and cardiovascular diseases;
- antioxidants that protect tissue cells from free radicals responsible for cellular damage, cardiovascular disorders, and inflammatory diseases [12,13].

Extensive pharmacognostic studies on *Avena sativa* L. grains and extracts have been conducted by scientists in our country, focusing on the standardization of their major bioactive constituents. In particular, cultivated oat fruits have been investigated as a promising medicinal raw material. Scientific studies have examined the identification, isolation, accumulation dynamics, and morphological-anatomical characteristics of dominant compounds present in oat grains, including  $\beta$ -glucans, neutral lipids, polysaccharides, fatty acids, amino acids, and mineral elements [14,15,16,17].

One of the principal bioactive compounds present in *Avena sativa* L. is beta-glucan ( $\beta$ -glucan). This compound has been extensively studied by researchers and has attracted considerable interest in medical practice as a promising and valuable natural product. Beta-glucan is a

soluble dietary fiber capable of absorbing excess water in the intestines, thereby helping to prevent diarrhea. In addition, it plays an important role in alleviating both diarrhea and constipation. As a result, it enhances the intestinal absorption of nutrients entering the body [13,18,19].

Since ancient times, European researchers and physicians have utilized *Avena sativa* L. in the treatment of nervous system disorders such as epilepsy, depression, and Parkinson's disease. Oat grains contribute positively to memory, cognitive flexibility, and concentration. The rich nutritional composition of oats has demonstrated restorative effects on an exhausted nervous system [20,21].

Furthermore, the antioxidant and anti-inflammatory bioactive compounds found in common oat have been shown to assist in reducing muscle pain, inflammation, and recovery time following intensive physical exercise [22]. Results from controlled studies conducted by 23 independent researchers demonstrated that oat consumption contributed to a reduction in blood levels of C-reactive protein in humans. However, analyses of four different systemic inflammatory markers did not reveal consistently positive outcomes. Therefore, researchers concluded that existing evidence regarding the anti-inflammatory effects of oats remains insufficient and that further investigations are necessary to clarify their beneficial properties [23]. Another study conducted in 2015 revealed that *Avena sativa* may help regulate hunger and reduce food cravings in humans. Moreover, oats are also considered to possess detoxifying properties within the body [24].

Furthermore, it has been proven that the beta-glucan contained in *Avena sativa* L. contributes to reducing blood lipid levels, including lipids and lipoproteins, as well as total and low-density lipoprotein ("bad") cholesterol concentrations [25,26,27]. Other studies have investigated the positive effects of beta-glucan derived from oat groats on metabolic syndrome, a condition associated with an increased risk of diabetes mellitus and cardiovascular diseases. In addition, beta-glucan has been shown to exert beneficial effects on the regulation of blood glucose levels [28].

The pharmacological activity of avenanthramides, bioactive compounds present in cultivated oat extracts, has also been investigated in vitro. These studies confirmed their antibacterial properties against *Staphylococcus aureus*, *Escherichia coli* (*E. coli*), and several other pathogenic microorganisms [27,29].

According to the findings of several scientific studies, the effective therapeutic dose of oat extract used in medical practice ranges from 800 to 1600 mg per day. However, it has been reported that the dosage may vary depending on the intended therapeutic purpose, product type, and the age of the patient [30].

*Berberis vulgaris* L., commonly known as common barberry, belongs to the Berberidaceae family. It is a thorny shrub that can reach a height of 2.5–3 meters. The spines are either simple or divided into three parts. The leaves are obovate, elongated, or elliptical in shape, thick in texture, and possess either entire or serrated margins. They are alternately arranged along the stem and branches by means of short petioles. The yellow flowers are grouped into simple, branched, or racemose inflorescences. The fruits are elongated, oblong-elliptical, or obovate berries that may appear black, purple, or dark red in color. They are sour in taste, juicy, and contain numerous seeds.

Species of barberry are distributed throughout Western Asia, the Caucasus, Eastern, Central, and Southern Europe, and have been cultivated since 1894. These plants commonly grow on mountain slopes, forest edges, meadows, and mountainous regions at elevations up to 2000

meters above sea level. In Central Asia, barberry species occur in the lower mountainous zones, on mountain slopes, along irrigation ditches, and within juniper forests. Common barberry, however, is mainly cultivated. Five species of barberry are known to grow in Uzbekistan. Among them, three species are widely used in traditional medicine:

1. *Berberis vulgaris* L. – common barberry;
2. *Berberis integerrima* Bunge – red barberry;
3. *Berberis oblonga* Schneid. – black barberry.

In folk medicine, the roots, leaves, and fruits of barberry species are commonly utilized for therapeutic purposes.

The roots of common barberry (*Radix Berberidis vulgaris* L.), which are used for berberine production, serve as medicinal raw material. The prepared raw material consists of woody root fragments not exceeding 20 cm in length and 6 cm in thickness. The roots are entire, smooth, and frequently branched, with a brownish-gray outer surface and a lemon-yellow color at the fracture site. They possess a faint odor and a slightly bitter taste. The berberine content must not be less than 0.6%, moisture content should not exceed 12%, and darkened roots should comprise no more than 5% of the material.

Another medicinal raw material is the leaves of common barberry (*Folium Berberidis vulgaris* L.), which are used for the preparation of barberry leaf tincture (*Tinctura folii Berberidis*). The leaves are 2–7 cm long and 1–4 cm wide, with a wedge-shaped base and rounded apex, while each tooth extends into a soft needle-like projection. The leaves possess a characteristic odor and a sour taste. The fruits are elongated and juicy, measuring 9–10 mm in length, purple or dark red in color, and covered with a slight waxy coating. The seeds are ovate, dark brown, 5–6 mm long, and finely wrinkled [10,31].

All parts of *Berberis vulgaris* L. contain alkaloids in concentrations ranging from 0.04% to 0.9%. From the total alkaloid complex, compounds such as berberine, jatrorrhizine, palmatine, and several other alkaloids have been isolated. The principal alkaloid is berberine, the concentration of which reaches up to 1.5% in the roots. Other identified alkaloids include palmatine, columbamine, jatrorrhizine, berberrubine, oxyacanthine, its isomer berbamine, and tetrandrine. Barberry fruits contain malic acid and other organic acids, sugars, and pectin substances. The seeds contain up to 15% fatty compounds. Triterpene saponins are present in the buds, while the leaves contain up to 90 mg/% of ascorbic acid and vitamin E.

Historically, medicinal preparations based on barberry were widely used in ancient India. Their therapeutic effects, including sedative, anti-inflammatory, choleric, and diuretic properties, are associated with the presence of alkaloids and tannins in the plant. The total alkaloid complex and berberine chloride have been shown to enhance blood coagulation, lower blood pressure, and exhibit choleric activity [32].

For this reason, berberine is widely utilized in medical practice due to its antispasmodic properties, ability to relieve pain, stimulate bile secretion, and exert anti-inflammatory and antimicrobial effects. In addition, it demonstrates sedative activity, lowers arterial blood pressure, slows heart rate, and promotes uterine contractions. Berberine bisulfate (*Berberini bisulfas*), isolated from barberry roots, is used in clinical medicine. It is prescribed as a choleric agent in the treatment of chronic hepatitis, hepatocholecystitis, cholecystitis, gallstone disease, and other gallbladder disorders [33].

Barberry root tincture is used in the treatment of cardiovascular and gastrointestinal diseases, neurasthenia, rheumatism, and fever. It is also included in Zdrenko's formulation, where it exhibits hemostatic and diuretic properties. Decoctions prepared from the leaves are

traditionally used for treating headaches, epistaxis, and urinary disorders. Barberry leaf tincture initially slows gallbladder motility and subsequently stimulates it. This pharmacological effect enables the effective use of barberry-based preparations in biliary dyskinesia, chronic cholecystitis, cholangiohepatitis exacerbations, and uncomplicated gallstone disease without jaundice. The recommended duration of treatment is approximately one month.

Fruit infusions are utilized to improve cardiac function, reduce fever and blood pressure, relieve thirst, purify the blood, and treat diarrhea [34]. Preparations derived from common barberry are generally well tolerated by patients with diabetes mellitus. They are also considered effective supportive remedies in the management of kidney disorders and cystitis. In addition, barberry has traditionally been used in the treatment of tuberculosis, gout, rheumatism, digestive disorders, leishmaniasis, and for improving uterine blood circulation during the postpartum period.

Chinese researchers were the first to identify the blood glucose-lowering effect of berberine while treating diarrhea in patients with diabetes mellitus [35]. Furthermore, several studies have reported that diabetic patients who consumed 500 mg of berberine two to three times daily for up to three months demonstrated significant reductions in blood glucose levels. Subsequent monitoring revealed that its effectiveness was comparable to metformin, a widely used drug for the treatment of type 2 diabetes mellitus [36].

Berberine is capable of activating AMP-activated protein kinase (AMPK), increasing the AMP/ATP ratio, and inhibiting ATP biosynthesis within mitochondria [37]. In addition to enhancing insulin sensitivity, berberine also functions as an  $\alpha$ -glucosidase inhibitor [38,39] and suppresses adipogenesis, thereby exhibiting anti-obesity activity [40].

Several scientific investigations have also shown that berberine may contribute to reducing elevated cholesterol levels. Administration of 500 mg twice daily for three months was found to decrease total cholesterol, low-density lipoprotein cholesterol, and triglyceride concentrations [41]. Moreover, the combined use of 1000 mg of berberine with cholesterol-lowering drugs such as simvastatin demonstrated greater efficacy than the pharmaceutical agent alone [42].

Due to the antioxidant properties of barberry extract and its influence on hepatic enzyme activity, plant extracts have been suggested to improve liver function. Polyphenolic compounds are considered important antioxidants. These compounds, particularly flavonoids, protect the liver against damage caused by free radicals and toxic substances [43].

Foreign researchers have investigated the hepatoprotective effects of *Berberis vulgaris* extract against carbon tetrachloride-induced hepatotoxicity in rats. The results demonstrated that administration of carbon tetrachloride increased hepatic enzyme levels and caused hepatic necrosis and fibrosis in histological examinations. However, co-administration of barberry extract with carbon tetrachloride significantly reduced the levels of ALT, AST, gamma-glutamyl transferase, direct bilirubin, total protein, and malondialdehyde (MDA). At the same time, the concentrations of glutathione (GSH), superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx) increased. According to the findings of numerous studies, the extract exhibits hepatoprotective activity primarily due to its antioxidant properties [44].

Studies conducted on animals using aqueous and alcoholic extracts of *Berberis vulgaris* L. fruits have demonstrated that, due to their broad spectrum of pharmacological activity, these extracts may be effective in the treatment of numerous diseases. As a medicinal plant raw material, *Berberis vulgaris* can be regularly used in the management of type 2 diabetes mellitus,

liver diseases, gallbladder and biliary tract disorders, digestive system diseases, gallstone disease, and urinary tract disorders [47].

*Rosa canina* L., commonly known as dog rose, is a perennial shrub belonging to the Rosaceae family. It is a thorny shrub reaching 1.5–3 meters in height and occasionally up to 6 meters. The branches are flexible, glossy, and covered with brownish-red or reddish-brown bark. The leaves are 7–9 cm long, green to bluish-green in color, and smooth, with the main petiole sometimes sparsely covered by short hairs. The flowers are typically pale pink, white, or bright pink. The ripe fruits are large, measuring 15–25 mm in length, broadly oval, and sometimes spherical or elongated-oval in shape, with a smooth light-red surface. The inner walls of the fruit are covered with numerous rigid hairs, among which hard stone-like nutlets are located. Rosehip blooms from May to July, while the fruits ripen between August and October [48]. More than 200 species belonging to the genus *Rosa* L. have been identified worldwide. These species are predominantly distributed across the Northern Hemisphere, particularly throughout Europe, Asia, the Middle East, and North America. *Rosa canina* possesses a unique meiotic and reproductive system characterized by heterogamous meiosis involving tetraploid egg cells and haploid pollen grains that form a stable pentaploid organism. The species was first described as a medicinal plant by Pliny the Elder. Historical records indicate that among French tribes, the fruits were traditionally used as a remedy for dog bites. This medicinal application later became the basis for the species epithet *canina*, meaning “dog rose” [34,49].

Representatives of the rosehip genus preserved in the National Herbarium of Uzbekistan include 93 species. In Uzbekistan, four species of rosehip are widely used in medicine:

1. *Rosa beggeriana* – Begger rosehip (white wild rose);
2. *Rosa canina* L. – dog rose;
3. *Rosa fedtschenkoana* – Fedchenko rosehip;
4. *Rosa kokanica* – Kokand rosehip.

*Rosa canina* L. grows wild in the fields, gardens, lower and middle mountainous regions, riverbanks, and juniper forests of the Tashkent, Samarkand, Syrdarya, Fergana, Jizzakh, Surkhandarya, and Kashkadarya regions of Uzbekistan [34,49,50].

The pseudofruits of *Rosa canina* L. are primarily used as medicinal raw material. The commercial product consists of whole fruits of various shapes—spherical, ovate, or elongated—from which the sepals and fruit stalks have been removed. The fruits generally measure 0.8–2.5 cm in length and approximately 0.7–2.8 cm in diameter. Exposure to frost significantly reduces the vitamin C content of the fruits. Therefore, harvested rosehip fruits should be dried immediately in open air under sunlight or in specialized drying ovens at temperatures of 80–90°C.

The quality requirements established for rosehip fruits include: moisture content not exceeding 15%, total ash content up to 4%, admixture of other plant parts such as stems, branches, and shoots not exceeding 2%, burned, blackened, or pest-damaged fruits not exceeding 3%, unripe fruits not exceeding 5%, and both organic and mineral impurities limited to 0.5% each [49,50]. The concentration of biologically active compounds in rosehip fruits depends largely on the climatic conditions and the geographical region in which the plants are cultivated and harvested. In general, the fruits contain up to 15% vitamin C, as well as vitamins B<sub>2</sub>, P, E, and K, 12–25% carotene, up to 29% organic acids (primarily malic and citric acids), up to 18% sugars, approximately 3.7% pectin, up to 4.5% tannins, and up to 9.3% fatty oils in the seeds [34].

Among rosehip species, *Rosa canina* L. contains comparatively lower amounts of vitamin C, ranging from 0.2% to 2.2% in the fruit. Nevertheless, this concentration is still reported to be 5–10 times higher than that found in aronia and barberry fruits. In recent years, scientific interest in rosehip fruits has increased considerably across many research centers worldwide. Their pharmacological properties—including antioxidant, anti-inflammatory, immunomodulatory, choleric, antitumor, neurorestorative, and hormone-regulating effects—continue to be extensively investigated under laboratory conditions by researchers.

One of the best-known pharmaceutical preparations produced from *Rosa canina* fruits is Holosas. This preparation consists of a concentrated aqueous extract of rosehip fruits combined with sugar syrup and is widely used in the treatment of liver diseases such as cholecystitis, hepatitis, and gallstone disorders of the biliary tract [34,50].

Foreign researchers isolated 3-O-(6 $\alpha$ -O-E- $\beta$ -coumaroyl)- $\alpha$ -D-glucopyranoside and kaempferol 3-O-(6 $\alpha$ -O-Z- $\beta$ -coumaroyl)- $\alpha$ -D-glucopyranosides from the methanolic extract of *Rosa canina* L. seeds and subsequently investigated the antibacterial activity of these compounds. The mixture containing these isolated substances demonstrated inhibitory effects against microorganisms such as *Staphylococcus epidermidis*, *Proteus mirabilis*, and *Lactobacillus plantarum* [51,56].

The antimicrobial activity of hexane, chloroform, ethyl acetate, aqueous, and methanolic extracts of *Rosa canina* L. fruits has also been evaluated *in vitro*. Antibacterial activity was studied against bacterial strains including *Staphylococcus aureus* (PTCC1431), *Bacillus cereus* (PTCC1015), *Bacillus subtilis*, *Escherichia coli* (PTCC1399), and the fungal strain *Candida albicans* (PTCC5027). Among the tested extracts, the methanolic extract demonstrated the strongest antimicrobial activity. The aqueous extracts also produced positive effects against both Gram-positive and Gram-negative bacteria. In contrast, the acetone extract exhibited activity specifically against *Escherichia coli*, *Staphylococcus aureus*, and *Candida albicans*. However, the chloroform and hexane extracts did not demonstrate any significant antimicrobial effects. These findings suggest that certain extracts of *Rosa canina* possess promising antimicrobial properties and may therefore have potential applications in medical practice [52,56].

## Conclusion

The growing demand for modern medical therapies and natural products has renewed scientific interest in medicinal plant raw materials and the natural compounds isolated from them. The information presented in this article demonstrates that *Avena sativa* L., *Berberis vulgaris* L., and *Rosa canina* L. are promising plant species for the development of choleric herbal formulations. However, several limitations were identified in the published studies reviewed.

Previous scientific investigations have mainly focused on the development and pharmacological evaluation of combined phytopreparations consisting of medicinal plant extracts together with bile acids. Nevertheless, the formulation and production of such combined preparations remain technically challenging. As a result, the use of herbal mixtures derived directly from medicinal plant raw materials continues to retain its scientific and practical relevance.

Thus, the extensive and systematic data available in the scientific literature regarding *Avena sativa* L., *Berberis vulgaris* L., and *Rosa canina* L. indicate that these plants represent

promising medicinal raw materials for the development of phytopharmaceutical preparations intended for the prevention and комплексиве treatment of liver and gallbladder diseases.

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**Ядгарова Ситора Кахрамоновна<sup>1</sup>, Фарманова Нодира Тахировна<sup>2</sup>**  
**ЛЕКАРСТВЕННЫЕ РАСТЕНИЯ И ФИТОСБОРЫ ИСПОЛЬЗУЕМЫЕ ПРИ**  
**ЗАБОЛЕВАНИЯХ ПЕЧЕНИ И ЖЕЛЧНОГО ПУЗЫРЯ**

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В статье представлен анализ научной литературы, посвященный оценке возможностей рационального подбора лекарственных растений и составления фитосборов, предназначенных для применения при заболеваниях печени и желчного пузыря. В качестве объектов исследования выбраны *Avena sativa* L. (овёс посевной), *Berberis vulgaris* L. (барбарис обыкновенный) и *Rosa canina* L. (шиповник собачий). Проведён системный анализ отечественных и зарубежных исследований, посвящённых биологически активным веществам, фармакологическим свойствам и особенностям применения данных растений. Показано, что указанные виды обладают широким спектром фармакологической активности, включая гепатопротекторное и желчегонное действие, что обосновывает перспективность их использования в медицинской практике.

Результаты исследования свидетельствуют о целесообразности применения данных растений в качестве сырья для разработки фитопрепаратов, предназначенных для профилактики и лечения заболеваний печени и желчного пузыря.

**Ключевые слова:** печень, желчный пузырь, фитосбор, желчегонные средства, *Avena sativa* L., *Berberis vulgaris* L., *Rosa canina* L., флавоноиды, фенольные соединения, алкалоиды, витамины, минеральные вещества, органические кислоты, холекинети́ческое, гепатопротекторное, холелитическое, холеспазмолитическое действие.

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**MEDICINAL PLANTS AND PHYTOHERBS USED FOR LIVER AND GALLBLADDER DISEASES**

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This article presents a review of scientific literature aimed at evaluating the rational selection of medicinal plants and the formulation of herbal mixtures intended for the treatment of liver and gallbladder diseases. The objects of the study included *Avena sativa* L., *Berberis vulgaris* L., and *Rosa canina* L. A systematic analysis of both domestic and international studies was conducted, focusing on biologically active compounds, pharmacological properties, and patterns of application of these medicinal plants. The findings demonstrate that these species exhibit a broad spectrum of pharmacological activities, including hepatoprotective and choleric effects, supporting their potential use in medical practice.



The results indicate that these plants represent promising raw materials for the development of phytopharmaceuticals intended for the prevention and treatment of liver and gallbladder diseases.

**Keywords:** liver, gallbladder, herbal formulations, choleric agents, *Avena sativa* L., *Berberis vulgaris* L., *Rosa canina* L., flavonoids, phenolic compounds, alkaloids, vitamins, minerals, organic acids, cholekinetic, hepatoprotective, cholelithic, cholelasmolytic effects.