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Review Paper

# A review on hepatoprotective activity of medicinal plants

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ABSTRACT

Liver illnesses are a significant global health concern that are particularly common in developing nations. When consumed in extremely high concentrations, chemicals and some medications are the principal causes of them. Despite advancements in contemporary medicine, no medication has been shown to effectively promote liver function, shield the liver from harm, or aid in the regeneration of hepatic cells. Therefore, there is a pressing need for efficient medications to replace or enhance those now in use. There is no denying the value of the plant kingdom in discovering novel therapeutic medicines. The literature on plant extracts and chemically characterized natural compounds having hepatoprotective properties is reviewed in this paper. The review lists several therapeutic plants, their families, geographical origin, chemical composition, chemical structure, plant parts used, and liver damage inducers. The goal of this endeavor is to support scientists as they investigate medicinal plants that may be used to treat liver disorders.

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## 1. INTRODUCTION

Throughout history, medicinal plants have been recognized for their ability to prevent illness and are held in high regard as a valuable source of therapeutic compounds. India has been dubbed the "Medicinal Garden of the World" due to the vast abundance of medicinal plants that nature has bestowed upon humanity. Ancient civilizations including Egypt, China, India, South America, and others continue to use a variety of plant treatments for a range of ailments. In this sense, India is unique in that it is home to several internationally recognized indigenous medical systems, including Ayurveda, Siddha, Unani, homeopathy, yoga, and naturopathy, all of which are used to treat patients. the need for pharmaceuticals, health goods, nutritional supplements, cosmetics, and other plant-based medications[1].

Medicinal plants have been used for decades to treat illnesses. The World Health Organization (WHO) has long organized and alerted numerous nations to the public's growing interest in using medicinal plants and their products to treat a variety of illnesses. India has a large abundance of medicinal plants, and many different medical systems use extracts from these plants to treat various illnesses[2].

Medicinal plants have a vital role in maintaining human health. It is estimated that 80% of people on the planet use conventional medication, which is primarily based on plant components. The term "traditional medicine" describes the widest range of traditional herbal remedies. It is estimated that some 7,500 plants are used in traditional fitness rituals in India's rural and tribal areas; of these, over 4,000 have true medicinal value that is either little understood to the general public or barely acknowledged by the scientific community. About 1,200 plants are used in the traditional medicinal system, which encompasses Ayurveda, Siddha, Amchi, Unani, and Tibetan medicine[3]. Thorough studies chronicle the flowers used in regional fitness customs, and pharmacological analysis of these plants and their taxonomic family can lead to the development of

priceless plant medicines for a variety of terrible illnesses. Plant screening at random has lost its economic viability[4].

## 2.Plants used for Hepatoprotective activity

### 1. Silybum marianum

The medicinal plant silybum marianum has been used for 2000 years to treat jaundice, enlarged liver and spleen, and other hepatoprotective conditions. Silybum marianum is a worldwide plant that was originally native to Asia and South Europe. Numerous liver disorders marked by degenerative necrosis or functional impairment have been treated with it. Additionally, silymarin can shield the kidneys from nephrotoxic substances[5-6].

Cardus marianus, Scotch thistle, Blessed milk thistle, Marian thistle, Mary thistle, Mary's thistle, Saint Mary's thistle, Mediterranean milk thistle, and variegated thistle are some of the names for Silybum marianum, an asteriacean plant. Shiny pale green foliage and crimson to purple blooms with white veins are characteristics of Silybum marianum. It is referred to as Mary thiqhal in Arabic and Persian nations.

Numerous substances, including silybin, silibinin A and B, silicristin, silidianin, apigenin, dehydrosilybin, and deoxysilyn cristin, are found in the plant's seeds. This plant's dried seed extract has up to 4% silymarin. A mixture of flavonoids, including silibinin, is called silymarin[6].

Silymarin protects the liver against toxicities resulting from various toxins such as carbon tetra chloride, acetaminophen, and tetrachlorometane. It has been reported that Silymarin provides the Hepatoprotective effect by different mechanism including Antioxidant activity and scavenging free radicals, stimulation of DNA polymerase and stable of Hepatocellular membrane[7].

### 2. B.Vulgaris

B. vulgaris, popularly known as barberry, is a member of the Berberidaceae family and is a popular culinary and medicinal plant in Iran. B. vulgaris is a shrub that grows to a height of one to three meters. It is found across the world, particularly in Iran (Khorasan). Hepatoprotection is one of the medical uses for fruit, leaves, and stem. Fruit extract from B. vulgaris contains a variety of flavonoids that have antioxidant properties[8-9]. Some additional chemicals include oxyacanthine, berberine, and other alkaloids including berbamine, palmatine, columbamine, malic acid, jatrorrhizine, and berberrubine. This plant was also shown to contain polyphenols, oleanolic acid, stigmasterol glucoside, terpenoids lupeol, and stigmasterol.

The plant's roots, rhizomes, and stem bark contain berberine, an isoquinoline alkaloid with a lengthy history of medical use. Potassium and calcium currents in isolated rat hepatocytes are inhibited by berberine. By scavenging the peroxidative products, it exerts hepatoprotective effects on CC14-induced liver injury that are both preventative and curative. In rats, CC14 markedly raised the levels of alkaline phosphatase, aspartate aminotransferase, and alanine aminotransferase in the serum. The application of B. vulgaris fruit methanolic extract much assisted in bringing these alterations close to normal. Furthermore, the extract may shield rats' livers from oxidative damage caused by CC14[10]. The results of Domitrović's study suggested that berberine could shield the liver against damage caused by CC14. Berberine's hepatoprotective actions may be ascribed to its ability to scavenge free radicals, reduce oxidative and nitrosative stress, and suppress the inflammatory response in the liver. Furthermore, when administered orally, B. vulgaris extract/β-cyclodextrin had superior hepatoprotective effects compared to free extract, potentially because of its higher bioavailability. The prepared extract has potential use as a cost-effective phytotherapeutic supplement for both acute and chronic illnesses, as well as a supplementary treatment for standard medicines[11].

### 3. Woodfordia fruticosa

According to data from the World Health Organization (WHO), 80% of people in underdeveloped nations receive their primary medical care from traditionally used medicinal herbs. Woodfordia floribunda Salisb and Woodfordia fruticosa Kurz syn are two of the many species utilized in folk medicine. Practitioners of traditional medicine have traditionally used it extensively throughout many South East Asian nations[12].

Hepatoprotective activity: These medicinal herbs have the ability to protect rats' livers against phenytoin-induced damage and carbon tetrachloride-induced hepatotoxicity. They also exhibit this ability when combined with petroleum ether, ethyl alcohol, chloroform, and an aqueous extract of Woodfordia fruticosa flower.

Woodfordia fruticosa Kurz is a member of the Lythraceae family, which also includes Ammania baccifera Linn and other significant medicinal plants[13]. The plant may be found in large quantities not only in most of South East and Far East Asia's nations, such as Malaysia, Indonesia, and China, but also reaching to an altitude of around 1500 meters throughout India.

Chemical compound: It was initially shown that the stems contained the common plant ingredients, octacosanol and β-sitisterol. Subsequent reports indicated that β-sitosterol was also found in the leaves of the flower. The steroid sapogenin hecogenin is one of the other non-phenolic substances that makes up reports[14].

### 4. C. Officinalis

In Europe and the USA, C. officinalis, sometimes known as marigold, is a prominent medicinal and cosmetic herb belonging to the Asteraceae family. This plant's dried flower heads, also known as dried ligulate blossoms, are utilized in cosmetic and/or pharmacological applications[15]. For C. officinalis, antibacterial, anti-inflammatory, antiviral, and antioxidant properties have already been reported. It has been used to induce menstruation and treat jaundice

and fevers. C. officinalis extracts, tinctures, salves, and balms have all been administered topically to treat wounds and reduce inflammation and injury to the skin. Monoterpenes like α-thujene and T-muurolol, sesquiterpene and flavonol glycosides, triterpene alcohols, triterpenoid saponins, flavonoids, carotenoides, xanthophylls, phenolic acids, mucilage, bitters, phytosterols, tocophrrols, calendulin, resin, and volatile oil are among the potentially active chemical constituents of C. officinalis.

In vivo pharmacological investigations have linked the triterpenoid fatty acid esters to the anti-inflammatory properties of C. officinalis flowers[16]. Singh's study examined the 80% protective effect of a methanolic extract of C. officinalis leaves (500 mg/kg orally, four treatments spaced 12 hours apart) against acetaminophen-induced liver damage in albino rats. In isolated primary rat hepatocytes, CC14-induced oxidative stress and cytotoxicity were observed to be inhibited by C. officinalis extracts. This was verified by a notable increase in cell viability and enzyme leakages (ALT, AST, and LDH).

Hepatoprotective effects may also be responsible for the decrease in hepatocytolysis and steatosis as well as the recovery of different enzyme activities to normal levels[17]. Plant extracts containing C. officinalis considerably increased cell survival and made a substantial contribution to protecting the integrity of the cellular membranes against CC14. Furthermore, as demonstrated by the preservation of GST and the inhibition of LPO, plant extracts of C. officinalis safeguard the intracellular antioxidant defense system.
It has been demonstrated that C. officinalis flower extract has a protective effect against CC14-induced acute hepatotoxicity and cisplatin-induced nephrotoxicity. The floral extract's potential mode of action could be attributed to its antioxidant properties and ability to reduce oxygen radical levels.

## 5. Schisandra Chinensis

*Schisandra Chinensis* Turz (Bail) belongs to the family of *Schisandraceae* family. The plants are native to northeastern China, Japan Korea, Manchuria, and the FarEast part of Russia. Their purple-red berries are called five-flavor fruits because of the sweet, bitter, pungent, salty, and sour taste. *Chinensis* is widely used as an herbal supplement in traditional Chinese medicine and in Western phytotherapy.

**Chemical components:** *S.Chinensis* fruits contain about 1.5% sugars (polysaccharides and monosaccharide, glucose, fructose, galactose, and arabinose). The other chemical constituents are organic acids,including malic acid, tartaric acid.

**Hepatoprotective activity:** Some Lignans bioactivities of antitumor-promoting by inhibiting early antigen activation and multi drug resistance in cancer cells and enhancing doxorubicin induced apoptosis in human hepatic cancer cells as well as inhibiting the platelet aggregation and anti-HIV effects. The plant shows various beneficial biological activities on the liver such as respiration, and central nervous and cardiovascular system[18]. It exhibit a Hepatoprotective effect by lowering the serum glutamate pyruvate level and antioxidant properties.

## 6. T. Porrifolius

Purple salsify, or T. porrifolius, is a member of the Asteraceae family and is planted for its edible roots and shoots. It contains bioactive substances that shield against cancer and other diseases brought on by free radicals. This plant's nutritional value comes from polyphenols, vitamins, fructo-oligosaccharides, and monounsaturated and essential fatty acids, which all have probiotic effects on the gut microbiota. 4-vinyl guaiacol (19.0%), hexadecanoic acid (17.9%), hexahydrofarnesylacetone (15.8%), and hentriacontane (10.7%) are the plant's most prevalent compounds[19].

The hepatogenic/hepatoprotective activities of T. porrifolius appear to be effective against liver disorders or hepatotoxicity caused by a range of hepatotoxic agents, including chemicals, medicines, pollutants, and infections with bacteria, viruses, or parasites (hepatitis A, B, and C). The polyphenolic chemicals in plants are responsible for these health benefits. The investigation of the aerial component of T. porrifolius's methanolic extract's antioxidant activity and its ability to shield rats' livers from CC14-induced hepatotoxicity revealed a dose-dependent rise in the activity of liver antioxidant enzymes.

The activity of GST, SOD, and CAT was enhanced by a dosage of about 250 mg/kg body weight. Additionally, it has been demonstrated that there is a significant hepatoprotective potential against CC14-induced liver injury, which is related to the restoration of normal levels of AST, ALT, and LDH activity[20].

Studying the effects of T. porrifolius shoot water extract on lipemia, glycemia, inflammation, oxidative stress, hepatotoxicity, and gastric ulcer using a rat model revealed that serum cholesterol, triglyceride, glucose, and liver enzyme (ALP, ALT, and LDH) levels significantly decreased after one month of T. porrifolius water extract intake. Rats treated with T. porrifolius extract showed significant anti-inflammatory benefits against both acute and chronic inflammation brought on by formalin and carrageenan[21].
Furthermore, T. porrifolius demonstrated potent antioxidant activity because of its exceptional scavenging capacity.

## 7. Ocimum Sanctum

Tulsi means ‘incomparable one’ or ‘matchless’ and it is derived from Sanskrit. Tulsi is a sacred plant of Hindu religion worshipped all over the India. *Ocimum sanctum* is a many branched, erect, stout and aromatic herb about 75 cm high. They are cultivated in different parts of the world and are widely known for their medicinal properties. The leaves, seeds and root of this plant have been used in indigenous

Ayurvedic medicine. This small herb is found throughout India and is cultivated, worshiped in temples and houses of Hindus.

**Morphological feature:** This branched fragmented shrub with the height of about 30-60 cm when mature and belonging to family *Labiatae.* Its leaves are simple, aromatic, branched, opposite, obtuse, elliptical and have dentate margins. Tulsi leaves are purple in colour and seeds radish yellow and frits are small. It is planted after rainy season and harvested after few months.

**Hepatoprotective activity:** Hepatoprotective activity of *Ocimum sanctum* alcoholic leaf extract against paracetamol-induced liver damage in albino rats synergism with Silymarin and concluded that *Ocimum sanctum* that alcoholic leaf extract showed significant Hepatoprotective activity and synergism with Silymarin[22].

**Chemical components:** The leaves of *Ocimum sanctum* contain 0.7% volatile oil comprising about 71% eugenol and 20% methyl eugenol. Fresh leaves and stem of *Ocimum sanctum* extract yielded some phenolic compounds. Such as cirsilineol, circimaritin, isothymusin, apigenin and rosameric acid[23].

## 8. Solanum Nigrum

*Salanum nigrum* is a medicinal plant and it is also known as black night shade in English, Makoi in Hindi, Kachchipandu in Telugu, Munatakali in Tamil, Piludi in Gujarati and Kamuni in Marathi.
Two varieties of *Solanum nigrum* found one is black colour fruits and seconds is reddish roots are used for health point of view.

**Morphological Feature***: Solanum nigrum* is 25-100 cm tall, pubescent with simple hairs. The fruits are dull black, the leaves are ovate, and bases are cuneate, 4-10 and 3-7 cm wide, pubescent, coarsely dentate, the apex isobtuse. Belonging to the family of *Solanales.*

**Hepatoprotective activity:** *Solanum nigrum* aqueous and methanolic extracts were studies for hepatoprotective activity in rats injected with 0.2 ml kg of carbon tetrachloride for 10 consecutive days. Hepatoprotective against CC14- induced liver damage. The ethanol extract showed remarkable hepatoprotective activity. Ethanol extracts of *Salanum nigrum* Linn. Was investigated for the hepatoprotective activity against CC14- induced hepatic damage in rats. The histopathological changes of liver sample in treated animals and compared of the control.

**Chemical components**: The *Salanum nigrum* possesses numerous compounds that are responsible for pharmacological activities.Whole plant reported that which contain alkaloids, flavonoids, tannins, saponins, glycosides, proteins carbohydrates, coumarins and phytosterols, Small unripe fruits of *Salanum nigrum*[23].

Several compounds have been isolate from different fraction of solanum nigrum which have shown pharmacological relevance to the observed effects of whole plants preparation of solanum nigrum. Solanidine is obtained after hydrolysis of solqnine, solanine is less toxic[24]. Although toxic constituents are presents in most part of the plants, nutritional potential of the leaves and seeds that solanum nigrum is nutritive despite the presence of some anti nutritive components like oxalate. protein contents of the leaves and seeds were found to be 24.90 and 17.63% other finding of are ash 10.18 and 8.05% crude fibres, 6.81 and 6.29% and carbohydrates, 53.51% for leaves and seeds[25].

## 9. A. Majus

The Apiaceae family plant A. majus is an annual that grows to a height of 0.30 to 0.60 meters. It has ascending branches and finely divided leaves into filiform segments. The plant is native to Asia. There are tiny white blooms in an umbellate inflorescence. The involucral bracts are divided pinnately, and the involucels are composed of several linear bracts. Furocoumarins are the primary poisons. All plant parts, especially the seeds, have the potential to be phototoxic to humans, sheep, cattle, and birds when consumed or applied topically and then exposed to sunlight.

A. majus is a native medicinal plant whose fruits should not be consumed while nursing, pregnant, suffering from tuberculosis, liver or kidney illness, HIV, or any other autoimmune disease. It is frequently used to treat skin conditions like vitiligo and psoriasis. A. majus should not be used in patients with known xanthotoxin sensitivity, photosensitivity-related disorders, cataracts, aggressive squamous-cell carcinoma, or younger patients than 12 years old[26].

As the main coumarines, A. majus concurrently accumulates several 7-Oprenylated umbelliferones. It is thought to be a source of the primary coumarin, 6-hydroxy-7-methoxy coumarine. Since A. majus contains several active chemicals, including quercetine, kaempferol, and marmesinin, which inhibit cytochrome P450, including xanthotoxin, bergapten, imperatorin, and isoimpinellin, it has the potential to treat diabetic nephropathy and cardiac injury. Rats treated with varying concentrations of the extract from A. majus seeds may exhibit dose-dependent hepatoprotective benefits against liver damage produced by CC14[27].

## 10. C. Lanatus

The Cucurbitaceae family plant C. lanatus is utilized in conventional herbal therapy. When completely ripe or nearly putrid, the fruits are consumed as a febrifuge. In addition, the fruit has diuretic properties and can be used to treat renal stones and dropsy. The fruit's rind is recommended for diabetes and alcohol toxicity. Cucurbitacin, triterpenes, anthraquinones, steroids, alkaloids, flavanoids, saponins, tannins, flavones, aglycone, and simple phenols are among the

bioactive substances found in C. lanatus. It is thought that the aqueous extract of C. lanatus is a good source of beta carotene, lycopene, glucose, fiber, and vitamin C. According to epidemiology, antioxidants can lessen or even prevent the effects of oxidative stress on bodily tissues[28].

Rats were given 120 g/70 kg body weight of watermelon juice, which may have antioxidant benefits. This resulted in a drop in SOD activity and low density lipoprotein-cholesterol and an increase in CAT and high density lipoprotein-cholesterol. On HepG2 cells, most cucurbitacin exhibits cytoprotective effects. It has been shown that curcumin has a great deal of potential as a liver-fibrosis agent.

Research has been conducted to examine the impact of C. lanatus juice on LPO in the liver, kidney, and brain of rats. as CC14 was administered in vivo once a week for 28 days, there was a notable decrease in albumin and a rise in serum indicators of liver injury, including AST, ALT, and total bilirubin, as compared to the control group. But the administration of ursodeoxycolic acid or watermelon juice together with CC14 greatly reduced these alterations.

Following CC14 treatment, there was a rise in LPO levels in the liver, kidney, and brain tissues. On the other hand, ursodeoxycolic acid therapy and watermelon juice stopped the rise in LPO. The findings show that watermelon juice, likely as a result of its antioxidant activity and ability to suppress the generation of lipid peroxide, shields the liver, kidney, and brain tissues against in vitro CC14 toxicity in rats. The combined biological evidence favors the use of watermelon juice as a therapy for hepatotoxicity caused by chemicals.

## 3. CONCLUSION

The extract from these plants has a protective effect against CC14, and it may be related to phytosterols, alkaloids, terpenoids, polyphenolic chemicals, and coumarines. Polyphenolic substances such because flavonoids can strengthen the ability of antioxidant enzymes (CAT, SOD, and glutathione peroxidase) to prevent cells from emptying reduced glutathione. Hepatoprotection benefits from flavonoids' antilipoperoxidant, free radical scavenging, and antioxidant properties. Moreover, these substances possessing antioxidant qualities have the ability to neutralize free radicals in the surroundings, so preventing their detrimental consequences.

Antioxidants are also terpenoids, such as carotenoids with antihepatotoxic action. One triterpene that may have hepatoprotective properties is ursolic acid. Additionally, it has been shown that silymarin, β-sitosterol, betalain, neoandrographolide, phyllanthin, andrographolide, curcumin, picroside, hypophyllanthin, kutkoside, and glycyrrhizin have strong hepatoprotective qualities out of a number of leads derived from plants containing potential hepatoprotective agents. Treatment for cirrhosis, alcohol-associated liver disease, and hepatitis was greatly aided by silymarin and glycyrrhizin. β-sitosterol exhibited proliferative, angiogenic, antioxidant, and anti-inflammatory properties. Species that contain betalain are frequently used as medications to treat a wide range of illnesses, including liver problems, malaria, jaundice, and low urine production. Betalains have antiviral, anticancer, antiparasitosis, and antioxidant properties.

The evidence supporting the use of herbal medicines to treat viral hepatitis or other chronic liver illnesses is insufficient, despite promising signs for the discovery of new treatments in the near future. As a result, recommendations for herbal medicines should only be made in the context of carefully managed clinical trials. It appears that both patients and doctors need to receive better education regarding herbal preparations.

## 4.CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

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