



Hepatoprotective Potential Of Medicinal Plants

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❖ Abstract:-

The liver plays a vital role in metabolism, detoxification, and biochemical regulation. However, it is highly susceptible to damage caused by various factors such as drugs, alcohol, toxins, and infectious agents. Hepatoprotective agents are therefore essential to prevent or manage liver disorders. In recent years, medicinal plants have gained significant attention due to their potent hepatoprotective activities, minimal side effects, and cost-effectiveness compared to synthetic drugs. Various phytoconstituents such as flavonoids, alkaloids, terpenoids, phenolic compounds, and glycosides have been identified as key contributors to liver protection. This review highlights medicinal plants with proven hepatoprotective efficacy, their bioactive constituents, mechanisms of action, and experimental models used for evaluation. The findings suggest that plant-based compounds possess promising potential in the prevention and treatment of hepatic diseases, warranting further pharmacological and clinical investigations.

❖ **Keywords:** Hepatoprotective activity, medicinal plants, liver disorders, phytoconstituents, natural therapy

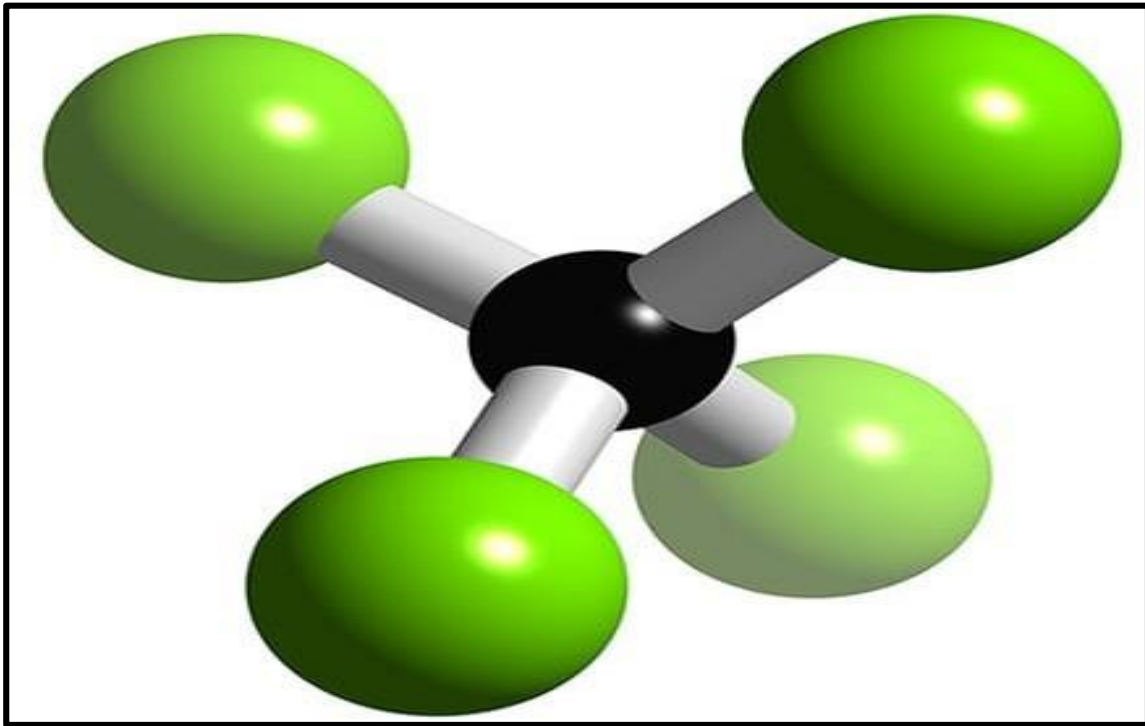
❖ Introduction:-

One of the body's most vital organs is the liver. Its action is linked to several essential activities, including metabolism, secretion, and storage, and it plays a critical role in the control of a variety of physiological processes. Numerous researchers have examined its ability to generate beneficial agents and detoxify endogenous (waste metabolites) and/or exogenous (toxic chemicals) substances of organisms since the 1970s [1–4].

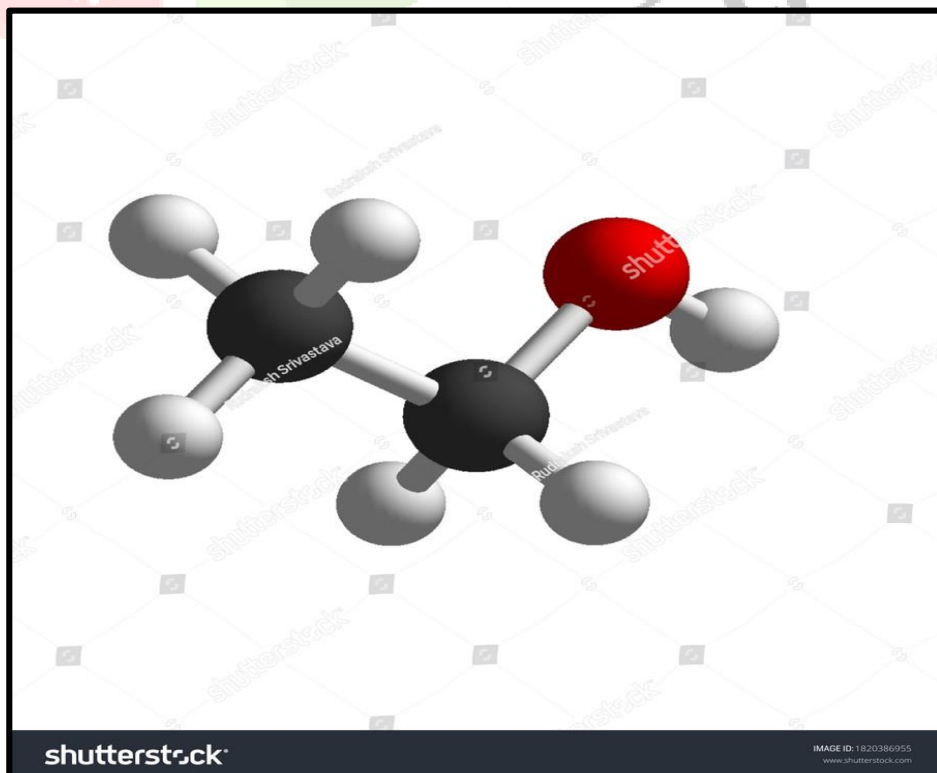
HEPATOTOXICITY AGENTS

CCl₄: The initial report of CCl₄-induced liver damage in rats (fig. 1a) dates back to 1936 and has been widely used by numerous studies. The dosage and length of exposure determine the toxicity of CCl₄. Low doses can cause apoptotic events that are followed by cellular regeneration, as well as consequences like loss of Ca²⁺ homeostasis, lipid peroxidation, and cytokine release. Furthermore, the patient may develop fibrosis, cirrhosis, or even cancer if the exposure is high or prolonged. It is metabolized by cytochrome P450 dependent monooxygenases, primarily through the CYP2E1 isoform

in the endoplasmic reticulum and mitochondria



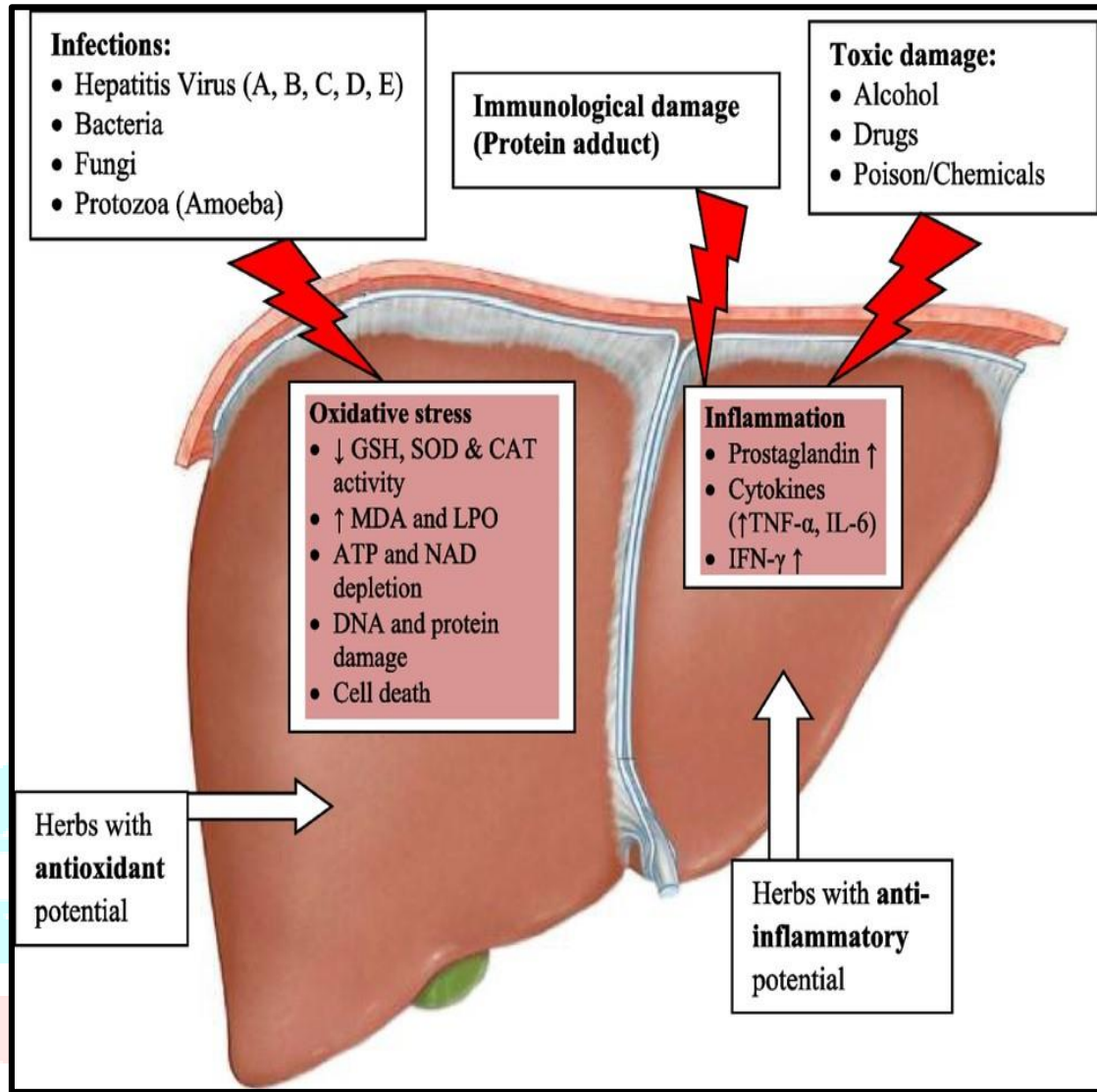
C₂H₅OH: According to Figure 4, the liver is the organ most vulnerable to the harmful effects of C₂H₅OH. The CYP2E1 isoform of cytochrome P450 metabolizes ethanol, causing oxidative stress that results in the production of reactive oxygen species and an increase in lipid peroxidation, which changes the phospholipid compositions of the cellular membrane. The loss of structure and integrity caused by membrane lipid peroxidation raises serum levels of the membrane bonding enzyme glutamyl-transpeptidase. Catalase and superoxide dismutase activity are decreased by C₂H₅OH, which also inhibits glutathione peroxidase[5]



Possible best mechanism of herbal remedy for the protection of liver against variety of toxins and injury

According to the study, the anti-inflammatory pathway and free radical scavenging activity are the herbal plants' most potent hepatoprotective mechanisms. The peroxidation of fatty acids in the hepatocyte membrane is a constant cause of hepatic damage, which causes the cells and their organelles to deform. According to recent research, oxidative stress plays a critical part in the onset and progression of liver damage. Oxidative stress's role in autoimmune syndrome-related liver disorders and viral hepatitis has been extensively researched and documented. Additionally, the production of reactive free radicals that engage covalently with the amino acid residue of the hepatic cell membranes is the primary way that xenobiotics and hazardous substances harm hepatic cells[6]





Plants used for Hepatoprotective activity :-

1, Silybum marianum



Silybum marianum

A hepatoprotective drug used to treat jaundice and enlarged liver and spleen, Silybum marianum is a medicinal plant with a 2000-year therapeutic history. Although Silybum Marianum is found all over the world, it was originally endemic 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. Asteraceae (Compositae) is the family. Typical Name: Milk The thistle Used Parts: Fruits and Seeds Constituents of Active Chemicals: The primary active compound is silymarin, which is a blend of flavonolignans including isosilybin, silybin (silibinin), silychristin, and silicone. Chemical Nature: Coniferyl alcohol and taxifolin combine to form silymarin, a complex of flavonolignans. Uses in Pharmacology: Hepatoprotective (liver cell protection) Hepatitis, cirrhosis, and toxic liver diseases are treated with antioxidants and anti-inflammatory drugs. -caused harm to the liver - Encourages the flow of bile (cholagogue effect) In summary, Silybum marianum is a useful hepatoprotective herb that is frequently utilized in both conventional and alternative medicine. Its bioactive ingredient silymarin is essential for detoxification and liver preservation. [7]



Chemical Substances Numerous substances, including silybin, silibinin A and B, silicristin, silidianin, apigenin, dehydrosilybin, and deoxysilybin, are found in this plant's seeds. Up to 4% silymarin can be found in the dried seed extract of this plant. A mixture of flavonoids, including silibinin, is called silymarin. Silymarin exhibits hepatoprotective action, shielding the liver from poisons such as acetaminophen, carbon tetrachloride, and tetrachloroethane. According to reports, silymarin has a hepatoprotective impact through a variety of mechanisms, such as antioxidant activity, free radical scavenging, DNA polymerase activation, and hepatocellular membrane stability.

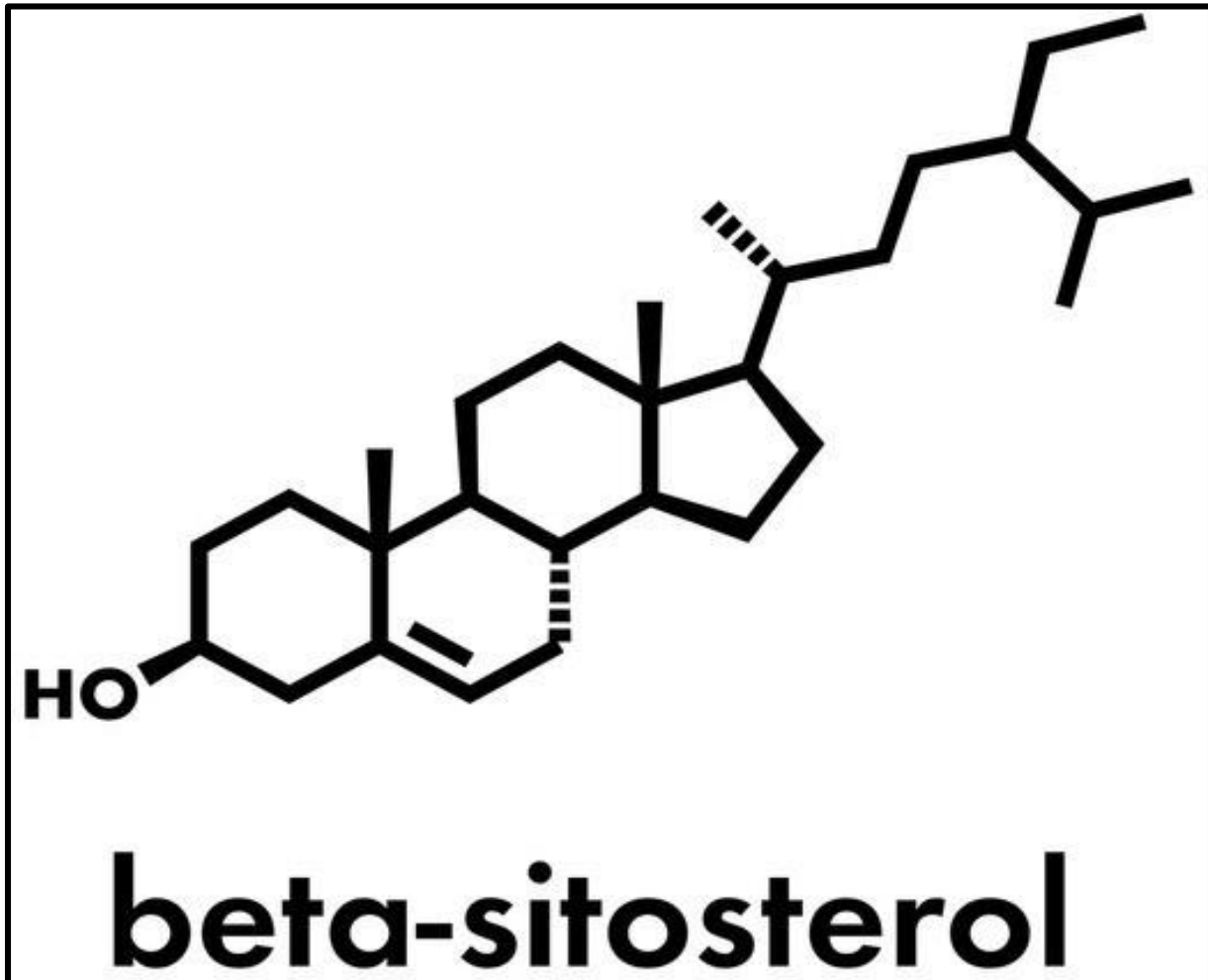
2, Woodfordia fruticosa



Woodfordia fruticosa, also known as Fire Flame Bush, Dhataki, or Dhawai The Lythraceae

family The Chemical Components: • Ellagitannins, in particular, are tannins. •

Flavonoids(kaempferol, quercetin) Glycosides Anthraquinones • Sterols Uses: 1. Astringent: used to treat bleeding disorders and diarrhea. 2. Wound healing: helps wounds and ulcers heal. 3. anti-inflammatory and antioxidant qualities. 4. "Dhataki Pushpa" is utilized in Ayurvedic medicine to ferment asava and preparations for Arishta (such as Dashmoolarishta and Ashokarishta). 5. beneficial for blood and skin conditions.[8]



Chemical compound: It was initially shown that the stems contained the common plant elements octacosanol and β -sitosterol. β -sitosterol was later found in the leaves as well, according to reports from the bloom. Hecogenin, a steroid sapogenin, is one of the additional non-phenol components that are reported.[9]

3.Schisandra Chinensis



The Schisandraceae family Synonyms: Baill, Schisandra chinensis (Turcz).Maximowiczia chinensis Rupr. Wu Wei Zi, or "five-flavor fruit" in Chinese, is the common name for the Chinese magnolia vine. Principal Chemical Components: Lignans: Gomisin A, N, and B, Schisandrin, Schisandrol A and B, Deoxyschisandrin, Schisantherin A Essential oils Organic acids, such as tartaric, malic, and citric acids Vitamins, particularly C and E □ Therapeutic and Pharmacological Applications: Hepatoprotective activity: Promotes liver regeneration and shields liver cells from harm. Antioxidant: Prevents damage from free radicals and oxidative stress. Adaptogenic: Increases the body's ability to withstand stress, exhaustion, and anxiety. Neuroprotective: Promotes memory and brain function. Immunomodulatory: Boosts the immune system. anti-aging and anti-inflammatory properties[11]

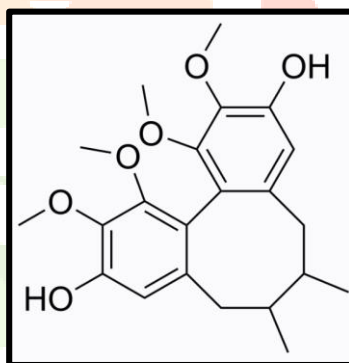


Fig.C22H28O6 Gomisin J.

Chemical composition: Polysaccharides and monosaccharides, glucose, fructose, galactose, and arabinose make up around 1.5% of S.chinensis fruits.[12]

Hepatoprotective evidence for chamomile and its phytochemicals:-

In barium chlorate-induced spasms, α -bisabolol was 91% more effective than papaverine, a smooth muscle relaxant medication, whereas bisabolol A and B oxides were 46%–50% more effective. effectiveness of an ethanolic chamomile extract in acetylcholine and histamine-induced spasms using the same experimental paradigm. In comparison to an ethanol control solution, the chamomile extract caused both acetylcholine and histamine's dose response curves to shift to the right at 2.5 and 10 mL/L dosages (of a 31% w/w solution), indicating an increase in their median effective doses.

Unlike chamomile, atropine (7.0 µg/L) did not reduce maximal contraction in response to either acetylcholine or histamine, although it did modify dosage response curves in a comparable way. Both apigenin and α -bisabolol prevented rats from developing stomach ulcers brought on by alcohol, stress, and indomethacin.[10]

❖ Conclusion:-

The liver plays a vital role in detoxification and maintaining metabolic balance in the human body. However, exposure to numerous chemicals, medicines, and infections can contribute to liver impairment. The use of medicinal plants as hepatoprotective agents has gained significant importance due to their safety, efficacy, and availability compared to synthetic drugs. Many plants such as *Phyllanthus amarus*, *Andrographis paniculata*, *Silybum marianum*, and *Glycyrrhiza glabra* offer high antioxidant and hepatoprotective effects owing to their phytochemical elements such flavonoids, tannins, phenolic compounds, and terpenoids. To determine their mechanisms and therapeutic potential, more scientific research—including clinical studies—is necessary. Thus, medicinal plants represent a promising alternative for the development of novel hepatoprotective drugs with fewer side effects.

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