Review Article

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MEDICINAL PLANTS OF AYURVEDA USED IN LIVER PROTECTION: A REVIEW

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ABSTRACT

Liver is one of the largest organs in human body and the chief site for intense metabolism and excretion. So it has a surprising role in the maintenance, performance and regulating homeostasis of the body. Liver is also associated in detoxification from the exogenous and endogenous challenges like xenobiotics, drugs, viral infections and chronic alcoholism. Liver cell injury caused by various toxic chemicals like certain antibiotics, chemotherapeutic agents, carbon tetrachloride, thioacetamide, environmental pollutants, hepatic cancer and alcoholic intoxicants and microbes. Hepatic disease stand as one of the foremost health troubles worldwide with liver cirrhosis and drug induced liver injury accounting 9th leading cause of death in western and developing countries. The present review describes the literature survey on liver protective drugs; herbal drugs used as hepatoprotectives in Ayurvedic system of medicine to cure liver disorders.

Keywords: Hepatoprotective, Pharmacological activities, liver, medicinal plants

INTRODUCTION

The liver is the largest glandular organ in the body that plays an important role in maintaining various physiological processes in the body^{1,2}. A person's entire blood supply passes through the liver several times a day³. It is involved in several vital functions, such as storage, secretion and metabolism⁴. Its capacity to detoxify exogenous (toxic compounds) and endogenous (waste metabolites) substances of organisms, as well as for synthesize useful agents, has been analyzed by many researchers since 1970s⁵. The liver is also involved in the biochemical processes of supplying energy, providing nutrients, growing and reproducing⁶. In addition, it aids in the storage of vitamins, metabolism of fats and carbohydrates, in the secretion of bile⁵. Liver diseases are among the most serious ailment. They may be classified as hepatosis (non inflammatory diseases), cirrhosis (degenerative disorder resulting in fibrosis of the liver) and acute or chronic hepatitis (inflammatory liver diseases). Liver diseases are mainly caused by infections, excess consumption of alcohol, toxic chemicals (carbon-tetrachloride, chlorinated hydrocarbons, certain antibiotics, chemotherapeutics, peroxidised oil, aflatoxin, etc.) and autoimmune/disorder⁴. Hepatic disease is a term that indicates damage to the tissues, cells, structure or liver function and this damage can be induced by biological factors (virus, bacteria and parasites) and autoimmune diseases (primary biliary cirrhosis, immune hepatitis), as well as by the action of different chemicals, such as some drugs [high doses of paracetamol (PCM) and antitubercular drugs], toxic compounds [thioacetamide, carbon tetrachloride(CCL₄), dimethylnitrosamine (DMN),

D- galactosamine /lipopolysaccharide (GalN/LPS)] and high intake of alcohol⁵.

The present review is aimed at compiling the data on promising herbal extract from plants that have been tested in hepatotoxicity model using modern scientific system. About 80% of the world population is using herbal medicines primarily in the developing countries for their primary health care needs. The herbal drug products are prepared from renewable resources of raw materials by ecofriendly processes and will bring economic prosperity to the masses growing these raw materials. More than 500 vital functions have been identified with the liver. Unfortunately, it is extremely difficult to detect early warning symptoms specific to liver metabolic imbalances and a person may suffer for a long time from a liver disorder without knowing it. In fact, the nature has bestowed some plants with the property to prevent, treat and cure hepatic disturbances with interception of fewer side effects. Hepatoprotectives are a class of therapeutic agents that includes synthetic as well as natural product which offer protection to liver from damage or help in regeneration of hepatic cells⁷. A large number of medicinal plants have been tested and found to contain active principles with curative properties against a variety of diseases. Liver protective plants contain a variety of chemical constituents like carotenoids, alkaloids, essential oil, phenols, coumarins, lignans, monoterpenes, glycosides, flavonoids, organic acids, lipids, and xanthenes³. Medicinal herbs are significant source of hepatoprotective drugs. This review article has been presented to enumerate some indigenous plants that have hepatoprotective properties.

Table 1: List of Hepatoprotective Natural Plants

Sl. No.	Name of plant Family and Common name	Extract/ Part/ Isolated compound	Dose/ Model/Animal/ Days	Mechanism of action / Inference
1.	<i>Aframomum melegueta</i> (Zingiberaceae) Grana paradisi ⁸	Aqueous	4.8 g/kg, b.w./ Ethanol/ Male wistar rats for 16 days	Suppressed the elevation of lipid peroxidation
2.	<i>Arrabidaea chica</i> (Bignoniaceae) Pariri ⁹	Hydroethanol/ Leaf	300, 500 or 600 mg/kg b.w., p.o./ CCl ₄ / Rats for 7 days	Reduction of serum level of hepatic enzymes
3.	<i>Asparagus racemosus</i> (Asparagaceae) Shatavari ¹⁰	Whole plant	50 mg/kg, p.o./ Isoniazid/ Male albino rat for 21 days	Free radical scavenging activity
4.	<i>Averrhoa carambola</i> (Oxalidaceae) Starfruit ¹¹	Aqueous/ Fruit	0.9 g/kg b.w./ CCl ₄ / Albino mice for 7 days	Reduced serum levels of hepatic enzyme
5.	<i>Artemisia absinthium</i> L. (Asteraceae) Phunkar-burtse ¹²	Aqueous	50, 100 or 200 mg/kg b.w., p.o./ day/ CCl ₄ / Mice	Reduced the lipid peroxidation
6.	<i>Arachniodes exilis</i> (Hance) Ching (Dryopteridaceae) East Indian Holly Fern ¹³	Ethanol	360, 720 mg/kg, p.o./ CCl ₄ / Mice	Showed reduction in lipid peroxidations
7.	<i>Alocasia indica</i> Linn. (Araceae) Mankanda ¹⁴	Hydroalcohol/ Leaf	250 and 500 mg/kg b.w., p.o./ CCl ₄ and PCM	Significant potential as hepatoprotective agent
8.	<i>Amorphophallus campanulatus</i> (Roxb.) (Araceae) Jamikand ¹⁵	Ethanol and Aqueous/ Tubers	500 mg/kg, p.o./ CCl ₄ / Rats	Free radical scavenging potential
9.	<i>Adhatoda vasica</i> (Acanthaceae) Adosa ¹⁶	Aqueous/ Leaf	50-100 mg/kg, p.o./ D-GAIN/ Rats	Significant hepatoprotective effect
10.	<i>Aronia melanocarpa</i> (Rosaceae) Black chokeberry ¹⁷	Fruit	5, 10 and 20 ml/kg b.w./ CCl ₄ / Rats for 4 days	Prevented the elevation of malondialdehyde formation and depletion of glutathione
11.	<i>Achyrocline satureioides</i> (Lam) D. C. (asteraceae) Macela ¹⁸	Aqueous/ Aerial parts	300 mg/kg b.w., p.o./ Bromobenzene(BB)/ Mice	Inhibition the increase of hepatic serum enzymes
12.	<i>Bidens pilosa</i> Linné (Compositae) Pitchforks ¹⁹	Hydroethanol and ethyl acetate fraction	15 mg/kg b.w., p.o./ CCl ₄ / Mice for 10 days	Free radical scavenger power
13.	<i>Butea monosperma</i> (Fabaceae) Palash ²⁰	Aqueous/ Flower	200, 400, 800 mg/kg b.w., p.o./ CCl ₄ / Rats	Reduced hepatic lipid peroxidation
14.	<i>Byrsocarpus coccineus</i> Schum. and Thonn. (Connaraceae) Tsaamiyar-kasa ²¹	Aqueous/ Leaf	200, 400, and 1000 mg/kg b.w./ CCl ₄ / Rats for 7 days	Significant decrease in hepatic serum enzymes
15.	<i>Bauhinia variegata</i> (Leguminosae) Kachnar ²²	Alcohol/ Stem bark	100 and 200 mg/kg b.w., p.o./ CCl ₄ / Sprague-dawley rats	Exhibited significant hepatoprotective activity
16.	<i>Beta vulgaris</i> (Amaranthaceae) Chukandar ²³	Ethanol/ Roots	1000, 2000 and 4000 mg/kg b.w./ CCl ₄ / Rats	Reduction in elevated serum levels of enzyme activities
17.	<i>Curcuma longa</i> (Zingiberaceae) Haldi ²⁴	Aqueous/ Rhizome	50 mg/kg b.w., p.o./ CCl ₄ / Swiss Albino mice for 15 days	Reduced the level hepatic serum enzymes
18.	<i>Cichorium intybus</i> (Asteraceae) Kasani ²⁵	–	75 mg/kg b.w., p.o./ CCl ₄ / Albino rats for 7 days	Possessed significant hepatoprotective activity
19.	<i>Ceratonia siliqua</i> (Fabaceae) Salvia ²⁶	Ethyl acetate fraction/ Leaf	250 mg/kg b.w., i.p./ CCl ₄ model/ Rats for 8 days	Free radical scavenging activity
20.	<i>Capparis deciduas</i> (Capparaceae) karir ²⁷	Aqueous and methanol/ Stem	200, 400 mg /kg b.w., p.o./ CCl ₄ / Rats for 10 days	Hepatoprotective activity
21.	<i>Calotropis procera</i> (Asclepiadaceae) Mudar ²⁸	Methanol/ Root bark	200 mg/kg b.w., p.o./ CCl ₄ / Mice for 7 days	Lowering in lipid peroxidation
22.	<i>Ceiba pentandra</i> Linn. (Bombacaceae) Cotton tree ²⁹	Methanol/ Stem bark	400 mg/kg b.w., p.o./ PCM/ Rats	A significant reduction in hepatic serum enzymes and total bilirubin content
23.	<i>Coptidis rhizoma</i> (Ranunculaceae) Huanglian ³⁰	Aqueous/ Rhizome	400, 600, 800 mg/kg and 120 mg/kg b.w., p.o./ CCl ₄ / Sprague-Dawley rats	Significantly inhibited the activities of hepatic serum enzymes

24.	<i>Cuscuta chinensis</i> Lam. (Convolvulaceae) Amar bel ³¹	Ethanol/ Seed	125 and 250 mg/kg b.w., p.o./ APAP/ Rats	Superoxide radical scavenging activity
25.	<i>Dichrostachys cinerea</i> (Fabaceae) Kunali ³²	Methanol/ Leaf	350 mg/kg/day, p.o./ CCl ₄ / Albino mice and Rats for 14 days	Significant hepatoprotective activity
26.	<i>Decalepis hamiltonii</i> (Wight and Arn) (Asclepiadaceae) Makali ber ³³	Methanol/ Root	100 mg/kg b.w., p.o./ CCl ₄ / Albino rats for 7 days	Reduction in lipid peroxidation
27.	<i>Euphorbia fusiformis</i> Buch.-Ham.ex D.Don (Euphorbiaceae) ³⁴	Ethanol/ Tuber	250 mg/kg b.w., p.o./ RMP/ Wistar albino rats for 15 days	Restored the elevated levels of hepatic serum enzymes
28.	<i>Enicostemma axillare</i> (Lam). Raynal (Gentianaceae) Chota-chirayata ³⁵	Ethyl acetate	100 and 200 mg/kg b.w., p.o./ CCl ₄ / Rats for 8 days	It shows potent hepatoprotective effect
29.	<i>Eugenia jambolana</i> Lam. (Myrtaceae) Jamun beej ³⁶	Methanol/ Seed	100, 200 and 400 mg/kg b.w., p.o./ CCl ₄ / Wistar albino rats	Prevented the elevation of hepatic serum enzymes level
30.	<i>Ficus microcarpa</i> L. Fil. (Moraceae) Kallich ³⁷	Ethyl acetate/ Bark	CCl ₄ and PCM/ Rats	Hepatoprotective effect
31.	<i>Ficus carica</i> Linn. Anjeer (Moraceae) ³⁸ and <i>Morus alba</i> Linn. Shahtut (Moraceae) ³⁸	Methanol/ Leaf, fruit and root barks.	150 mg/kg b.w., i.p./ CCl ₄ / Rats	Methanol extract shows more potent hepatoprotection
32.	<i>Ficus glomerata</i> (Moraceae) Gular ³⁹	Methanol/ Bark	250 and 500 mg/kg bw, p.o./ CCl ₄ / Rats	Potent hepatoprotective effect
33.	<i>Filipendula ulmaria</i> (Rosaceae) Meadowsweet ⁴⁰	Ethyl acetate and chloroform fractions /Aerial parts	CCl ₄	Normalizing the lipid peroxidation
34.	<i>Glycosmis pentaphylla</i> (Retz.) DC (Rutaceae) Ban nimbu ⁴¹	Methanol and petroleum ether	200 and 400 mg/kg b.w./ PCM/ Mice	Reduction in the elevated hepatic serum enzymes level
35.	<i>Gypsophila trichotoma</i> Wend. (Caryophyllaceae) ⁴²	Saponarin	80 mg/kg b.w., p.o./ Cocaine/ Male wistar rats	Hepatoprotective activity
36.	<i>Graptopetalum paraguayense</i> E.Walther (Crassulaceae) Mexican ghost plant ⁴³	Aqueous	50- 300 mg/kg b.w./ CCl ₄ / Male sprague-dawley rats for 8 consecutive weeks	Decreased hepatic serum enzymes level
37.	<i>Hybanthus enneaspermus</i> (Violaceae) Ratan purush ⁴⁴	Aqueous	200 or 400mg/kg b.w./ CCl ₄ / rats for 14 days	Decreased hepatic lipid peroxidation
38.	<i>Halenia elliptica</i> (Gentianaceae) Spurred gentian ⁴⁵	Methanol/ Herb	100 mg/kg b.w./ CCl ₄ / Rats	Strong free radical-scavenging and antioxidant activities
39.	<i>Hemidesmus indicus</i> R. BR. (Asclepiadaceae) Anantmoool ⁴⁶	Methanol/ Root	100-500 mg/kg b.w., p.o./ PCM or CCl ₄ / Rats	Possessed a potential anti-hepatotoxic activity
40.	<i>Hedyotis corymbosa</i> (L.) Lam. (Rubiaceae) Daman pappar ⁴⁷	Methanol/ Wholeplant	100 and 200 mg/kg p.o./ PCM/ Wistar rats for 3 days	Antilipid peroxidation effect
41.	<i>Ichnocarpus frutescense</i> (Apocynaceae) Kalidudhi ⁴⁸	Polyphenolic/ Leaf	200 mg/kg bw p.o./ CCl ₄ and tamoxifen/ Rats for 7 days	Hepatoprotective effect
42.	<i>Indigofera trita</i> (Fabaceae) Goramti nili ⁴⁹	Ethanol	200 and 400 mg/kg b.w. p.o./ CCl ₄ / Rats for 7 days	Decrease in the hepatic serum enzymes level
43.	<i>Justicia schimperiana</i> (Hochst. Ex Nees) (Acanthaceae) Dhumuga ⁵⁰	Hydroalcohol and methanol	CCl ₄ / Swiss albino mice	Moderate radical scavenging activity
44.	<i>Kyllinga nemoralis</i> (Hutch & Dalz) (Cyperaceae) Nirvishi ⁵¹	Ethanol and petroleum ether/ Rhizomes	100 and 200mg/kg b.w., p.o./ CCl ₄ / Male wistar rats for 7 days	Hepatoprotective activity
45.	<i>Kalanchoe pinnata</i> Pers. (Crassulaceae) Patharchur ⁵²	Ethanol/ Fresh leaf	200 mg/kg b.w. i.p./ CCl ₄ / Rats for 4 days	Hepatoprotection of juice found to be more then extract
46.	<i>Leptadenia reticulata</i> (Retz.) Wight. and Arn. (Asclpiadaceae) Jiwanti ⁵³	Ethanol and aqueous/ Stem	250 and 500 mg/kg b.w., p.o./ CCl ₄ / Rats for 7 days	Significant hepatoprotective activity

47.	<i>Litchi chinensis</i> Sonn. (Sapindaceae) Lychee ⁵⁴	Fruit pulp	100 and 500 mg/kg b.w., p.o./ CCl ₄ / Male wistar albino rats for 10 days	Anti-lipid peroxidation
48.	<i>Lumnitzera racemosa</i> (Combretaceae) ⁵⁵	Bark	100, 200 and 300 mg/kg b.w., p.o./ Wistar Albino Rats	Radical scavenging activities
49.	<i>Leucas lavandulaefolia</i> (Labiatae) Gumo ⁵⁶	Chloroform	200 mg/kg and 400 mg/kg b.w./ D- GAIN/ Rats	Hepatoprotective activity
50.	<i>Musa sapientum</i> Linn. (Musaceae) Banana ⁵⁷	Aqueous/ Stem	25, 50 and 100 mg/kg b.w./ CCl ₄ / Rats for 5 weeks	Hepatoprotective activity
51.	<i>Morus alba</i> Linn. Shahutut (Moraceae) ⁵⁸	Methanol/ Leaf, fruit and root barks.	50 mg/kg b.w., i.p./ CCl ₄ / Rats	Methanol extract shows more potent hepatoprotection
52.	<i>Melothria heterophylla</i> (Lour.) Cogn. (Cucurbitaceae) Bankakari ⁵⁸	Ethanol/ β -sitosterol	200 and 400 mg/kg b.w., p.o./ CCl ₄ / Rats on alternate days	Reduced lipid peroxidation
53.	<i>Murdannia bracteata</i> (C. B. Clarke) Beijing spiderwort ⁵⁹	Methanol	500 mg/kg and 1000 mg/kg b.w., p.o./ CCl ₄ / rats	Lipid peroxidation inhibition and free radical scavenging properties
54.	<i>Momordica dioica</i> Roxb. (Cucurbitaceae) Ban kerala ⁶⁰	Ethanol and aqueous/ Leaf	200 mg/kg b.w., p.o./ CCl ₄ / Rats for 5 days	Free radical-scavenging activity
55.	<i>Momordica tuberosa</i> Cogn. (Cucurbitaceae) Athalkkai ⁶¹	Hydro alcohol/ Tubers	20 and 40 mg/kg b.w., p.o./ CCl ₄ / Rats for 5 days	Normalize the serum biomarkers
56.	<i>Ocimum sanctum</i> (Lamiaceae) Green tulsi ⁶²	Alcohol/ Leaf	200 mg/kg b.w., p.o./ PCM/ Albino rats for 10 days	Significant hepatoprotective activity
57.	<i>Onopordum alexandrinum</i> L. (Asteraceae) ⁶³	Ethyl acetate fraction/ Flowers	CCl ₄ / Rats	Free radical scavenging activity
58.	<i>Orthosiphon stamineus</i> (Lamiaceae) ⁶⁴	Ethanol	200 mg/kg/ Thioacetamide/ Sprague dawleyrats for 60 days	Hepatoprotective effect
59.	<i>Prunus armeniaca</i> L. (Rosaceae) Khubani ⁶⁵	Ethanol/ Kernel	Ethanol/ Rats	Hepatoprotective effect
60.	<i>Podophyllum hexandrum</i> (Berberidaceae) Bankakdi ⁶⁶	Ethyl acetate	20, 30 and 50mg/kg b.w./ CCl ₄ / Male wistar rats	Prevented lipid peroxidations
61.	<i>Portulaca oleracea</i> (Portulacaceae) Lunia ⁶⁷	Aqueous/ Aerial parts	50 mg/kg b.w., p.o./ CCl ₄ / Male wistar rats for 14 days	Normalize the hepatic serum enzymes level
62.	<i>Phyllanthus acidus</i> (L.) Skeels (Phyllanthaceae) Chalmeri ⁶⁸	Ethanol and aqueous/ Leaf	200 and 400 mg/kg, b.w., p.o./ APAP and TAA/ Wistar rats for 7 days	Significant hepatoprotective activity
63.	<i>Plantago major</i> L. (Plantaginaceae) Isabgol ⁶⁹	Whole plant	10, 20 and 25 mg/kg/ CCl ₄ / Rats for 14 days	Considerable hepatoprotective effect
64.	<i>Piper chaba</i> (Piperaceae) Pipal ⁷⁰	Aqueous acetone/ Fruit	5 mg/kg, p.o./ D-GAIN/ LPS/ Mice	Hepatoprotective effect
65.	<i>Premna corymbosa</i> (Burm. F.) Rottl. & Willd. (Verbenaceae) Premna ⁷¹	Ethanol/ Leaf	200 & 400 ml/kg b.w., p.o./ CCl ₄ / Wistar rats daily for 14 days	Significant acute hepatoprotective activity
66.	<i>Parathelypteris nipponica</i> (Franch. Et Sav.) Ching. (Thelypteridaceae) ⁷²	Methanol	400, 800 and 1600 mg/kg bw/ CCl ₄ / Rat for 7 days	Strong free radical scavenging activity
67.	<i>Padina boergerenii</i> (Dictyotaceae) Brown Alga ⁷³	Extract	150 mg/kg b.w./ CCl ₄ / Rats	Reduction in lipid peroxidation
68.	<i>Phyllanthus amarus</i> Schum. Et. Thonn. (Phyllanthaceae) Jar amla ⁷⁴	Aqueous	25, 50 and 75 mg/kg b.w., p.o./ Ethanol/ Rats for 7 days	Normalize the hepatic serum biomarker enzymes
69.	<i>Pterospermum acerifolium</i> (Malvaceae) Kanak champa ⁷⁵	Ethanol/ Leaf	25 mg/kg b.w., p.o./ CCl ₄ / Male wistar rats for 14 days	Normalize the hepatic serum biomarker enzymes
70.	<i>Psidium guajava</i> Linn. (Myrtaceae) Amrood ⁷⁶	Leaf	250 and 500 mg/kg b.w., p.o./ CCl ₄ , PCM or TAA	Hepatoprotective effect
71.	<i>Polygala arvensis</i> (Polygalaceae) Khoto ⁷⁷	Chloroform/ Leaf	200 mg/kg and 400 mg/kg, p.o./ D-GAIN/ Wistar albino rats	Normalize the level of hepatic serum enzymes

72.	<i>Rosa laevigata</i> Michx. (Rosaceae) Cherokee rose ⁷⁸	Fruit	50, 200 mg/kg/ PCM/ Mice for 5 days	Decrease the level of hepatic serum enzymes
73.	<i>Rhododendron arboreum</i> (Ericaceae) Burans ⁷⁹	Ethyl acetate fraction	100, 200, and 400 mg/kg, p.o./ CCl ₄ model/ Wistar rats for 14 days	Potent hepatoprotective action
74.	<i>Rubus parvifolius</i> L. (Rosaceae) Native raspberry ⁸⁰	–	20 mg/kg p.o. twice daily/ CCl ₄ / Mice for 7 days	Hepatoprotective effect
75.	<i>Rauwolfia serpentina</i> (Apocynaceae) Sarpagandha ⁸¹	Aqueous and ethanol/ Rhizome	425 mg/kg b.w., p.o./ PCM/ Rats for 7 days	Hepatoprotective activity
76.	<i>Suaeda maritima</i> (L.) Dumort (Chenopodiaceae) Common Indian salt wor ⁸²	Ethanol	75, 150 and 300 mg/kg of b.w./ Concanavalin-a/ Wistar albino rats for 9 days	Hepatoprotective effect
77.	<i>Scutellariae radix</i> (Lamiaceae) Skullcaps ⁸³	Water	100 mg/kg, p.o./ Chronic alcohol model/ Mice for 28 days	Hepatoprotective effect
78.	<i>Solanum nigrum</i> (Solanaceae) Makoi ⁸⁴	–	250 mg/kg and 75 mg/kg b.w., p.o./ CCl ₄ / Albino rats for 7 days	Possessed significant hepatoprotective activity
79.	<i>Swietenia mahogani</i> (Maliaceae) Mahagoni ⁸⁵	Aqueous/ Leaf	250 and 500 mg/kg/ chronic alcohol/ Rats for 12 weeks	Reduced the hepatic serum enzyme activities
80.	<i>Silybum marianum</i> (Asteraceae) Kandiali ⁸⁶	Silymarin	CCl ₄ / Wistar rats	Hepatoprotective activity
81.	<i>Satureja macrostema</i> (Lamiaceae) Nurhiteni ⁸⁷	Methanol/ Leaf	200, 400, 600 mg/kg b.w., i.p./ PCM/ CCl ₄ / animals for 4 days	Free radical scavenging
82.	<i>Scoparia dulcis</i> (Scrophulariaceae) Mithi patti ⁸⁸	Ethanol	0.5 and 1.0 g/kg p.o./ CCl ₄ / Mice for 5 consecutive days	Hepatoprotective activity
83.	<i>Stereospermum suaveolens</i> DC (Bignoniaceae) Padar ⁸⁹	Methanol/ Stem bark	125, 250, and 500 mg/kg/ CCl ₄ / Albino rats	Decreased lipid peroxidation
84.	<i>Solanum fastigiatum</i> (Solanaceae) False jurubeba ⁹⁰	Aqueous/ Leaf	100 mg/kg and 200 mg/kg b.w., p.o./ PCM/ Mice for 7 days	Hepatoprotective activity
85.	<i>Strychnos potatorum</i> Linn. (Loganiaceae) (Strychnaceae) Nirmali ⁹¹	Aqueous/ Seed	100 and 200 mg/kg b.w., p.o./ CCl ₄ / rats	Reduction in lipid peroxidation
86.	<i>Scrophularia buergeriana</i> (Scrophulariaceae) Figworts ⁹²	Root/ Phenylpropanoids	CCl ₄ / Rats	Reduction in lipid peroxidation
87.	<i>Talinum triangulare</i> (Portulacaceae) Water leaf ⁹³	Whole plant	50, 100 and 200 mg/kg, p.o./ CCl ₄ / Mice for 7 days	Normalize the hepatic enzymes level
88.	<i>Trapa taiwanensis</i> Nakai (Trapaceae) Water caltrop ⁹⁴	Extract/ Fruit	12.5 mg/kg b.w., p.o./ CCl ₄ / Sprague-dawley male rats for 8 weeks	Decreased the hepatic serum enzymes level
89.	<i>Tribulus terrestris</i> (Zygophyllaceae) Gokhru ⁹⁵	Extract	250 mg/kg, p.o./ APAP/ Fresh water fish.	Hepatoprotective effect
90.	<i>Terminalia paniculata</i> (Combretaceae) Kindal ⁹⁶	Ethanol	200 mg/kg/ PCM/ Rats	Possessed hepatoprotective activity
91.	<i>Taraxacum officinale</i> (Asteraceae) Dandelion ⁹⁷	Aqueous/ Root	1 g/kg b.w./ Ethanol model/ Mice	Decreased lipid peroxidation
92.	<i>Trianthema portulacastrum</i> L. (Aizoaceae) Patharchatta ⁹⁸	Ethanol	100 mg, 200 mg/kg p.o./ PCM and TAA/ Albino rats for 10 days	Hepatoprotective effect
93.	<i>Vitex glabrata</i> (Verbenaceae) Bihbool ⁹⁹	Ethanol	CCl ₄ / Rats	Antioxidant mechanisms
94.	<i>Ventilago madraspatana</i> Gaertn. (Rhamnaceae) Pitti ¹⁰⁰	Emodin	20, 30 and 40 mg/kg, p.o./ Acetaminophen/ Rats	Protecting the lipid peroxidation
95.	<i>Vernonia amygdalina</i> (Asteraceae) khas-khas ¹⁰¹	Methanol	250 and 500 mg/kg, p.o./ CCl ₄ / Male rats for 2 weeks	Hepatoprotective effect
96.	<i>Vitex trifolia</i> (Lamiaceae) Samhalu ¹⁰²	Ethanol and aqueous/ Leaf	20 and 30 mg/kg/day p.o./ CCl ₄ / Animals for 14 days	Normalize the hepatic serum enzymes level

97.	<i>Vitex negundo</i> (Verbenaceae) Nirgundi ¹⁰³	Ethanol/ Leaf	100, 250 and 500 mg/kg b.w., p.o./ Antitubular drugs/ Rats for 45 days	Hepatoprotective effect
98.	<i>Vitis vinifera</i> L. (Vitaceae) Angur ¹⁰⁴	Ethanol	125 mg/kg b.w., p.o./ CCl ₄ / Rats	Hepatoprotective effect
99.	<i>Verbascum sinaiticum</i> Benth. (Scrophulariaceae) ⁵⁰	Hydroalcohol and methanol	CCl ₄ / Swiss albino mice	Moderate radical scavenging activity
100	<i>Woodfordia fruticosa</i> Kurz (Lythraceae) Dawai ¹⁰⁵	Methanol	Diclofenac sodium/ Rats	Reduction in hepatic serum enzymes level
101.	<i>Zosia absinthifolia</i> (Apiaceae) Golpar ¹⁰⁶	Coumarins (+)-Columbianadin and (-) deltoin	CCl ₄ / Rats	Hepatoprotective activity
102.	<i>Cichorium intybus</i> (Asteraceae) Chicory ¹⁰⁷	Methanol	Chicory at 250 and 500 mg/kg b.w./ CCl ₄ / Rats	Hepatoprotective activity
103.	<i>Zingiber officinale</i> (Zingiberaceae) Adrak ¹⁰⁸	Methanol	250 and 500 mg/kg	Hepatoprotective activity
104.	<i>Zanthoxylum armatum</i> DC (Rutaceae) Tejphal ¹⁰⁹	Ethanol/ Bark	100, 200 and 400 mg/kg b.w./ CCl ₄ / Male wistar rats for 7 days	Normalization of elevated hepatic serum enzymes

CONCLUSION

The liver disorders are increasing day by day due to change in lifestyle and dietary habits. Therefore, treating liver diseases with plant derived compounds which are accessible and do not require laborious pharmaceutical synthesis seems highly attractive. From this study, it is clear that the medicinal plants play an important role on various diseases. Various herbal plants and plants extracts have significant hepatoprotective activity in animal models. The hepatoprotective activity is probably due to the presence of flavonoids in few herbal plants. The results of this study indicate that extracts of leaves and plant extracts of some medicinal plant have good potential for use in hepatic disease. Hence the review study is concluded that the herbal drug possesses hepatoprotective activity and it has been proved by different animal models give many links to develop the future trials.

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