



Received on 18 November, 2010; received in revised form 28 January, 2011; accepted 12 February, 2011

A REVIEW ON HEPATOPROTECTIVE ACTIVITY OF MEDICINAL PLANTS

C. Hari Kumar*¹, A. Ramesh², J. N. Suresh Kumar¹, and B. Mohammed ishaq³

Deccan School of Pharmacy¹, Hyderabad, Andhra Pradesh, India

Sitha Institute of Pharmaceutical Sciences², Hyderabad, Andhra Pradesh, India

SSJ College of Pharmacy³, Gandipet, Hyderabad, Andhra Pradesh, India

ABSTRACT

A phytotherapeutic approach to modern drug development can provide many invaluable drugs from traditional medicinal plants. Search for pure phytochemicals as drugs is time consuming and expensive. Numerous plants and polyherbal formulations are used for the treatment of liver diseases. However, in most of the severe cases, the treatments are not satisfactory. Although experimental evaluations were carried out on a good number of these plants and formulations, the studies were mostly incomplete and insufficient. The therapeutic values were tested against a few chemicals-induced subclinical levels of liver damages in rodents. Even common dietary antioxidants can provide such protection from liver damage caused by oxidative mechanisms of toxic chemicals. However, experiments have clearly shown that plants such as *Picrorrhiza kurroa*, *Andrographis paniculata*, *Eclipta alba*, *Silibum marianum*, *Phyllanthus maderaspatensis* and *Trichopus zeylanicus* are sufficiently active against, at least, certain hepatotoxins. Screening plants for antihepatitis activities remains in its infancy. *P.kurroa*, *E. alba*, *Glycyrrhiza glabra*, *A. paniculata* and *P. amarus* are likely to be active against Hepatitis B virus. In the case of severe liver damage, most of the liver cells die or turn into fibrotic state. In this case, the treatment should include in addition to the therapeutic agents, agents which can stimulate liver cell proliferation. For developing satisfactory herbal combinations to treat severe liver diseases, plants have to be evaluated systematically for properties such as antiviral activity (Hepatitis B, Hepatitis C, etc), antihepatotoxicity (antioxidants and others), stimulation of liver regeneration and choleric activity. The plants with remarkable activities for each of the above properties have to be identified. Single plant may not have all the desired activities. A combination of different herbal extracts/'fractions is likely to provide desired activities to cure severe liver diseases. Development of such medicines with standards of safety and efficacy can revitalise treatment of liver disorders and hepatoprotective activity.

Keywords:

Phytomedicines,
Liver diseases,
Hepatitis,
Hepatoprotection,
Herbal drugs

Correspondence to Author:

C. Hari Kumar

Dept. of Pharmacology, Deccan
School of Pharmacy, Hyderabad,
Andhra Pradesh, India

INTRODUCTION: Medicinal plants play a key role in the human health care. About 80% of the world population rely on the use of traditional medicine which is predominantly based on plant materials ¹. The traditional medicine refers to a broad range of ancient natural health care practices including folk/tribal practices as well as Ayurveda, Siddha, Amchi and Unani. These medical practices originated from time immemorial and developed gradually, to a large extent, by relying or based on practical experiences without significant references to modern scientific principles.

These practices incorporated ancient beliefs and were passed on from one generation to another by oral tradition and/or guarded literature. Although herbal medicines are effective in the treatment of various ailments very often these drugs are unscientifically exploited and/or improperly used. Therefore, these plant drugs deserve detailed studies in the light of modern science.

It is estimated that about 7,500 plants are used in local health traditions in, mostly, rural and tribal villages of India. Out of these, the real medicinal value of over 4,000 plants is either little known or hitherto unknown to the mainstream population. The classical systems of medicine such as Ayurveda, Siddha, Amchi, Unani and Tibetan use about 1,200 plants ². A detailed investigation and documentation of plants used in local health traditions and pharmacological evaluation of these plants and their taxonomical relatives can lead to the development of invaluable plant drugs for many dreaded diseases. Random screening of plants has not proved economically effective ³.

Liver diseases and medicinal plants: Liver has a pivotal role in regulation of physiological processes. It is involved in several vital functions such as metabolism, secretion and storage. Furthermore, detoxification of a variety of drugs and xenobiotics

occurs in liver. The bile secreted by the liver has, among other things, an important role in digestion. Liver diseases are among the most serious ailment. They may be classified as acute or chronic hepatitis (inflammatory liver diseases), hepatosis (non-inflammatory diseases) and cirrhosis (degenerative disorder resulting in fibrosis of the liver). Liver diseases are mainly caused by toxic chemicals (certain antibiotics, chemotherapeutics, peroxidised oil, aflatoxin, carbon-tetrachloride, chlorinated hydrocarbons, etc.), excess consumption of alcohol, infections and autoimmune/disorder.

Most of the hepatotoxic chemicals damage liver cells mainly by inducing lipid peroxidation and other oxidative damages in liver. Enhanced lipid peroxidation produced during the liver microsomal metabolism of ethanol may result in hepatitis and cirrhosis ⁴. It has been estimated that about 90% of the acute hepatitis is due to viruses. The major viral agents involved are Hepatitis B, A, C, D (delta agents), E and G. Of these, Hepatitis B infection often results in chronic liver diseases and cirrhosis of liver. Primary liver cancer has also been shown to be produced by these viruses.

It has been estimated that approximately 14- 16 million people are infected with this virus in South East Asia region and about 6% of the total population in the region are carriers of this virus. A vaccine has become available for immunization against Hepatitis B virus. Hepatitis C and Hepatitis E infections are also common in countries of South East Asia region ⁵.

In the present work, authors had reviewed the articles of hepatoprotective activity of the medicinal plants and has arranged them in the systemic order as shown in **table 1**.

TABLE 1: HEPATOPROTECTIVE ACTIVITY OF THE MEDICINAL PLANTS

Name of the Plant	Source or Family	Plant parts used	Hepatotoxicity inducing agents	Extracts studied	Biochemical and Histopathological Parameters studied
<i>Orthosiphon stamineus</i> ⁶	Lamiaceae	Leaves	Acetaminophen	Methanol extract	AST, ALT and ALP
<i>Baliospermum montanum</i> ⁷	Euphorbiaceae	Roots	Paracetamol	Alcohol, chloroform extract	SGPT, SGOT and alkaline phosphate, Histopathological changes in liver.
<i>Tridax procumbens</i> ⁸	Asteraceae	Leaves	Carbon tetrachloride	Ethanol extract	Glutathione, superoxide dismutase and catalase
<i>Glycyrrhiza glabra</i> Linn. ⁹	Fabaceae	Root powder	Carbon tetrachloride	Root powder mixed with animal feed	TBARS, CD, SOD, CAT, GST, GSH-Px, GSH, LIPID PEROXIDATION
<i>Phyllanthus niruri</i> ¹⁰	Euphorbiaceae	Leaves and fruits	Carbon tetrachloride	Methanolic and aqueous	glutamate oxaloacetate transaminase (GOT) and glutamate pyruvate transaminase (GPT), DPPH radical scavenging
<i>Cochlospermum Planchoni</i> ¹¹	Coccolospermaceae	Rhizomes	Carbon tetrachloride	Aqueous	Total bilirubin Alkaline phosphatase Alanine aminotransferase
<i>Saururus chinensis</i> ¹²	Saururaceae	Whole plant	Carbon tetrachloride	Ethanol	alanine aminotransferase (ALT), aspartate aminotransferase (AST), hyaluronic acid (HA), hepatic malondialdehyde (MDA) content, and superoxide dismutase (SOD) activity, total cholesterol (TC), triglyceride (TG), total lipoprotein (TP), albumin (ALB), hydroxypropylamine (HYP), total antioxidant capacity (T-AOC), laminin (LN), type III collagen terminal peptide (PC-IIIINP), and type IV collagen (IV-C), as well as with Histopathological changes of liver.
'Teng-Khia-U' ¹³ derived from the entire plants of <i>Elephantopus scaber</i> L., <i>E. mollis</i> H.B.K. and <i>Pseudoelephantopus spicatus</i> (Juss.) Rohr	Asteraceae	Whole plant	D-galactosamine (d-gain)- and acetaminophen (apap)	Aqueous	serum glutamate-oxalate-transaminase (sGOT) and the serum glutamate pyruvate- transaminase (sGPT)
<i>Fructus Schisandrae chinensis</i> (LFS) with <i>Astragalus polysaccharides</i> (APS) ¹⁴	Magnoliaceae	Dried fructus	Carbon tetrachloride	Ethanol	Alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP) malondialdehyde (MDA), reduced glutathione (GSH) and catalase (CAT), superoxide dismutase (SOD)
<i>Cordia macleodii</i> ¹⁵	Boraginaceae	Leaves	Carbon tetrachloride	Ethanol extract	Glutamate pyruvate transaminase (GPT), serum glutamate oxaloacetate transaminase (GOT), Alkaline Phosphatase (ALP) and total bilirubin
<i>Arachniodes exilis</i> ¹⁶	Dryopteridaceae	Rhizomes	Carbon tetrachloride	Ethanol	Lipid peroxide, DPPH, ABTS, superoxide anion, hydroxyl radical and hydrogen peroxide, glutamate oxaloacetate transaminase, glutamate pyruvate transaminase, malondialdehyde and superoxide dismutase
<i>Momordica dioica</i> ¹⁷	Cucurbitaceae	Leaves	Carbon tetrachloride	Ethanol and aqueous	serum glutamate oxaloacetate transaminase (AST), serum glutamate pyruvate transaminase (ALT), serum alkaline phosphatase (SALP) and total

					bilirubin, Histopathological examination of rat liver sections
Swertiamarin isolated from <i>Encostemma Axillare</i> ¹⁸	Gentianaceae	Whole plant	D-galactosamine	Ethyl acetate	ASAT (IU/l) ALAT (IU/l) ALP (IU/l) Triglycerides (mg/dl) Total cholesterol (mg/dl) Total bilirubin (mg/dl) Total protein (g/dl) Creatinine (mg/dl) Albumin (g/dl)
<i>Asparagus racemosus</i> ¹⁹	Liliaceae	Whole plant	Γ-radiation	Crude extract and a purified aqueous fraction	Lipid peroxidation, protein oxidation
CGX,- a modified traditional Chinese herbal drug ²⁰	--	--	Carbon tetrachloride	Aqueous	alanine transaminase (ALT), aspartate transaminase (AST), and lactate dehydrogenase (LDH) in serum, and the malondialdehyde concentrations in liver tissue
Propolis- is a resinous hive product collected by honeybees from various plant sources ²¹	--	--	D-galactosamine (d-galn):tumor necrosis factor-α (tnf-α)	Meoh and water extracts	1,1-diphenyl-2-picrylhydrazyl (DPPH) free radical scavenging activity, cytotoxicity and hepatoprotective activity
<i>Tephrosia purpurea</i> L. and <i>Tecomella undulate</i> ²²	Fabaceae Bignoniaceae	Aerial parts of tephrosia purpurea and stem Bark of tecomella undulata	Thioacetamide	Aqueous-ethanolic extract	serum aspartate aminotransaminase, alanine aminotransaminase, gamma glutamyl, alkaline phosphatase, total bilirubin, liver glutathione
<i>Cassia fistula</i> ²³	Leguminosae	Leaf	Carbon tetrachloride	Methanol	Serum levels of transaminases (SGOT and SGPT), bilirubin and alkaline phosphatase (ALP).
<i>Amalkadi Ghrita</i> ²⁴ (AG), a polyherbal formulation composed of <i>Embllica officinalis</i> (10 g), <i>Glycyrrhiza glabra</i> (10 g), and cow's ghee	--	--	Carbon tetrachloride	Crude drug	Serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), alkaline phosphatase (ALP), and acid phosphatase (ACP). The serum levels of total proteins, bilirubin and histological studies.
<i>Gentiana olivieri</i> ²⁵	Gentianaceae	Aerial parts	Carbon tetrachloride	Ethanol	Plasma and hepatic tissue malondialdehyde formation, and liver tissue glutathione level, as well as plasma transaminase enzyme levels (aspartate transferase and alanine transferase).
<i>Zhi-Zi-Da-Huang</i> ²⁶ is a classical traditional Chinese formula comprising four crude drugs: <i>Gardenia jasminoides</i> Ellis. <i>Rheum officinale</i> Baill, <i>Citrus aurantium</i> L. and <i>Semen Sojae Preparatum</i> with a ratio of 3:1:4:8 in weight.	--	--	Alcohol	Diethyl ether and water	Aspartate transaminase (AST), alanine transferase (ALT), reduced glutathione (GSH), malondialdehyde (MDA) and superoxide dismutase (SOD). The biochemical observations were supplemented by Histopathological examination.
<i>Amaranthus spinosus</i> ²⁷	Amaranthaceae	Whole plant	Carbon tetrachloride	Petroleum ether	serum enzymatic levels of serum glutamate oxaloacetate transaminase (AST), serum glutamate pyruvate transaminase (ALT), serum alkaline phosphatase (SALP) and total bilirubin Histopathological examination

<i>Apium graveolens</i> and <i>Hygrophila Auriculata</i> ²⁸	Apiaceae Acanthaceae	Seeds	Paracetamol and thioacetamide	Petroleum ether and methanol	serum transaminases (SGOT and SGPT), alkaline phosphatase, sorbitol dehydrogenase, glutamate dehydrogenase and bilirubin in serum, Histopathological
<i>Boerhaavia diffusa</i> ²⁹	Nyctaginaceae	Roots	Thioacetamide	Aqueous	GOT, GPT, ACP and ALP, but not GLDH and bilirubin
<i>Clerodendrum inerme</i> ³⁰	Verbenaceae	Leaves	Carbon tetrachloride	Ethanol	alanine amino transferase (ALT), aspartate amino transferase (AST), alkaline phosphates (ALP), triglycerides (TGL), total cholesterol (TC)
<i>Zanthoxylum armatum</i> ³¹	Rutaceae	Bark	Carbon tetrachloride	Ethanolic	serum transaminases, alkaline phosphatase and total bilirubin and antioxidant enzymes: superoxide dismutase, catalase and glutathione
<i>Gundelia tourenfortii</i> ³²	Asteraceae	Fresh edible stalk	Carbon tetrachloride	Aqueous ethanol	Histopathological studies, ALT, AST and ALP, and bilirubin
<i>Cassia occidentalis</i> ³³	Caesalpiniaceae	Leaves	Paracetamol and ethyl alcohol	Aqueous-ethanolic extract	Serum transaminase (aspartate amino transferase) and serum alanine amino transferase), alkaline phosphatase, serum cholesterol, serum total lipids and Histopathological alterations.
<i>Kalanchoe pinnata</i> Pers. ³⁴	Crassulaceae	Leaves	Carbon tetrachloride	Juice of the fresh leaves and ethanolic extract	Serum glutamyl oxalacetic acid transaminase (SGOT), serum glutamyl pyruvate transaminase (SGPT) alkaline phosphatase (ALKP), serum bilirubin (SBLN), Histopathological studies.
<i>Luffa echinata</i> ³⁵	Cucurbitaceae	Fruits	Carbon tetrachloride	Petroleum ether, acetone and methanolic extracts	Serum glutamic oxalacetic transaminase (SGOT), serum glutamic pyruvate transaminase (SGPT), alkaline phosphatase (ALKP), total protein (TP) and total albumin (TA).
<i>Phyllanthus amarus</i> Schum. et. Thonn. ³⁶	Euphorbiaceae	Aerial part	Ethanol	Aqueous	Hepatotoxic parameters studied in vivo included serum transaminases (AST and ALT), serum triglyceride (STG), hepatic triglyceride (HTG), tumor necrosis factor alpha, interleukin 1 beta, together with Histopathological examination.
<i>Schouwia thebica</i> ³⁷	Arecaceae	Aerial parts	Carbon tetrachloride	Diethyl ether, chloroform, ethyl acetate, and n-butanol	ALT, AST, and GGT, and levels of glucose, triglycerides, and cholesterol in serum
<i>Thunbergia laurifolia</i> Linn. ³⁸	Acanthaceae	Leaves	Ethanol	Aqueous extract	Serum glutamyl oxalacetic acid transaminase (SGOT), serum glutamyl pyruvate transaminase (SGPT) alkaline phosphatase (ALKP), serum bilirubin (SBLN), Histopathological studies.
Thymoquinone, the active constituent of <i>Nigella sativa</i> ³⁹	Ranunculaceae	Seeds	Tert-butyl hydroperoxide	Aqueous-ethanolic extract	ALT and AST
<i>Apium gra_eolens</i> Linn.	Apiaceae.	Seeds	Carbon tetrachloride	Petroleum ether, acetone and methanol	Serum transaminases (SGOT and SGPT), alkaline phosphatase, total protein and albumin
<i>Croton oblongifolius</i> ⁴⁰	Euphorbiaceae	Aerial parts			
<i>Woodfordia fruticosa</i> Kurz ⁴¹	Lythraceae	Flowers	Carbon tetrachloride	Petroleum ether, chloroform, ethyl alcohol and	Serum transaminases, alkaline phosphatase, bilirubin and triglycerides

				aqueous	
<i>Piper chaba</i> ⁴²	Piperaceae	Fruit	D-galactosamine (d-galn)/lipopolysaccharides	Aqueous acetone	Serum glutamic oxalacetic transaminase (SGOT), serum glutamic pyruvate transaminase (SGPT), alkaline phosphatase (ALKP), total protein (TP) and total albumin (TA).
<i>Nelumbo nucifera Gaertn</i> ⁴³	Nelumbonaceae	Leaves	Carbon tetrachloride	Ethanollic	ALT and AST
<i>Bupleurum kaoi</i> ⁴⁴	Umbelliferae	Dried roots	Carbon tetrachloride	Ethanollic	Serum glutamyl oxalacetic acid transaminase (SGOT), serum glutamyl pyruvate transaminase (SGPT) alkaline phosphatase (ALKP), serum bilirubin (SBLN), Histopathological studies.
<i>Cuscuta chinensis</i> ⁴⁵	Convolvulaceae	Seeds	Acetaminophen	Aqueous and ethanollic	superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx), and by reducing malondialdehyde (MDA)
<i>Hygrophila auriculata</i> ⁴⁶	Acanthaceae	Root	Carbon tetrachloride	Aqueous extract	Alanine transaminase, aspartate transaminase (AST), alkaline phosphatase (ALP), total protein and total bilirubin. Hepatic tissues were subjected to Histopathological studies
<i>Halenia elliptica</i> ⁴⁷	Gentianaceae	Whole plant	Carbon tetrachloride	Methanollic	Showed a significant decrease in ALT, AST, ALP, and total bilirubin, Histopathological studies
<i>Laggera pterodonta</i> ⁴⁸	Asteraceae	Whole herb	Ccl4, carbon tetrachloride; d-galn, d-galactosamine; dpph, 1,1-diphenyl-2-picrylhydrazyl radical	Ethyl alcohol and aqueous	Alanine transaminase, aspartate transaminase (AST), alkaline phosphatase (ALP), total protein and total bilirubin.
<i>Equisetum arvense</i> ⁴⁹	Equisetaceae	Aerial parts	Carbon tetrachloride	Methanollic	alanine transaminase, aspartate transaminase (AST), alkaline phosphatase (ALP), and Histopathological studies
<i>Byrsocarpus coccineus Schum</i> ⁵⁰	Connaraceae	Leaf	Carbon tetrachloride	Aqueous	ALT and AST and total protein
<i>Euphorbia fusiformis</i> ⁵¹	Euphorbiaceae	Tubers	Rifampicin	Ethanol	Serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), gamma glutamyl transpeptidase (GGTP), alkaline phosphatase (ALP), total bilirubin and total protein
<i>Phyllanthus amarus Schum.</i> ⁵²	Euphorbiaceae	Whole Plant except root	Aflatoxin b1-induced liver damage	Ethanollic	Thiobarbituric acid reactive substances (TBARS) and enhancing the reduced glutathione level and the activities of antioxidant enzymes, glutathione peroxidase (GPx), glutathione-S-transferase (GST), superoxide dismutase (SOD) and catalase (CAT).
<i>Hypericum japonicum</i> ⁵³	Clusiaceae	Whole Plant	Carbon tetrachloride and α -naphthyl-isothiocyanate (anit)-	Aqueous, petroleum ether and chloroform	AST, ALT and T-BIL levels in serum
<i>Decalepis hamiltonii</i> ⁵⁴	Asclepiadaceae	Roots	Carbon tetrachloride	Aqueous extract	Lipid peroxidation and protein carbonylation, and restoring the levels of antioxidant enzymes (SOD, CAT, GPx, GR, and GST) and glutathione, Histopathological observations

<i>Trichosanthes cucumerina</i> ⁵⁵	curcurbitaceae	Whole plant	Carbon tetrachloride	Methanolic	Alanine amino transferase (ALT), aspartate amino transferase (AST), alkaline phosphatase (ALP), total bilirubin (TB), total protein (TP) and albumin (ALB) levels were estimated in serum as well as the glutathione (GSH) and malondialdehyde (MDA) Histopathological changes
<i>Vitis vinifera</i> ⁵⁶	Vitaceae	Leaves	Carbon tetrachloride	Chcl3, etoac, n-buoh, and water	(plasma and liver tissue MDA [malondialdehyde], transaminase enzyme levels in plasma [AST-aspartate transaminase, ALT-alanine transferase] and liver GSH [glutathione] levels) Histopathological studies
<i>Mallotus japonicas</i> ⁵⁷	Euphorbiaceae	Cortex	Carbon tetrachloride	Water	serum enzymatic activities of alanine: aspartate aminotransferase, sorbitol dehydrogenase and g-glutamyltransferase
<i>Ganoderma lucidum</i> ⁵⁸	Polyporaceaes	Winter mushroom s	D-galactosamine	Aqueous juice	(AST, ALT) in serum and MDA, GSH, Histological examination
<i>Pittosporum neelgherrense</i> ⁵⁹	Pittosporaceae	Stem bark	Carbon tetrachloride (ccl4)-, d-galactosamine (d-galn)- and acetaminophen (apap)-	Methanolic	serum enzymes, glutamate oxaloacetate transaminase (SGOT), glutamate pyruvate transaminase (SGPT)
<i>Rubia cordifolia</i> Linn. ⁶⁰	Rubiaceae	Roots	Carbon tetrachloride	Aqueous etoh extract	Serum glutamic oxaloacetic transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), serum alkaline phosphatase (SALP) and γ -glutamyltransferase
<i>Aloe barbadensis</i> Mill ⁶¹	Liliaceae	Dried aerial parts	Carbon tetrachloride	Petroleum ether, chloroform and methanol	Serum transaminases, alkaline phosphatase, bilirubin and triglycerides. lipid peroxidation, glutathione, glucose-6-phosphatase and microsomal aniline hydroxylase and amidopyrine N-demethylase
<i>Fumaria indica</i> ⁶²	PAPAVERACEAE	Whole plant	D-galactosamine	Butanol	Histological studies, serum enzymes (SGOT, SGPT, ALP) and metabolites bilirubin, reduced glutathione (GSH) and lipid peroxidation
<i>Cochlospermum vitifolium</i> ⁶³	COCHLOSPERMA CEAE	Bark	Carbon tetrachloride	Hexane, dichloromethane, methanol	Serum glutamic-pyruvic transaminase and alkaline phosphatase
<i>Picrorrhiza rhizome</i> ⁶⁴	Scrophulariaceae	Dried underground stem	Poloxamer (px)-407	Water	Body weight and gains, liver weight, serum aspartate transferase (AST) and alanine transferase (ALT) levels were monitored with serum low density lipoprotein (LDL), high density lipoprotein (HDL), triglyceride and total cholesterol levels. slight increase of liver weight, serum AST and ALT
<i>Artemisia absinthium</i> ⁶⁵	Asteraceae	Powdered aerial parts	Carbon tetrachloride and by injection of endotoxin (lps, 10 μ g, i.v.) In bcg-primed mice	Aqueous	The levels of aspartate aminotransferase (AST), alanineaminotransferase (ALT), tumor necrosis factor- (TNF- α) and interleukin-1(IL-1)in mouse sera, as well as superoxide dismutase (SOD),

					glutathioneperoxidase (GPx) and malondialdehyde (MDA)
<i>Lactuca indica</i> ⁶⁶	Compositae	Aerial parts	Carbon tetrachloride	Methanolic	serum glutamic-pyruvic transaminase and alkaline phosphatase
<i>Cassia tora</i> ⁶⁷	Caesalpinaceae	Leaves	Carbon tetrachloride	Ethyl acetate	Glutathione enzyme activities.
<i>Carum copticum</i> ⁶⁸	Apiaceae	Seed	Paracetamol And ccl4	Water	Serum glutamic-pyruvic transaminase and alkaline phosphatase serum alkaline phosphatase (ALP) and aminotransferases (AST and ALT).
<i>Azadirachta indica</i> ⁶⁹	Meliaceae	Leaf	Paracetamol	70% ethanol	(Glutathione peroxidase (GPx), glutathione-S-transferase (GST), superoxide dismutase (SOD) and catalase (CAT)
<i>Mamoridca subangulata</i> <i>Naragamia alata</i> ⁷⁰	Cucurbitaceae Meliaceae	Leaf, whole Plant	Paracetamol	10% aqueous suspension was prepared in 2% (w/v) gum acacia	Serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), gamma glutamyl transpeptidase (GGTP)
<i>Phyllanthus Niruri</i> ⁷¹	Euphorbiaceae	Leaves	Paracetamol	Petroleum ether and 50% ethanol	Serum glutamic oxaloacetic transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), serum alkaline phosphatase (SALP) and γ -glutmyltransferase and Histopathological studies.
<i>Orthosiphon stamineus</i> ⁷²	Lamiaceae	Leaves	Paracetamol	Methanol	SGOT, SGPT, ALP and lipid peroxides
<i>Silybum marianum</i> <i>Cichorium intybus</i> ⁷³	Asteraceae	Leaves	Thioacetamide	Chloroform	SGOT, SGPT, aminotransferase, alkaline phosphate and bilirubin
<i>Sarcostemma brevistigma</i> ⁷⁴	Asclepiadaceae	Stem	Carbon tetrachloride	Ethyl acetate	Serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvate transaminase (SGPT), alkaline phosphatase, total bilirubin and gamma glutamate transpeptidase (GGTP)
<i>Cassia fistula</i> ⁷⁵	Leguminosae	Seeds	Paracetamol	Methanolic	SGOT, SGPT, ALP and Billirubin
<i>Piper longum</i> ⁷⁶	Piperaceae	Fruits and roots powder	Carbon tetrachloride	Milk extract	SGOT, SGPT, ALP and Billirubin
<i>Chamomile capitula</i> ⁷⁷	Asteraceae	Fresh natural mature capitula	Paracetamol	Aqueous Ethanolic	Liver glutathione, Na ⁺ K ⁺ - ATPase activity, serum marker enzymes, serum bilirubin, glycogen and thiobarbutiric acid
<i>Calotropis procera</i> ⁷⁸	Apocynaceae	Flowers	Paracetamol	70% EtOH	SGPT, SGOT, ALP, bilirubin, cholesterol, HDL and tissue GSH
<i>Aerva lanata Linn</i> ⁷⁹	Amaranthaceae	Coarse powder plant material	Paracetamol	Hydroalcoholic	Serum enzymes alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP) and bilirubin.
<i>Acacia confuse</i> ⁸⁰	Leguminosae	Bark	Carbon tetrachloride	Hydroalcoholic	Aspartate aminotransferase (AST), alanine aminotransferase (ALT) and malondialdehyde (MDA) in plasma, and cytochrome P4502E1 (CYP2E1) protein superoxide dismutase (SOD), glutathione peroxidase (GPX) and catalase(CAT) in

					erythrocytes
<i>Kigelia africana</i> , <i>Calotropis procera</i> , <i>Hibiscus sabdariffa</i> and <i>Alchornea cordifolia</i> ⁸¹	Bignoniaceae Apocynaceae Malvaceae Euphorbiaceae	Leaves Leaves Calyces Leaves	Paracetamol	Distilled water	Lipid peroxidation product thiobarbituric reacting substances (tbars) superoxide dismutase (sod), catalase (cat), glutathione peroxidase (gpx), and d-aminolevulinate dehydratase (d-ala-d) activities
<i>Pterocarpus marsupium</i> Roxb. ⁸²	Papilionaceae	Stem bark	Carbon tetrachloride	Methanol and aqueous	Total bilirubin, serum protein, alanine aminotransaminase, aspartate aminotransaminase, and alkaline phosphatase activities) and Histopathological studies of the liver.
<i>Alocasia indica</i> Linn. ⁸³	Araceae	Leaves	Paracetamol	Hydroalcoholic	Total bilirubin, serum protein, alanine aminotransaminase, aspartate aminotransaminase, and alkaline phosphatase
<i>Capparis spinosa</i> ⁸⁴	Capparidaceae	Root bark	Carbon tetrachloride	Ethanol	Alanine transaminase and aspartate transaminase activities
<i>Spondias pinnata</i> ⁸⁵	Anacardiaceae	Stem heart wood	Carbon tetrachloride	Ethyl acetate and methanolic	SGPT, SGOT, ALP, Total bilirubin (TB).
<i>Embelia ribes</i> ⁸⁶	Myrsinaceae	Fruits	Paracetamol	Water	SGPT, SGOT, ALP, Total bilirubin (TB) and Histopathological studies
<i>Juncus subulatus</i> ⁸⁷	Juncaceae	Powdered tubers	Paracetamol	70% methanol	Serum Liver enzymes (AST, ALT and ALP), total protein, albumin, cholesterol, triglycerides, nitric oxide (NO), malondialdehyde (MDA) and total antioxidant capacity (TAC)
<i>Phyllanthus polyphullus</i> ⁸⁸	Euphorbiaceae	Leaves	Acetaminophen	Methanolic	Aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphatase (ALP), total bilirubin, gamma glutamate transpeptidase (GGTP), lipid peroxidase (LPO) with a reduction of total protein, superoxide dismutase (SOD), catalase, glutathione peroxidase (GPx) and glutathione S-transferase (GST).
<i>Tylophora indica</i> ⁸⁹	Asclepiadaceae	Leaf powder	Ethanol	Aqueous	Aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphatase (ALP), total bilirubin,
<i>Cleome viscosa</i> Linn. ⁹⁰	Capparidaceae	Leaf powder	Carbon tetrachloride	Ethanol	Aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphatase (ALP), total bilirubin and Histopathological studies.
<i>Ricinus Communis</i> ⁹¹	Euphorbiaceae	Leaves	Carbon tetrachloride	Cold aqueous extract	Aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphatase (ALP), total bilirubin and Histopathological studies
<i>Picrorhiza Kurroo</i> ⁹²	Scrophulariaceae	Root and rhizomes	Alcohol-carbon tetrachloride	Ethanol	Glutamate oxaloacetate transaminase, glutamate pyruvate transaminase, acid phosphatase, alkaline phosphatase, glutamate dehydrogenase and bilirubin
<i>Ocimum sanctum</i> ⁹³	Lamiaceae	Leaf	Paracetamol	Hydroalcoholic	Aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphatase (ALP), total bilirubin and Histopathological studies

<i>Acacia Catechu</i> ⁹⁴	Leguminosae	Powdered pale catechu	Carbon tetrachloride	Ethyl acetate	SGPT, SGOT, Serum alkaline phosphatase and Bilirubin content
<i>Ginkgo Biloba</i> ⁹⁵	Ginkgoaceae	Dried extract	Carbon tetrachloride	Ethanol	SGPT, SGOT, Serum alkaline phosphatase and Bilirubin content, Histopathological studies
<i>Scoparia dulcis</i> ⁹⁶	Scrophulariaceae	Whole plant	Carbon tetrachloride	Methanol, diethyl ether and petroleum ether	aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphatase (ALP), total bilirubin and Histopathological studies
<i>Plantago Major</i> L. ⁹⁷	Plantaginaceae	Seeds	Carbon tetrachloride	Ethanol	aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphatase (ALP), total bilirubin
<i>Pterospermum acerifolium</i> ⁹⁸	Sterculiaceae	Leaves	Carbon tetrachloride	Ethanol	aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphatase (ALP),
<i>Vitex trifolia</i> ⁹⁹	Verbenaceae	Leaves	Carbon tetrachloride	Ethanol and water	Total protein, Histopathological studies, aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphatase (ALP),
<i>Hoslundia opposita</i> ¹⁰⁰	Lamiaceae	Stem	Carbon tetrachloride and paracetamol	Methanol and ethyl acetate	AST, ALT and Bilirubin
<i>Trianthema decandra</i> ¹⁰¹	Aizoaceae	Leaves	Carbon tetrachloride	aqueous	AST, ALT and Bilirubin. Histopathological studies
<i>Hibiscus esculentus</i> Linn. ¹⁰²	Malvaceae	Roots	Carbon tetrachloride	Water	SGPT, SGOT, ALP, Total bilirubin (TB).
<i>Aegle marmelos correa ex Roxb.</i> ¹⁰³	Rutaceae	Pulp/seeds	Carbon tetrachloride	water	AST, ALT and Bilirubin. Histopathological studies
<i>Tylophora indica</i> ¹⁰⁴	Asclepidaceae	Leaves	Carbon tetrachloride	Methanolic	SGPT, SGOT, Serum alkaline phosphatase and Bilirubin content
<i>Casuarina equisetifolia,</i> <i>Cajanus cajan,</i> <i>Glycosmis pentaphylla,</i> <i>Bixa orellana,</i> <i>Argemone mexicana,</i> <i>Physalis minima,</i> <i>Caesalpinia bonduc</i> ¹⁰⁵	Casuarinaceae Fabaceae Rutaceae Bixaceae Papaveraceae Solanaceae Fabaceae	Plant materials	Carbon tetrachloride	Methanolic extract	SGPT, SGOT, AST, ALT AND Cholesterol.

CONCLUSION: The goal of ethnopharmacological studies on medicinal plants should not be restricted to find new prototype pure compounds as drugs. Active extracts, fractions or mixture of fractions/extracts may prove very effective drugs. Plant drugs (combinations or individual drug) for liver diseases should possess sufficient efficacy to cure severe liver diseases caused by toxic chemicals, viruses (Hepatitis B, Hepatitis C, etc.), excess alcohol intake, etc. A single drug cannot be effective against all types of severe liver diseases. Effective formulations have to be developed using indigenous medicinal plants, with proper

pharmacological experiments and clinical trials. The manufacture of plant products should be governed by standards of safety and efficacy.

References:

1. WHO, Regional Office For The Western Pacific, Research Guidelines For Evaluating The Safety And Efficacy Of Herbal Medicines, Manila, WHO, 1993.
2. Pushpangadan P. Role of Traditional Medicine in Primary Health Care. In: Iyengar PK, Damodaran VK, Pushpangadan P, Editors. Science for Health. Published By State Committee On Science, Technology And Environment, Govt. Of Kerala, 1995.
3. Aszalos A, Editor. Antitumor Compounds of Natural Origin. Boca Raton, CRC Press, 1982.

4. Smuckler EA. Alcoholic Drink: Its Production And Effects. Fed Proe 1975; 34:2038-44.
5. WHO, Regional Health Report. South East Asia Region Viral Hepatitis. Regional Office For South-East Asia, New Delhi, 1997:45-7 J.H.Chin,A.H.Hussin And S.Ismail,Anti-Hepatotoxicity Effect of Orthosiphon Stamineus Benth Against Acetaminophen-Induced Liver Injury In Rats By Enhancing Hepatic GST Activity, Pharmacognosy Research, March-April 2009,Volume-1, 53-58.
7. Raju Ratan Wadekar, Radhika Sachin Supale, Kunal Mahesh Tewari, Kalpana S.Patil, Sunil Satyappa Jalalpure, Screening of Roots of *Baliospermum Montanum* For Hepatoprotective Activity Against Paracetamol Induced Liver Damage In Albino Rats, International Journal Of Green Pharmacy, July 2010, 220-223.
8. Reddipalli Hemalatha, Anti-Hepatotoxic and Anti-Oxidant Defense Potential of *Tridax Procumbens*, International Journal of Green Pharmacy, July 2010, 164-169.
9. M.G.Rajesh,M.S.Latha, Protective Activityof Glycyrrhiza *Glabra* Linn. On Carbantetrachloride-Induced Peroxidative Damage, Indian Journal Pharmacol, October 2004, Vol 38, 284-287.
10. R. Harish, T. Shivanandappa, Antioxidant Activity and Hepatoprotective Potential of *Phyllanthus Niruri*, Food Chemistry 95 (2006) 180–185.
11. Roseline Aliyu A'b, Z.S.C. Okoye A, W, Thomas Shier *B, The Hepatoprotective Cytochrome P-450 Enzyme Inhibitor Isolated From The Nigerian Medicinal Plant *Cochlospermum Planchonii* Is A Zinc Salt, Journal Of Ethnopharmacology 48 (1995) 89-97.
12. Lishu Wanga,B, Dongyan Chenga, Haisheng Wanga, Lin Dia, Xuefeng Zhou, Tunhai Xuc, Xianwen Yangb, Yonghong Liub,*, The Hepatoprotective And Antifibrotic Effects Of *Saururus Chinensis* Against Carbontetrachloride Induced Hepatic Fibrosis In Rats, Journal Of Ethnopharmacology 126 (2009) 487–491
13. Chun-Ching Lln , Chin-Chuan Tsal , Ming-Hong Yen B, The Evaluation Of Hepatoprotective Effects of Taiwan Folk Medicine 'Teng-Khia-U', Journal Of Ethnopharmacology 45 (1995) 113-123.
14. Fei Yana,1, Qiao-Yanzhanga,1, Leijiaoa, Tinghana, Hongzhanga, Lu-Pingqina, Rahman Khalid, Synergistic Hepatoprotective effect of *Schisandrae Lignans* With Astragalus Polysaccharides On Chronic Liver Injury In Rats, Phytomedicine 16 (2009) 805–813
15. Naseem N. Qureshi A, Bhanudansh S. Kuchekar B, Nadeem A. Logade A, Majid A. Haleem A, Antioxidant And Hepatoprotective Activity of *Cordia Macleodii* Leaves, Saudi Pharmaceutical Journal, 23 May 2009,Vol-17, 299–302.
16. Daonian Zhoua B, Jinlan Ruana, Yaling Caia, Zhaemoui Xionga, Weifua, Anhua Weia, anti- antioxidant And Hepatoprotective Activity of Ethanol Extract of *Arachniodes Exilis* (Hance) Ching, Journal of Ethnopharmacology 129 (2010) 232–237.
17. Avijeet Jain, Manish Soni, Lokesh Deb, Anurekha Jain, A.P. Roul, V. B. Gupta, K.L. Krishna Antioxidant And Hepatoprotective Activity of Ethanolic And Aqueous Extracts of *Momordica Dioica* Roxb. Leaves, Journal of Ethnopharmacology 115 (2008) 61–66.
18. V. Jaishree, Shrishailappa Badami, Antioxidant and hepatoprotective effect of Swertiamarin from *Ecicostemma Axillare* against D-Galactosamine Induced Acute Liver Damage in Rats, Journal Of Ethnopharmacology 130 (2010) 103–106.
19. Jayashree P. Kamat A, Krutin K. Bloor A, Thomas P.A. Devasagayam A, S.R. Venkatachalam Bantioxidant Properties of *Asparagus Racemosus* against Damage Induced By G-Radiation in Rat Liver Mitochondria, Journal of Ethnopharmacology 71 (2000) 425–435.
20. Xiao-Ping Hu, Jang-Woo Shin, Jing-Huawang, Jung-Hyo Cho, Jin-Young Son, Chong-Kwan Cho, Chang-Gue Son, Antioxidative And Hepatoprotective Effect of Cgx, An Herbal Medicine, Against Toxic Acute Injury In Mice Journal Of Ethnopharmacology 120 (2008) 51–55
21. Arjun H. Banskota A, Yasuhiro Tezuka A, I Ketut Adnyana A, Kiyoshi Midorikawa A, Katsumichi Matsushige A, Dejair Message B, Alfredo A.G. Huertas B, Shigetoshi Kadota A,, Cytotoxic, Hepatoprotective And Free Radical Scavenging Effects of Propolis From Brazil, Peru, The Netherlands And China, Journal Of Ethnopharmacology 72 (2000) 239–246
22. Amit Khatria, Arun Gargb, Shyam S. Agrawal C, Evaluation of Hepatoprotective Activity Of Aerial Parts of *Tephrosia Purpurea* L. And Stem Bark of *Tecomella Undulate*, Journal Of Ethnopharmacology 122 (2009) 1–5
23. T. Bhakta A, Pulok K. Mukherjee B, Kakali Mukherjee A, S. Banerjee A, Subhash C. Mandal A, Tapan K. Maity A, M. Pal A, B.P. Saha A, Evaluation of Hepatoprotective Activity of Cassia Fistula Leaf Extract, Journal Of Ethnopharmacology 66 (1999) 277–282.
24. Girish S, Achliya, Sudhir G. Wadodkar, Avinash K. Dorle, Evaluation of Hepatoprotective Effect of Amalkadi Ghrita Against Carbon Tetrachloride-Induced Hepatic Damage In Rats, Journal Of Ethnopharmacology 90 (2004) 229–232.
25. Didem Deliorman Orhana, Mustafa Aslana, Go`Knur Aktayb, Ender Ergunc, Erdem Yesiladaa, Fatma Erguna, Evaluation Of Hepatoprotective Effect Of *Gentiana Olivieri* Herbs on subacute Administration And Isolation Of Active Principle, Life Sciences 72 (2003) 2273–2283.
26. Hang Wanga, Fang Fenga. B, Bo-yang Zhuanga, Ya sunc, Evaluation of Hepatoprotective Effect of Zhi-Zi-Da-Huang Decoction And Its Two Fractions Against Acute Alcohol-Induced Liver Injury In Rats, Journal of Ethnopharmacology 126 (2009) 273–279.
27. Hussain Zeashan A, G. Amresh A, Satyawan Singh B, Chandana Venkateswara Rao A, Hepatoprotective Activity Of *Amaranthus Spinousus* In Experimental Animals, Food And Chemical Toxicology 46 (2008) 3417–3421.
28. Anubha Singh, S.S. Handa, Hepatoprotective Activity of *Apium Graveolens* And *Hygrophila Auriculata* against

- Paracetamol And Thioacetamide Intoxication In Rats, Journal of Ethnopharmacology 49 (1995) 119-126.
29. .K.S. Rawat A S. Mehrotra A, S.C. Tripathi B, U. Shome , Hepatoprotective Activity Of *Boerhaavia Diffusa* L. Roots - A Popular Indian Ethnomedicine, Journal Of Ethnopharmacology 56 (1997) 61- 66.
 30. N. Gopal A, S. Sengottuvelu B, Hepatoprotective Activity of *Clerodendrum Inerme* against CCL4 Induced Hepatic Injury In Rats, Fitoterapia 79 (2008) 24-26.
 31. Lalit singh, Ranawat, Jigar Bhatt, Jagruti Paetl, Hepatoprotective activity of Ethanolic Extracts of Bark of *Zanthoxylum Armatum* DC In Ccl4 Induced Hepatic Damage In Rats, Journal of Ethnopharmacology 127 (2010) 777-780.
 32. Akram Jamshidzadeh, Fatema Fereidooni, Zohreh Salehi, Hossein Niknahad, Hepatoprotective activity of *Gundelia tourenfortii*, Journal of Ethnopharmacology 101 (2005) 233-237
 33. M.A. Jafri A,* , M. Jalis Subhani A, Kalim Javed A, Surender Singh B, Hepatoprotective Activity Of Leaves Of *Cassia Occidentalis* Against Paracetamol And Ethyl Alcohol Intoxication In Rats, Journal Of Ethnopharmacology 66 (1999) 355-361.
 34. N.P. Yadav, V.K. Dixit, Hepatoprotective Activity of Leaves of *Kalanchoe Pinnata* Pers, Journal of Ethnopharmacology 86 (2003) 197-202.
 35. Bahar Ahmed, Tanveer Alam, Shah A. Khan, Hepatoprotective Activity Of *Luffa Echinata* Fruits, Journal of Ethnopharmacology 76 (2001) 187-189
 36. Pornpen pramyothin, Chanon ngamtin, Somlak Pongshompoo, Chaiyo Chaichantipyuth, Hepatoprotective Activity of *Phyllanthus Amarus* Schum. Et. Thonn.Extract In Ethanol Treated Rats: *In Vitro* And *In Vivo* Studies, Journal Of Ethnopharmacology 114 (2007) 169-173.
 37. Amani, S. Awaad, A D. J. Maitlandb And G. A. Solimanc, Hepatoprotective Activity Of *Schouwia Thebica* Webb, Bioorganic & Medicinal Chemistry Letters 16 (2006) 4624-4628.
 38. Pornpen Pramyothin , Hemvala Chirdchupunsare, Anudep Rungsipipat, Chaiyo Chaichantipyuth C, Hepatoprotective Activity Of *Thunbergia Laurifolia* Linn Extract In Rats Treated With Ethanol: *In Vitro* And *In Vivo* Studies, Journal of Ethnopharmacology 102 (2005) 408-411.
 39. Mohamed Hesham Daba, Mohamed S. Abdel-Rahman, Hepatoprotective Activity of Thymoquinone in Isolated Rat Hepatocytes, Toxicology Letters 95 (1998) 23-29.
 40. Bahar Ahmed, Tanveer Alam, Manoj Varshney, Shah Alam Khan, hepatoprotective activity of two plants belonging to the apiaceae and the euphorbiaceae family, journal of ethnopharmacology 79 (2002) 313-316.
 41. B.K. Chandan, A.K. Saxena, Sangeeta Shukla, N. Sharma, D.K. Gupta, K. Singh, Jyotsna Suri, M. Bhadauria, G.N. Qazi, Hepatoprotective Activity of *Woodfordia Fruticosa* Kurz Flowers against Carbontetrachloride induced Hepatotoxicity, Journal Of Ethnopharmacology 119 (2008) 218-224.
 42. Hisashi Matsuda A, Kiyofumi Ninomiya A,B, Toshio Morikawa A,B, Daisuke Yasuda A, Itadaki Yamaguchi A,Masayuki Yoshikawa A,* , Hepatoprotective Amide Constituents From The Fruit Of Piper Chaba : Structural Requirements, Mode Of Action, And New Amides, Bioorganic & Medicinal Chemistry 17 (2009) 7313-7323.
 43. Bo Huang, Xiaoquan Ban, Jingsheng He, Jing Tong, Jun Tian, Youwei Wang, Hepatoprotective And Antioxidant Activity Of Ethanolic Extracts Of Edible Lotus (*Nelumbo Nucifera* Gaertn.) Leaves, Food Chemistry 120 (2010) 873-878.
 44. Be-Jen Wang,, Chu-Ting Liu, Chin-Yin Tseng, Chien-Ping Wu, Zer-Ran Yu, Hepatoprotective And Antioxidant Effects Of Bupleurum Kaoli Liu (Chao Et Chuang) Extract And Its Fractions Fractionated Using Supercritical CO2 On Ccl4-Induced Liver Damage, Food And Chemical Toxicology 42 (2004) 609-617.
 45. Feng-Lin Yen, Tzu-Hui Wu, Liang-Tzung Lin, Chun-Ching Lin, Hepatoprotective And Antioxidant Effects Of *Cuscuta Chinensis* Against Acetaminophen-Induced Hepatotoxicity In Rats, Journal Of Ethnopharmacology 111 (2007) 123-128.
 46. P. Shanmugasundaram, S. Venkataraman, Hepatoprotective And Antioxidant Effects of *Hygrophila Auriculata* (K. Schum) Heine Acanthaceae Root Extract, Journal of Ethnopharmacology 104 (2006) 124-128.
 47. Bouang, Xiaoquanban, Jingshenghe, Hongzeng, Pengzhang, Youweiwang, Hepatoprotective and antioxidant effects of the methanolic Extract from *Halenia Elliptica*, Journal Ofethnopharmacology Xxx (2010) Xxx-Xxx.
 48. Yihang Wu A,B, Leixiang Yang B, Fang Wang C, Xiumei Wu D, Changxin Zhou B, Shuyun Shi B, Jianxia Mo B, Yu Zhao B, Hepatoprotective And Antioxidative Effects Of Total Phenolics From *Laggera Pterodonta* on chemical-induced injury in primary cultured neonatal rat hepatocytes, Food and Chemical Toxicology 45 (2007) 1349-1355.
 49. Hyuncheol Oh, Do-Hoon Kim, Jung-Hee Cho, Youn-Chul Kimc, Hepatoprotective and Free Radical Scavenging Activities Of Phenolic Petrosins and Flavonoids isolated from *Equisetum Arvense*, Journal Of Ethnopharmacology 95 (2004) 421-424.
 50. Abidemi J. Akindede, Kenneth O. Ezenwanebe, Chidozie C. Anunobi, Olufunmilayo O. Adeyemi, Hepatoprotective And In Vivo Antioxidant Effects of *Byrsocarpus Coccineus* Schum. and Thonn. (Connaraceae), Journal of Ethnopharmacology 129 (2010) 46-52.
 51. N. Anusuya, K. Raju, S. Manian, Hepatoprotective and Toxicological Assessment of an Ethnomedicinal Plant *Euphorbia Fusiformis* Buch.-Ham.Ex D.Don, Journal Of Ethnopharmacology 127 (2010) 463-467.
 52. Farah Naaz, Saleem Javed , M.Z. Abidin, Hepatoprotective Effect of Ethanolic Extract of *Phyllanthus Amarus* Schum. Et Thonn. on Aflatoxin B1-Induced Liver Damage in Mice, Journal of Ethnopharmacology 113 (2007) 503-509.

53. Ning Wang , Peibo Li, Yonggang Wang, Wei Peng, Zhong Wu, Suiyi Tan, Shaoling Liang, Xiao Shen, Weiwei Su, Hepatoprotective Effect of *Hypericum Japonicum* Extract And Its Fractions, Journal Of Ethnopharmacology 116 (2008) 1–6.
54. Anup Srivastava, T. Shivanandappa , Hepatoprotective Effect Of The Root Extract Of *Decalepis Hamiltonii* Against Carbon Tetrachloride-Induced Oxidative Stress In Rats, Food Chemistry 118 (2010) 411–417.
55. S. Sathesh Kumar, B. Ravi Kumar, G. Krishna Mohan, Hepatoprotective Effect Of *Trichosanthes Cucumerina* Var *Cucumerina* L. on Carbontetrachloride Induced Liver Damage in Rats, Journal Of Ethnopharmacology 123 (2009) 347–350.
56. Didem Deliorman Orhan , Nil Ufer Orhan, Ender Ergun, Fatma Ergun,, Hepatoprotective Effect Of *Vitis Vinifera* L. Leaves On Carbontetrachloride-Induced Acute Liver Damage In Rats, Journal of Ethnopharmacology 112 (2007) 145–151.
57. Hwa-Kyung Lim, Hack-Seang Kim, Hong-Serck Choi, Seikwan Oh, Jongwon Choi , Hepatoprotective Effects of Bergenin, A Major Constituent of *Mallotus Japonicus*, on Carbon Tetrachloride-Intoxicated Rats, Journal of Ethnopharmacology 72 (2000) 469–474.
58. Yanling Shi, Jie Sun, Hui He, Hui Guo, Sheng Zhang Hepatoprotective Effects Of *Ganoderma Lucidum* Peptides Against D-Galactosamine-Induced Liver Injury in Mice, Journal of Ethnopharmacology 117 (2008) 415–419.
59. S. Shyamal, P.G. Latha, V.J. Shine, S.R. Suja, S. Rajasekharan, T. Ganga Devi, Hepatoprotective Effects Of *Pittosporum Neelgherrense* Wight&Arn., A Popular Indian Ethnomedicine, Journal of Ethnopharmacology 107 (2006) 151–155.
60. Guntupalli M. Mohana Rao, Chandana V. Rao, Palpu Pushpangadan, Annie Shirwaikar, Hepatoprotective Effects Of Rubiadin, A Major Constituent Of *Rubia Cordifolia* Linn., Journal Of Ethnopharmacology 103 (2006) 484–490.
61. B.K. Chandan, A.K. Saxena, Sangeeta Shukla, Neelam Sharma, D.K. Gupta, K.A. Suri, Jyotsna Suri, M. Bhadauria, B. Singh, Hepatoprotective Potential of *Aloe Barbadosensis* Mill. Against Carbon Tetrachloride Induced Hepatotoxicity, Journal of Ethnopharmacology 111 (2007) 560–566.
62. Anshu Rathia, Arvind Kumar Srivastava, Annie Shirwaikar, Ajay Kumar Singh Rawata, Shanta Mehrotrad, Hepatoprotective Potential of *Fumaria Indica* Pugsley Whole Plant Extracts, Fractions and an isolated Alkaloid Protopine, Phytomedicine 15 (2008) 470–477.
63. J.C. S´Anchez-Salgado, R.R. Ortiz-Andrade, F. Aguirre-Crespo, J. Vergara-Galicia, I. Le´On-Rivera, S. Montes, R. Villalobos-Molina, S. Estrada-Soto, Hypoglycemic, Vasorelaxant and Hepatoprotective Effects of *Cochlospermum Vitifolium* (Willd.) Sprengel: A Potential Agent for the treatment of metabolic syndrome, Journal of Ethnopharmacology 109 (2007) 400–405
64. Hyeung Sik Lee, Hyo Chan Ahn, Sae Kwang Ku, Hypolipidemic Effect Of Water Extracts Of *Picrorrhiza Rhizoma* In PX-407 Induced Hyperlipemic ICR Mouse Model With Hepatoprotective Effects: A Prevention Study, Journal Of Ethnopharmacology 105 (2006) 380–386.
65. Nurmuhamat Amata, Halmuratupura, Biljanabla Zekovi´ Cb, In Vivo Hepatoprotective Activity Of The Aqueous Extract Of *Artemisia Absinthium* L. Against Chemically An Immunologically Induced Liver Injuries In Mice, Journal Ofethnopharmacology Xxx (2010) Xxx–Xxx.
66. Ki Hyun Kim, A Young Ho Kimb And Kang Ro Leea,*, Isolation Of Quinic Acid Derivatives And Flavonoids From The Aerial Parts Of *Lactuca Indica* L. And Their Hepatoprotective Activity In Vitro, Bioorganic & Medicinal Chemistry Letters 17 (2007) 6739–6743.
67. Muniyappan Dhanasekarana, Savarimuthu Ignacimuthua, Paulagastianb, Potential Hepatoprotective Activity Of Ononitol Monohydrate Isolated From *Cassia Tora* L. On Carbontetrachloride Induced Hepatotoxicity In Wistar Rats, Phytomedicine 16 (2009) 891–895.
68. A.H. Gilani A, , Q. Jabeen A, M.N. Ghayur A, K.H. Janbaz B, M.S. Akhtar C, Studies On The Antihypertensive, Antispasmodic, Bronchodilator And Hepatoprotective Activities Of The *Carum Copticum* Seed Extract, Journal Of Ethnopharmacology 98 (2005) 127–135.
69. R. R. Chattopadhyay, M. Bandyopadhyay, Possible Mechanism Of Hepatoprotective Activity Of *Azadirachta Indica* Leaf Extract Against Paracetamol-Induced Hepatic Damage In Rats: Part III, Indian J Pharmacol, June 2005, Vol 37, Pg No. 184-185.
70. V.V.ASHA, Preliminary Studies On The Hepatoprotective Activity Of *Mamordica Subangulata* And *Naragamia Alata*, Indian Journal Of Pharmacology 2001; Vol-33, Pg No. 276-279.
71. Nahid Tabassum, Sushma Chattervedi, S. S Aggrawal, Nissar Ahmed, Hepatoprotective Studies On *Phyllanthus Niruri* On Paracetamol Induced Liver Cell Damage In Albino Mice, Experimental Medicine, October-December 2005, Vol-12, Pg.No-211-212
72. C. Maheswari, R. Maryammal And R. Venkatanarayanan, Hepatoprotective Activity Of "*Orthosiphon Stamineus*" On Liver Damage Caused By Paracetamol In Rats, Jordan Journal Of Biological Sciences, September. 2008, Volume 1, Pages 105 -108.
73. H. Madani, M. Talebolhosseini, S. Asgary and G. H. Naderi, Hepatoprotective activity of *Silybum marianum* And *Clchorium Intybus* against Thioacetamide In Rats, Pakistan Journal of Nutrition, 2008, Vol-7(1), Pg No.-172-176.
74. Nirmal K. Neoliya, Yogendra N. Shukla, Mamta Mishra, Hepatoprotective Activity of *Sarcostemma Brevistigma* Against Carbontetrachloride-Induced Hepatic Damage In Rats current Science, Vol. 84, No. 9, 10 May 2003.
75. Chaudhari N. B., Chittam K. P., Patil V. R., Hepatoprotective Activity Of *Cassia Fistula* Seeds against paracetamol-induced hepatic injury in rats, Arch Pharm Sci & Res Vol 1 No 2 218 - 221 October 2009.
76. Jagruti A. PATEL & Urvi S. SHAH, hepatoprotective activity of *Piper Longum* Traditional Milk extract on carbon

- tetrachloride induced liver toxicity in wistar rats, vol. 8, 2009, pp. 121-129.
77. Ajay Kumar Gupta and 2Neelam Misra, hepatoprotective activity of aqueous ethanolic extract of *Chamomile Capitula* in paracetamol intoxicated albino rats, *American Journal of Pharmacology and Toxicology* 1 (1): 17-20, 2006.
 78. S. Ramachandra Setty A, Absar Ahmed Quereshi A, A.H.M. Viswanath Swamy B, Tushar Patil A, T. Prakash A, K. Prabhu A, A. Veeran Gouda A, Hepatoprotective activity of *Calotropis procera* flowers against paracetamol-induced hepatic injury in rats, *Fitoterapia* 78 (2007) 451-454.
 79. Manokaran S, Jaswanth A, Sengottuvelu S, Nandhakumar J, Duraisamy R, Karthikeyan D And Mallegaswari R, hepatoprotective activity of *Aerva Lanata* Linn. against paracetamol induced hepatotoxicity in rats, *Research J. Pharm. And Tech.* 1(4): Oct.-Dec. 2008.
 80. Yu-Tang Tung, Jyh-Horng Wu, Chi-Chang Huang, Hsiang-Chi Peng, Ya-Ling Chen, Suh-Ching Yang, Shang-Tzen Chang, protective effect of *Acacia Confusa* Bark extract and its active compound gallic acid against carbon tetrachloride-induced chronic liver injury in rats, *Food and Chemical Toxicology*, 2009, Pg No.03-21.
 81. M. Tolulope Olaleyea, B, B.T. Joa O Rochaa, Acetaminophen-induced liver damage in mice: Effects of some medicinal plants on the oxidative defence system, *Experimental and Toxicologic Pathology* 59 (2008) 319-327.
 82. K. L. Mankani, V. Krishna, B. K. Manjunatha, S. M. Vidya, S. D. Jagadeesh Singh, Y. N. Manohara, Anees-Ur Raheman, K. R. Avinash, Evaluation of hepatoprotective activity of stem bark of *Pterocarpus marsupium* Roxb., *Indian J Pharmacol*, June 2005, Vol 37, Pg No. 165-168.
 83. Wahid A Mulla, Vijay R Salunkhe & Satish B Bhise, Hepatoprotective activity of hydroalcoholic extract of leaves of *Alocasia Indica* (Linn.), *Indian Journal Of Experimental Biology*, October 2009, Vol-47, Pg No.816-821.
 84. Nasrin Aghela, Iran Rashidib And Amir Mombeinia, hepatoprotective activity of *Capparis Spinosa* Root Bark against CCl_4 induced hepatic damage in mice, *Iranian Journal Of Pharmaceutical Research* (2007), 6 (4): 285-29.
 85. B. Ganga Rao, N. Jaya Raju*, Investigation Of hepatoprotective activity of *Spondias pinnata*, *International Journal of Pharma Sciences and Research*, Vol.1 (3), 2010, 193-198.
 86. Nahid Tabassum, Shyam S. Agrawal, hepatoprotective activity of *Emebelia ribes* against paracetamol induced acute hepatocellular damage in mice, *Experimental Medicine*, 2003, Vol-10, 43-44.
 87. Ayman F. Abdel-Razika*, Abdel-Samid I. Elshamya, Mahmoud I. Nassara, Salah M. El-Kousyb, Hanaa Hamdyc, Chemical Constituents And Hepatoprotective Activity Of *Juncus Subulatus*, 2009, Pg No.70-84.
 88. Rajkapoor B, Venugopal Y, Anbu J, Harikrishnan N, Gobinath M* And Ravichandran V, Protective Effect Of *Phyllanthus Polyphyllus* On Acetaminophen Induced Hepatotoxicity In Rats, *Pakistan Journal Of Pharmaceutical Sciences*, January 2008, Vo.21, Pg No.57-62.
 89. Vipul Gujrati, Nilesh Patel, Venkat N. Rao, K. Nandakumar, T.S. Gouda, Md. Shalam, S.M. Shanta Kumar, Hepatoprotective Activity Of Alcoholic And Aqueous Extracts Of Leaves Of *Tylophora Indica* (Linn.) In Rats, *Indian Journal Of Pharmacology*, Feb-2007, Vol-39, Pg No.43-47.
 90. Nishant Kumar Gupta, Vinod Kumar Dixit, Evaluation Of Hepatoprotective Activity Of *C. Eome Viscose* Linn. Extract., *Indian Journal Of Pharmacology*, Feb 2009, Vol-41, Pg No.-36-40.
 91. M. V. Natu. Suraj Agarwal. S. L. Agarwal And S. Agarwal, Protective Effect Of *Ricinus Communis* Leaves In Experimental Liver Injury. *Indian Journal Of Pharmacology*, 1977, Vol- 9 (4), Pg No. 265-268.
 92. S. C. Tripathi, G, K. Patnaik And B. N. Dhawan, Hepatoprotective Activity Of *Picroliv* Against Alcohol- Carbon Tetachloride Induced Damage In Rat, *Indian Journal Of Pharmacology*, 1991, Vol-23, Pg No.143-148.
 93. R.R. Chattopadhyay, S.K. Sarkar, S. Ganguly, C. Medda, T.K. Basu, Hepatoprotective Activity Of *Oclmum Sanctum* Leaf Extract Against Paracetamol Induced Hepatic Damage In Rats, *Indian Journal Of Pharmacology*, 1992; Vol-24: Pg No. 163-165.
 94. P. Jayasekhar, P.V. Mohanan*, K. Rathinam, Hepatoprotective Activity Of Ethyl Acetate Extract Of *Acacia Catechu*, *Indian Journal Of Pharmacology*, 1997; Vol-29: Pg No. 426-428.
 95. K. Ashok Shenoy, S.N. Somayaji, K.L. Bairy, Hepatoprotective Effects Of *Ginkgo Biloba* Against Carbon tetrachloride, Induced Hepatic Injury In Rats, *Indian Journal Of Pharmacology*, 2001, Vol-33, Pg No.260-266.
 96. T. K. Praveen, S.D. Harmaraj, Jitendra Bajaj, S. P. Dhanabai, S. Manimaran, M.J. Nanjan, Rema Razdan, Hepatoprotective activity of petroleum ether, diethyl ether and methanol extract of *Scoparia Dulcis* L. Against CCL_4 -Induced Acute Liver Injury In Mice, *Indian Journal Of Pharmacology*, June 2009, Vol-41, Pg No.110-114
 97. Idris Torel, Haneli Ozbek, Remzi Erten, Ahmet Cihat Oner, Nureddin Cengiz, Orhan Yilmaz, Hepatoprotective and anti inflammatory activities of *Plantago Major* L., *Indian Journal of Pharmacology*, June 2009, Vol-41, Pg No.120-124.
 98. S. Kharpate, G. Vadnerkar, Deepthi Jain and S. Jain, Evaluation of Hepatoprotective activity of ethanol extract of *Pterospermum Acerifloium* Ster leaves, *Indian Journal Of Pharmaceutical Sciences*, Nov-Dec 2007, Vol-69, Pg No.850-852.
 99. B. K. Manjunatha And S.M. Vidya, Hepatoprotective activity of *Vitex Trifolia* against CCl_4 induced hepatic damage, *Indian Journal Of Pharmaceutical Sciences*, April 2008, Vol-70(2), Pg. No.-241-245.
 100. Pete A. Akah, Gasmir L. Odo, Hepatoprotective Effect Of The Solvent Fractions Of The Stem Of *Hoslundia Opposite* Vahl (Lamiaceae) Against Carbon tetrachloride And Paracetamol

- Induced Liver Damage In Rats, International Journal Of Green Pharmacy, Oct-17 2010, Pg No.54-58.
101. Singaravel Sengottuvelu ,Duraisamy Srinivasan, Rasilingam Duraisami, Jothivel Nandhakumar, Mani Vasudevan And Thangavel Sivakumar, hepatoprotective activity of *Trianthema Decandra* on CCl₄ induced hepatotoxicity on rats, International Journal Of Green Pharmacy, Oct-17 2010, Pg No-122-125.
 102. J.Anbu Jeba Sunilson, P.Jayaraj, M. Syam Mohan, A. Anitha Gnana Kumara, R. Varatharajan, Antioxidant And Hepatoprotective Effect Of The Roots Of Hibiscus Esculentus Linn., International Journal Of Green Pharmacy, Oct-17 2010, Pg No-200-203.
 103. Ramnik Singh, Harwinder Singh Rao, Hepatoprotective Effect Of The Pulp/Seed Of Aegle Marmelos Correa Ex Roxb Against Carbontetrachloride Induced Liver Damage In Rats, International Journal Of Green Pharmacy, Oct-17 2010, Pg No-232-234.
 104. M. Mujeeb, V. Aeri,, P. Bagri, S. A. Khan, Hepatoprotective Activity Of Methanolic Extract Of Tylophora Indica(Burm.F,) Merill. Leaves, International Journal Of Green Pharmacy, Oct-17 2010, Pg No-125-127.
 105. Md. Rajib Ahsan, Km Monirul Islam, Israt Jahan Bulbul, Md. Ashik Musaddik, Ekramul Haque, Hepatoprotective Activity Of Methanol Extract Of Some Medicinal Plants Against Carbon Tetrachloride-Induced Hepatotoxicity In Rats, European Journal Of Scientific Research, 2009, Vol.37(2), 302-310.
