Hepatoprotectives: Role of Various Herbs as Hepatoprotectives: A Review

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ABSTRACT
As liver plays an important role in the metabolism of carbohydrates, fats, proteins and many others, subsequently it becomes key organ for human beings and animals. Management of liver and liver diseases is challenge to the current modern medicines. In the present review article various herbs and there relative utility in management of liver diseases is discussed. These are the Herbal or Ayurvedic drugs which are not only best known for the hepatoprotective activity in convalescence but also can be used in a proper combination formulation in prophylaxis too. Such drugs are not known with considerable toxicity so no any adverse events are reported.

Key words: Hepatoprotectives, Herbs, Liver.

INTRODUCTION
The liver is the heaviest gland of body, weighing about 1.4 kg in an average adult. The basic functional unit of the liver is the liver lobule, which is a cylindrical structure several millimeters in length and 0.8 to 2 millimeter in diameter. Liver plays an important role in metabolism of carbohydrates, fats, proteins, drugs and many others. So, liver becomes the key organ for human beings and animals. Management of liver diseases are till today a challenge to the current medicines. T今日human beings are exposed to various toxic chemicals; number of allopathic drugs administered for treating these ailments are reported to adversely affect the liver function. Up till now no specific treatment is available in the drug induced liver damage, where in only option left is to switch over to alternate therapy.

In the present paper a stress is given to discuss new herbal medicines and collection of data, which will be useful in the treatment of liver diseases. 

Acathopanax senticosus: (Araliaceae): Acathopanax senticosus extend some antioxidant effects on carbontetrachloride or acetaminophen intoxicated model. The levels of aspartate, amino transferase, and alanine were increased by carbontetrachloride or acetaminopen administration and reduced by treatment with the plant extracts in small doses. Treatment in larger doses would possibly induce some cell toxicity.2

Ambrosia maritima: (Compositae): The hepatoprotective activity of aqueous and methanolic extract of Ambrosia maritima was investigated against acetaminopen induced hepatic damage. Acetaminopen at a dose of 640mg/kg produced liver damage in rats as manifested by significant rise in serum levels of glutamate, oxaloacetate transaminase, glutamate pyruvate transaminase and alkaline phosphatase. These biochemical alteration resulting from acetaminopen administration were inhibited by pretreatment with A.maritima extract.3

Andrographis paniculata herb: (Acanthaceae): Andrographolide, a active constituent isolated from the plant of A.paniculata has been found to be useful in protecting liver from various chemical damage. Oral administration of andrographolide compound shows extensive first pass metabolism. To avoid this effect the rectal suppositories (50mg/suppository) were prepared with different preparation of P.E.G bases and evaluated. It was found that it is showing improved bioavailability.4

Apocynum venetum leaves: A water extract of the leaves of Apocynum venetum showed protective effect against liver injury in mice. Tumor necrosis factor alpha (TNF-alpha) secreted from LPS-stimulated macrophage is most crucial mediator in the D-gal N/LPS-induce liver injury model. The extract has no significant inhibition on the increase of serum TNF-alpha.5

Artichoke leaves (Cynara scolymus): (Asteraceae): Artichoke leaves at concentration between 0.08 to 0.5mg/ml were able to prevent the formation of bizarre canicular manner when added simultaneously with the bile acid. Taurolithocholate induced cholestatic bile canicular membrane distortion were studied by electron microscopy.6

Asparagus racemosus: (Asparagaceae, Liliaceae): Ethanolic extract of asparagus racemosus has been proved to shows hepatoprotective in rats. carbon tetrachloride induced hepatic damage models in rats was used for assessment of antihapatotoxic activity. Serum enzymes were measured to assess hepatic damage. Asparagus root extract reduced the levels of increased enzymes in carbon tetrachloride treated rats to optimum.7

Azadirachta Indica leaves: ( Meliaceae): The effect of aqueous leaf extract of Azadiracta indica was evaluated

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in paracetamol-induced hepatotoxicity in rats. Liver necrosis was produced by administering single dose of paracetamol and the liver damage was evidenced by elevated level of serum aspartate aminotransferase (AST), Alanine aminotransferase (ALT), gamma glutamyl transferase peptidase and by histopathological observation of liver section. Aqueous leaf extract of A.indica significantly reduce the elevated levels of AST, ALT and gamma GT. Paracetamol induce liver necrosis was also found to be reduced as observed macroscopically and histologically.  

Capparis moonii fruits: (Capparidaceae): C.moonii commonly known as ‘Rudanti’. It has been known for its antibacterial activity. The ethanolic fruit extract of C. moonii was screened for hepatoprotective activity in wister albino rats with carbon tetrachloride induce hepatotoxicity.  

Citharexylum quadrangular: (Verbenaceae): Bioactive constituents iridoids glycoside, phlomiol, 5-deoxy pulchelloside lamide durantoside and lamidoside is isolated from the C. quadrangular. Biological screening of 70% aqueous ethanol extract of C. quadrangular revealed a significant antituberular activity and hepatoprotective effects.  

Cnidium monieri herb(Apiaceae): Ethanolic extract of C.monieri contains two hepatoprotective sesquiterpenes torfin and torilolone, together with a new derivatives, hydroxyl torium. Both these compounds showed hepatoprotective effect on tacrine-induced cytotoxicity in human liver derived HepG2 cells.  

Coffea arabica seeds (Syn: Green and roasted coffee): The properties of green and roasted coffee are evaluated by determining the reducing substance (RS) of coffee and its antioxidant activity in vitro and ex vivo as protective activity against rat, their cells microsome lipid peroxidation measured as TBA-reacting substances. Protective activity was significantly lower in green coffee compared to that of all roasted sample. Most protective compounds are extracted from acidified dark roasted coffee solution with ethyl acetate. Low molecular mass fraction showed protective activity. The small amount of these acidic, low molecular fraction isolated indicate that they contains very strong protective agents.  

Coccinia Indica leaves: (Cucurbitaceae): Ethanolic extract (50%) has shown significant hepatoprotective activity by lowering the serum enzyme like SGPT, SGOT, and ALP in wistar rats intoxicated with Carbon tetrachloride.  

Aqueous light petroleum, chloroform, alcohol, benzene and acetone extracts of the leaves of Coccinia indica were screened for hepatoprotective activity. Alcohol and light petroleum ether extract were found to have good activity against carbon tetrachloride induced hepatic damage.  

Combretum quadrangulare seeds: ( Combretaceae): Water-Fraction of methanol extract of Combretum quadrangulare seeds contains new gallic acid derivative, 1-o-galloyl-6-o-(4-hydroxy-3, 5-dimethoxy) benzoyl-beta-D-glucose which exhibit potent hepatoprotective activity against D-Gal N/NTNF-alpha induced cell death in primary cultured mouse hepatocytes.  

Curcuma longa rhizomes: (Zingiberaceae): Assay guided fraction of EtOAC soluble fraction furnished three free radicals diarylethynanoids, curcumin (1) dimethyl curcumin (2) and bisdemethoxycurcumin (3) compounds. These three compounds shows significant hepatoprotective effect on tacrine –induced cytotoxicity in human liver derived HepG2 cells.  

Turmeric has been found to protect animal liver from a variety of hepatotoxic substances inducing carbon tetrachloride, galactosamine, pentobarbital, 1-Chloro-2, 4-dinitrobenzene, 7, 4-hydroxy-nonenal and paracetamol.  

Cucurbita maxima: (Zuccheraceae): The bioactivity of its leaves.  

Diospyros montana: (Ebenaceae): Total aqueous extract and successive petroleum extract, ethanolic and aqueous extract were screened for activity. A significant decrease in the malondialdehyde level, in fatty degeneration reduced necrosis as well as triglyceride accumulation in hepatocytes was observed in case of total aqueous extract and petroleum extract.  

Elephantopus scaber: (Compositae): Dried juice of Elephantopus scaber to prevent carbon tetrachloride induced hepatic necrosis. Administration of dried juice shows decrease in the SGPT level.  

Elephantopus scaber Linn: (Compositae): The efficiency of the elephantopus scaber to prevent carbon tetrachloride induced chronic liver dysfunction in the rats was examined. The biochemical changes induced by the carbon tetrachloride in the liver tissue improved following treatment with E.scaber.  

Emblia officinalis fruits: (Euphorbiaceae): Emblia officinalis extracts were found to inhibit the hepatotoxicity produced by acute & chronic carbon tetrachloride administration in rats as seen from the decreased levels of serum and liver lipids peroxides glutamate pyruvate transaminase and alkaline phosphatase.  

Eucalyptus tereticornis leaves: (Myrtaceae): Urosolic acid isolated from the leave of Eucalyptus ursoic acid showed significant preventive effect in vitro against ethanol induced toxicity in isolated rat hepatocytes compared with the incubation of isolated hepatocytes with ethanol only.
**Ficus hispida leaves**: (Urteicaceae): The methanol extract of the leaves of *Ficus hispida* at an oral dose of 400 mg/kg exhibited a significant protective effect by lowering the serum levels of aspartate transaminase and alkaline phosphatase. The activity of extract was also comparable to that of Liv-52 a known hepatoprotective formulation.  

**Ficus racemosa bark**: (Moraceae): The stem bark of *Ficus racemosa Linn* is known as ‘gular umbar’ is found throughout India. It is very useful in treating several liver disorders. Carbon tetrachloride induced hepatotoxicity was carried out in liquid paraffin. The result established pharmacological evidence as hepatoprotective agent and thereby it substantiated the folklore claim.  

**Foenum-graecum**: (Umbelliferae): Fennel oil shows considerable hepatoprotective activity against carbon tetrachloride induced hepatotoxicity. Fennel oil when administered in hepatic damage, it was found that there is considerably decreased level of serum aspartate aminotransferase (AST), alanine aminotransferase (ALT), alanine phosphatase (ALP) and bilirubin.  

**Garcinia indica fruits**: (Guttiferae): The fruits of *Garcinia indica* as known as refreshing drink in Goa. It improves appetite and alleys & thirst and used as anhelminetic, cardiotonic, tumors pains and heart diseases. It is used in liver disorders. In current studies an effect has been made to establish hepatoprotective activity of ethanolic & aqueous extracts of fruits rind of *Garcinia indica*. Both the ethanolic and aqueous extract showed significant hepatoprotective activity.  

**Gloriosa superba tubers**: (Liliaceae): In the systematic studied experiment, it was found that hydroalcoholic extract of *Gloriosa superba* tubers was found to lower down the serum level of enzyme and this effect is quite greater as compared to petroleum extract and alcoholic extract.  

**Glycyrrhiza glabra rhizomes**: ( Papilionaceae): *Glycyrrhiza glabra* contain triterpene saponin known as glycyrrhizin which has potential hepatoprotective activity. Glycyrrhizin can alleviate histological disorder due to inflammation and restore the liver structure and function from the damage due to carbon tetrachloride lowering the SGPT level, reducing the degeneration and necrosis and also recovering the glycogen and RNA of liver cells.  

**Glycyrrhiza uralensis rhizomes**: (Leguminosae): Water-soluble extract of glycyrrhiza uralensis, glycerrhin was isolated as potent inhibitor of beta–glucuronidase. However glycyrrhin was orally administered and it showed a hepatoprotective activity. However when glycyrrhin was intraperitoneally administered, it didn’t have hepatoprotective activity.  

18-beta–glycyrrhin which is major metabolite of glycyrrhin by human intestinal bacteria was also a potent inhibitor of beta glucuronidase. When 18-beta–glycyrrhetinic acid was intraperitoneally administered, it also had some hepatoprotective activity. These results suggest that glycyrrhin may be natural prodrug for the observed hepatoprotective effect.  

**Grewia asiatica bark**: (Liliaceae): It is a traditional medicinal and as remedy for liver cirrhosis. Crude methanolic extract of bark *Grewia asiatica* was used to test hepatoprotective activity using carbon tetrachloride induced hepatotoxic method in rats. Crude methanolic extract of bark were administered orally along with acacia mucilage to albino rats 1hr prior to induction of hepatotoxicity. Blood samples were collected from marginal vein before and after treatment and were analyzed to determine SGOT, SGPT and serum bilirubin levels.  

**Hemidesmus indicus roots**: (Asclepiadaceae): The study was undertaken to investigate the relationship between liver protective effect and antioxidant activity of the dried root of *H.indicus* in carbon tetrachloride induced hepatic damage in rats. It was proved that 50% ethanolic extract of *H.indicus* roots exhibited the formation of oxygen dried free radical production. The oral administration of extract significantly reduced carbon tetrachloride induced hepatotoxicity in rats as judged from serum marker enzyme. These results were comparable with those obtained with quercetin. Based on these findings, it may suggest that liver protective antioxidant effects of *H.indicus* possibly involve each related to free radicals scavenger effect.  

**Hedychium spicatum rhizomes**: (Scitamineae): Different extracts of *Hedychium spicatum* shows the presence of steroid glycosides and carbohydrates. It is reported by H.Hukkeri et al that the ethyl acetate and alcohol extract of dried rhizomes showed significant hepatoprotective activity. These extracts lowered enzymes like serum glutamate, oxaloacetate, transaminase and serum glutamate pyruvate transaminase in albino rats intoxicated with carbon tetrachloride.  

**Ilex Paraguariensis leaves**: (Aquifoliaceae): It is known as refreshing drink in Goa. It improves appetite and alleys & thirst and used as anhelminetic, cardiotonic, tumors pains and heart diseases. It is used in liver disorders. In current studies an effect has been made to establish hepatoprotective activity of ethanolic & aqueous extracts of fruits rind of *Ilex Paraguariensis*. Both the ethanolic and aqueous extract showed significant hepatoprotective activity.  

**Indigoflora tinctoria herb**: (Papilionaceae): *I. Tinctoria* pretreated male albino rats showed considerable protection against acute hepatitis induced by D-galactosamine (D-gal N) endoxine. D-Galactosamine/endotoxin–induced oxidative stress as evidenced by a significant increase in the activities of all the antioxidant enzyme and significant decrease in level of lipid peroxidase.  

A bioactive fraction, indotcone (FA), obtained from fraction of petroleum ether extract of the aerial parts of *Indigofera tinctoria* showed significant hepatoprotective activity against carbon tetrachloride induced liver injury in rats and mice. And, in hexobarbitone and zoxalamine induces liver damage pre and post treatment with the fraction of FA significantly decreases the effect of these drugs.  

The in vitro study carried out by Sreepriya S et al on rat bile flow showed that the release of LDH and level of urea is altered by *I. Tinctoria*.  

**Ixeris laevigata var. oldhami**: (Asteraceae): The hepatoprotective effect of *Ixeris laevigata var. oldhami*...
(IL) were studied on cholestatic hepatitis induced by alpha -naphthylsulfinopyridine and acute hepatitis induced by carbon tetrachloride in rats and it shows significant hepatoprotective effect.\textsuperscript{42} *Lanata camara* roots: (Verbenaceae): Two novel triterpenoids has isolated from the root of *Lanata camara*, 3-beta, 19-alpha dihydroxy ursan-28-oic acid and 21, 22 beta –epoxy-3 beta-hydroxy olean-12-en-28-oic acid in its methyl ester form. Its leaves has yielded an essential oil which was rich in sesquiterpene oleanolic acid which showed hepatoprotective activity.\textsuperscript{43} *Lawsonia alba* bark: (Lythraceae): The aqueous suspension of extract of *Lawsonia alba* bark extract shows good hepatoprotective activity against carbon tetrachloride induced liver damage.\textsuperscript{44} The experiment was performed on rats and aqueous extract was administered orally to rats for period of ten days which shows best hepatoprotective activity. The ethanol extract also shows good hepatoprotective activity.\textsuperscript{45} 

*Legumes*: *Phaseolus aureus* (Mung bean) *Paseolus angularis* (Adzuki bean), *Castanospermum australe* (Black bean), *Rheum officinale* (Rhubarb) are food, folk and traditional medicine of Taiwan. Water extract concentration in range of 100,500mg/kg by wt. and Silymarin is used as hepatoprotective agent against acetaminophen induced liver injury.\textsuperscript{46} *Ligustrum robustum*: (Oleaceae): Glycoside rich fraction B2 shows marked hepatoprotective activity in rat liver damaged by acetic acid.\textsuperscript{47} *Lycium chinense* fruits: (Solaneceae): New cerebroside LCC isolated from the fruits of *Lycium chinense* and it was used to assess the hepatoprotective activity. Primary culture of rat hepatocytes exposed to galactosamin were used for screening system.\textsuperscript{48} *Mallotus japonicus*: (Ephorbiaceae): Bergenin a major constituent of *Mallotus japonicus* administered orally once daily for successive seven days and then the mixture of 0.5 ml/ kg of carbon tetrachloride in olive oil was injected two times each at 12&36 hours after final administration of bergenin, the substantially elevated serum enzymatic activities of alanine / aspartate aminotransferase, sorbitol dehydrogenase & gamma-glutamyl transferase due to carbon tetrachloride treatment were close dependently restored towards normalization.\textsuperscript{49} *Mikania cordata* roots: (Compositae): Methanolic fraction of *mikania cordata* root extract (50,100,or 150mg/kg) was administered once daily for 15 consecutive days, liver tissue was excised to assay for lipid peroxidation (LPO), glutathione-s-transferase (GST), glutathione content, glutathione peroxidase activity following standard procedure. The increased LPO (2fold) and decrease GSH level due to carbon tetrachloride treatment were significantly reversed towards normalization is an inverse dose responsive manner by treatment with extract. These result indicate a possible hepatoprotective role of *M. cordata* root against carbon tetrachloride induced oxidative damage.\textsuperscript{50}

*Morus alba* herb: (Maraceae): Ethanolic extract of *morus alba* as guided by free radical scavenging activity furnished (1) 5,7-dihydroxyxocoumarin 7-Methyl ether (2) 2-phenyl flavones, (3)cudraflavone B (4) oxyresveratrol. Compound one and four showed superoxide scavenging effect and compounds 2 and 4 shows hepatoprotective effect on tacrine induced cytotoxicity in human liver derived hepatic G2cells.\textsuperscript{51} *Momordica charantia* fruits: (Cucurbitaceae): *M.charantia* selected for evaluation of hepatoprotective activity against carbon tetrachloride induced liver toxicity. The successive extracts of petroleum, pet. ether, benzene, chloroform, ethanol were prepared and screen for hepatoprotective activity in male waster rats. Between different extracts, chloroform and ethanol extract exhibited significant hepatoprotective activity at 200mg/kg body wt., which was comparable to activity exhibited by reference standard, Silymarin in carbon tetrachloride induced hepatotoxicity model.\textsuperscript{52} *Nardostchys Jatamansi* rhizomes: (Valerianaceae): In an experiment, ethnologic extract of *Nardostchys Jatamansi* rhizomes for three consecutive amelerioted the liver damage in rats exposed hepatotoxic compound thiocetamide alone. Elevated level of serum transaminase and alkaline phosphatase observed in thiocetamide alone treated group of animals were significantly lowered in Nardostchys pretreated rats.\textsuperscript{53} *Nigella sativa* fruit : (Umbelliferae): An aqueous extract of *Nigella sativa* fruits exhibited hepatoprotective activity against paracetamol-induced hepatotoxicities in rats.\textsuperscript{54} *Ocimum sanctum* herb: (Labiae): Effect of *Ocimum sanctum* leaf was studied on paracetamol induced hepatic damage in rats. *O. sanctum* was found to protect the rats from hepatotoxic action of paracetamol as evidenced by significant reduction in the elevated serum enzyme levels. Histopathological studies should marked reduction in fatty generation in animals receiving *O. sanctum* along with paracetamol as compared to the control group. It is stipulated that the extract treated group was partially protected from hepatic cell damage caused by paracetamol.\textsuperscript{55} *Pergularia daemia* leaves: *P. daemia* use as a folk remedy for jaundice in Orissa. Leaf of *P. daemia* with yog hurt was administered as in graded doses to rats before and after carbon tetrachloride. The changes in liver weight and liver volume and biochemical parameters were studied. Histopathological examination of liver showed that in rats receiving higher doses, liver damage was comparatively less.\textsuperscript{56} *Pistacacia lentiscus*: (Anescardiaceae): The hepatoprotective effect of boiled and non boiled aqueous extract of *Pistacacia lentiscus*, *phillyrea latifolia*, *nicotiana glauca* that are alleged to be effectiveness in the treatment of jaundice in Jordanian folk medicines were evaluated in vivo by using carbon tetrachloride, intoxicated rats was experimental models. The bilirubin level and the activity of alkaline phosphatase (ALP) were both reduced upon treatment with boiled aqueous extract of *P.latifolia* without reducing the activity of alkaline. Aqueous extract of *P.lentiscus* (both boiled and non
boiled) showed marked hepatoprotective against carbon tetrachloride by reducing the activity of three enzymes and level of bilirubin.\textsuperscript{57} 

\textit{Platycodon grandiflorum} roots: (Campanulaceae): 

\textit{Platycodon grandiflorum} used as traditional medicine. Extracts from the roots have wide ranging health benefits. In Korea, the roots is used as food and employed as a folk remedy for adult disease. Lee and others from South Korea student studied the aqueous extract from the roots on acetaminophen induce hepatotoxicity and the mechanism underlying these protective effects in mice.\textsuperscript{58} 

\textit{Pomegranate peel fruits}: (Punica granatum-Lythraceae): 

The acetone and methanolic extract of dried peel powder of \textit{Punica granatum} was subjected to a study to ascertain the hepatoprotective activity in rats intoxicated with carbon tetrachloride. The hepatoprotective activity of the acetone and methanol extract is detected by the decreased level of SGPT (Serum glutamate pyruvic transaminase) enzyme activity which has been shown to reduce microsomal enzyme and thereby accelerating the excretion of carbon tetrachloride. The aqueous and powder extract did not show any activity. Further study to identify the active principles is required on such a potential hepatoprotective material.\textsuperscript{59} 

\textit{Psoralea corylifolia} seeds: (Leguminosae, Papilionaceae): Bioassay guided fraction of the water extract of seeds of \textit{P.corylifolia} furnished two compound bakuchin and psoralein which protect the liver against tacrine induced cytotoxicity.\textsuperscript{60} 

\textit{Sarcotema acidium} stem: (Asclepiadaceae): \textit{Sarcotema acidium} voigt. (syn S brevistigma Wight and Arn)(Hindi-Somlata). It is reported to possess antiinfluenza , antiallergic, antiemetic and bronchodilatory activities. The oral administration in varying doses of ethyl acetate extract of its sarcostemma (stem) acidium to albino rats for seven days shows best hepatoprotective activity against carbon tetrachloride induced hepatic damage.\textsuperscript{61} 

\textit{Sarurus chinesis}: (Sauraceae): Two new diasteromeric sauchinone - A and epi-sauchinone along with the known a phenylpropanoid (Sarisan )and two known lignans (galbacin and saucernetin )were isolated from n-hexane incubation of cultured rat hepatocytes initially injured with carbon tetrachloride. With each of the compounds significantly reduced the levels of glutamic pyruvic transaminase released by the damage hepatocytes.\textsuperscript{62} 

\textit{Scutellaria baikalensis} roots: (Labiateae): \textit{S baikalensis} root extract exhibited the best hepatoprotective effect in induced carbon tetrachloride liver lesion where hepatotoxicity improved in baikalensis treated rats, compared with sylimarol.\textsuperscript{63} 

\textit{Scoparia dulcis} (Scrophulariaceae): A study was conducted in albino rats to evaluate the hepatoprotective activity in aqueous and alcoholic extracts of \textit{S. dulcis} in carbon tetrachloride induce cirrhosis. Simultaneous treatment with aqueous extract and alcoholic extract was significantly protected the carbon tetrachloride induced hepatotoxicity. The result obtained from a base study indicated that aqueous extract showed most significant activity, alcoholic extract also exhibited potent activity but less than aqueous extract.\textsuperscript{64} 

\textit{Scrophularia buergeriana}: (Scrophulariaceae): Phenyl propanoid (4-O-E-p-Methoxyoxinanoyl alpha L-rhamnopyranoside ester, p-methoxyxynamic acid and isofeluric acid) from scrophularia buergeriana shows hepatoprotective activity induced by carbon tetrachloride. The activities of enzyme involve in the glutathione (GSH) redox system were measured and assayed the level in primary cultures of rat hepatocytes were significantly preserved by the treatment with these phenylpropanoids. The activities of glutathione disulfide reductase and glutathione –s-transferase which normally decrease in Carbontetrachloride injured rat hepatocytes were significantly preserved by the treatment with these three phenyl propanoid.\textsuperscript{65} 

\textit{Silybum marianum} herb (Compositae): Infusion of \textit{Silybum marianum} on some enzymes relevant to liver function was investigated in mice. The content of glutathion cytochrome P 450 and transamine in animal tissue suggest the hepatoprotective activity.\textsuperscript{66} 

Silymarin is a mixture of flavanoid lignans isolated from \textit{Silybum marianum} at dose administered at dose 0,10,50, & 250 mg/kg, daily for five days to mouse and effect of cyanokinase in mouse was studied. It was observed alteration of transforming growth factor beta and c-mye expression in liver may involve in the hepatoprotective effect.\textsuperscript{67} 

\textit{Sida cordifolia} roots: (Malvaceae): Antihepatotoxic activities of various extract of the roots of \textit{Sida cordifolia} against carbontetrachloride intoxicated rats has been studied. Pet. ether and chloroform extract did not shows any protection and methanolic extract exhibited marked protection as evidenced by serum biochemical parameters and histological examination.\textsuperscript{68} 

\textit{Taraxacum officinale} roots: (Compositae): Traditionally \textit{Taraxacum officinale} has been used as remedy for jaundice and other disorder of liver and gallbladder. Oral administration of extracts from these roots of \textit{taraxacum officinale} has been shown to act as chologogue, increasing the flow of bile.\textsuperscript{69} 

\textit{Terminalia catappa} leaves: (Combretaceae): Punicalin and punicin were isolated from the leaves of \textit{Terminalia catappa}. The antihepatotoxic activity of punicalin and punicin on acetaminophen –induced toxicity in rat liver was studied. After evaluating the changes of several biochemical functions in serum the levels of aspartate aminotransferase and alanine aminotransferase were increased by acetaminophen administration and reduce by punicalin and punicin. Histological changes induced by acetaminophen were also recovered by both compound. Punicalin and punicin shows antihepatotoxic activity, but treatment with larger doses with punicalgin enhanced liver damage.\textsuperscript{70} 

\textit{Terminalia myrocarpa} leaves: (Combretaceae): 4,5,6,4'5',6'hexahydroxybiphenyl-2'-2'diyldicarbonyl–(alpha/beta)-D-glucopyranosone(1), Flavogallic acid(2), ethyl gallate, 2,3-di-o-((5), 4,5,6,4',5',6'hexahydroxybiphenyl-2'-2'-diyl dicarbonyl ( alpha/beta)- punicalin bioactive constituents isolated.
from the leaves of *T. Myrocarpa*. It is reported that these constituents shows significant hepatoprotective activity. Comparison was made between (1) and (2). It was found that (1) shows significant activity than 2 against carbon tetrachloride induced hepatotoxicity.\textsuperscript{71} 

*Thespesia populnea* (Malvaceae): The methanolic and aqueous extracts were compared for hepatoprotective activity against carbon tetrachloride induced liver damage. It was observed that methanolic extracts exhibited higher hepatoprotection than aqueous extract.\textsuperscript{72} 

*Triandrychos incana* (Labiatae): The ethanolic extract of *C. incana* which are included in the brande established and protected too. Some examples of plants treasure from ayurveda and herbalism must be well brands like Liv [54x94]medica , V.66(2), p. 127-133, 2000 

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