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Dandelion (*Taraxacum officinale*) - Hepatoprotective Herb with Therapeutic Potential

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ABSTRACT

Extracts of the dried leaves of dandelion (*Taraxacum officinale* G.H. Weber ex Wiggers. (Asteraceae) are used in traditional medicine for gastrointestinal and hepatic diseases. The plant is valued as laxative and diuretic. Lately, several research and review papers have highlighted hepatoprotective property of specific herbals like *Kalmegh* (*Andrographis paniculata* Nees.) and *Kutki* (*Picrorhiza kurroa* Benth.) from Traditional Indian Medicine (TIM) and milk thistle (*Silybum marianum* L.) from Western Botanical Medicine. Market studies show dandelion to be ingredient of liver and gall bladder preparations. Little data is available on pre-clinical and clinical studies done on the plant. Since concept of reverse pharmacology is rapidly catching up for discovering 'leads' from plants, it is worthwhile to conduct scientific studies on dandelion to support the traditional use. The studies may provide evidence in support of additional indications, both traditional and novel.

KEY WORDS: Hepatoprotective-Cholagouge- Dandelion- *Taraxacum officinale*

INTRODUCTION

Complementary and Alternative systems of medicine (CAM) viz. Ayurveda, Siddha, and Traditional Chinese Medicine, have become more popular in recent years (1). Medicinal herbs and their extracts are widely used in the treatment of liver diseases like hepatitis, cirrhosis, and loss of appetite (2). Several reviews have focused on the therapeutic utility and adverse effects of herbal products, particularly hepatotoxicity (3, 4).

Silymarin (1) (flavanolignan mixture from *Silybum marianum* Linn.), daphnoretin (2) (coumarin from *Wilkstroemia indica*) kutkin or picrosides and kutkosides (3) (iridoid glycosides from *Picrrorhiza kurroa* Royle), glycyrrhizin (4) (triterpene saponin from *Glycyrrhiza glabra* Linn.), schizandrins (lignans from *Schizandra sinensis),* andrographolide (5) (diterpene lactone from *Andrographis paniculata* Nees), and lignans (*Phyllanthus niruri)*, are proven hepatoprotective phyto-constituents, as they have shown genuine utility in experimental and clinical studies (**5**).

More than 700 mono and polyherbal preparations in the form of decoction, tincture, tablets and capsules from more than 100 plants are in clinical use (**5**). Keeping in mind the non-availability of standard hepatoprotective agent in synthetic medicine and discovery of silymarin as lead from traditional medicine, we need to initiate screening for herbals with documented effect on liver. Among several plants used for liver diseases, *T. ofiicinale* is well-recognized in Complementary and Alternative Medicine (CAM). The folk medicines of China, India and Russia have recognized *T.officinale* as a liver tonic. Traditional Chinese Medicine combines *T.officinale* with other herbs to treat hepatitis (**6**).

Dandelion In Traditional Medicine

The genus name *Taraxacum* is derived from the Greek word "taraxos", meaning "disorder" and "akos" meaning "remedy". As a medicinal plant, *T.officinale* has been considered to be an aperient or mild laxative, diuretic, stimulant, stomachic, tonic, and detoxicant. Tea prepared from *T.officinale* has been used against fever, insomnia, jaundice, rheumatism, eczema and other skin diseases, and constipation (**6, 7**). *T.officinale* and other *Taraxacum* species have also been used against warts, cancers, and tumors (**8**).

PHYTOCHEMISTRY

Carotenoids: Lutein (6) and violaxanthin (7) (**8**).

Coumarins: Esculin (8) and scopoletin (9) (**9, 10**).

Flavonoids: Apigenin-7-glucoside (10), luteolin-7-glucoside (11), isorhamnetin 3-glucoside (12), luteolin-7-diglucoside (13), quercetin-7-glucoside (14), quercetin (15), luteolin (16), rutin (17) and chrysoeriol (18) (**9, 11**).

Phenolic acids: Caffeic (19), chlorogenic (20), chicoric (21) (dicaffeoyltartaric acid) and ρ-hydroxyphenylacetic acids (**9, 11**).

Polysaccharides: Glucans and mannans and inulin (**8**).

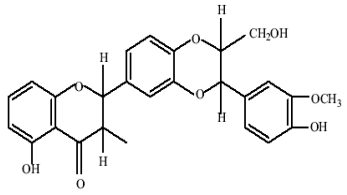
Sesquiterpene lactones: The plant is rich source of sesquiterpene lactones or bitter principles (**12**). Taraxacin or taraxinic acid or lactucopicrin (22), lactucin (23) and cichorin (24) are chief bitter principles and belong to the guaianolide class (**13, 14, 15**). Taraxacin in concentrated solutions, forms precipitates with a number of alkaloidal reagents (**16**). The plant contains a crystalline substance, taraxacerine or taraxaceron, which is reported to be bitter resin (**14**). Taraxacoside, a type of acylated gamma-butyrolactone glycoside has been reported from the plant (**17**). Other sesquiterpene lactones are of the germacranolide type including 11ß, 13-dihydrolactucin (25), ixerin D (26), ainslioside taraxinic acid ß-glucopyranosyl, taraxinic acid 1 '-

glucosyl ester, and 11, 13-dihydrotaraxinic acid l'-glucoside (**18**). Eudesmanolides including tetrahydroridentin-B (27) and taraxacolide-O-ß-glucopyranoside are reported (**19**). Recently, a cyanogenic glycoside, prunasin has been reported from extract of the plant (**20**). Phenylpropanoid glycosides: dihydroconiferin (28), syringin (29), and dihydrosyringin (30) have been reported (**18**).

***Sterols*:** Taraxasterol (31), ψ-taraxasterol, (32), homo-taraxasterol (Chopra, 1956), ß-sitosterol (33), stigmatsterol (34), campesterol (35) (**21**).

***Triterpenes*:** α-amyrin (36), ß-amyrin (37), lupeol (38), taraxol, taraxaserol, and cycloartenol (39) are present in the roots (**22; 23**). 3ß-hydroxylup-18(19)-ene-21-one (40) has been reported from fresh roots of the plant (**18**). Arnidiol (41) and faradiol (42) have been reported (**9**).

***Other*:** Lettucenin A (43), a serine proteinase: taraxalisin (**24**), amino acids, choline, mucilage and pectin (**8**).



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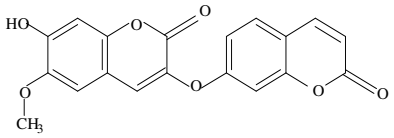

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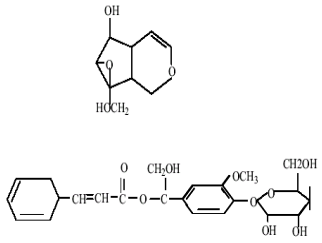

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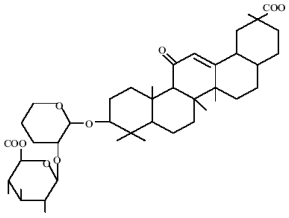

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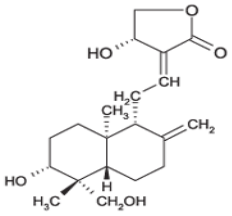

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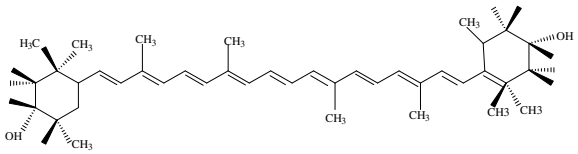
Chemical structure of hepatoprotective phyto-constituents



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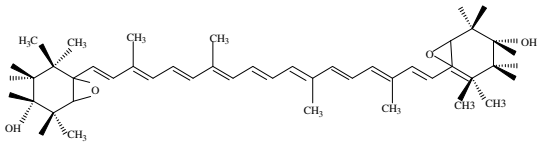

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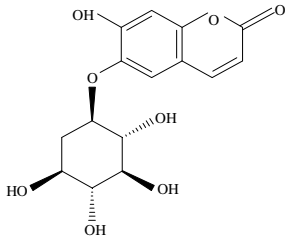

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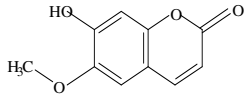

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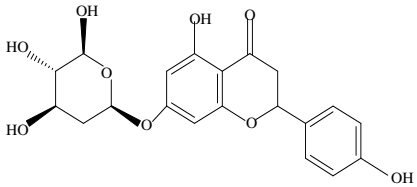

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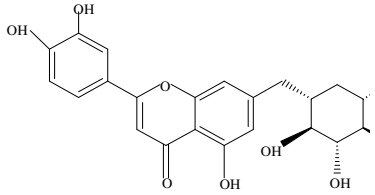

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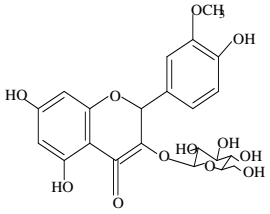

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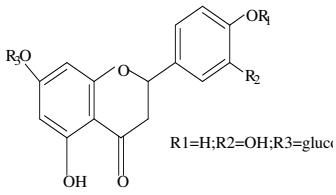

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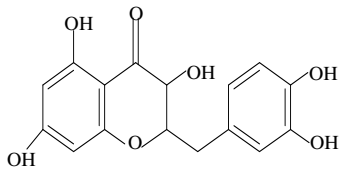

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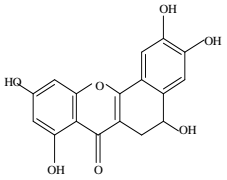

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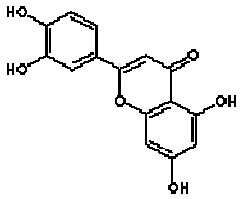

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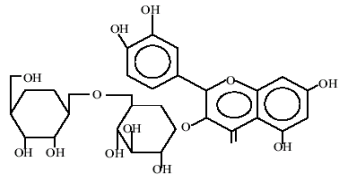

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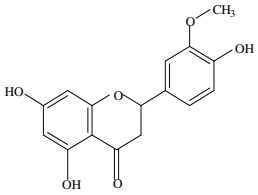

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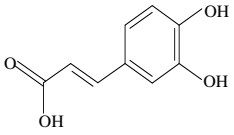

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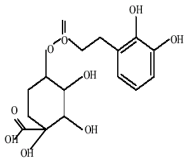

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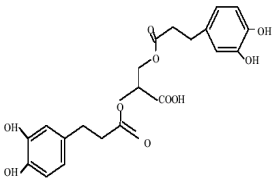

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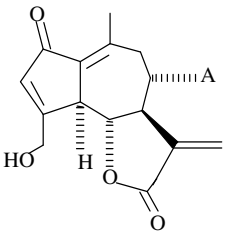

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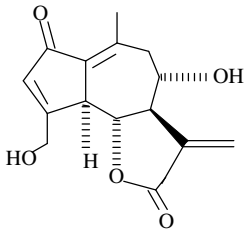

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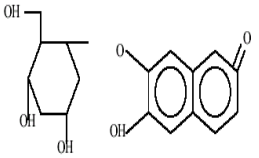

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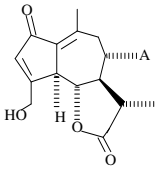

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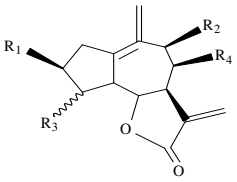

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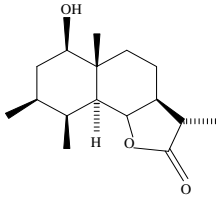

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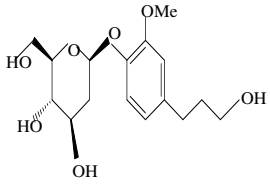

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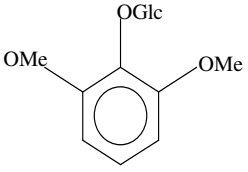

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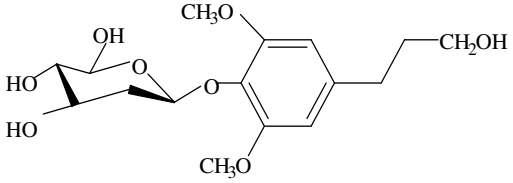

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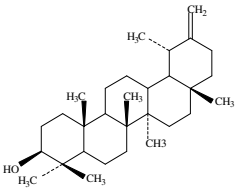

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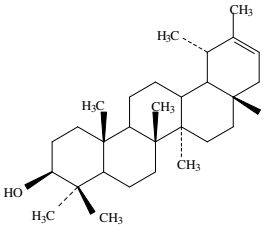

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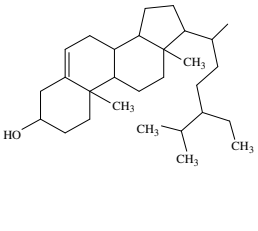

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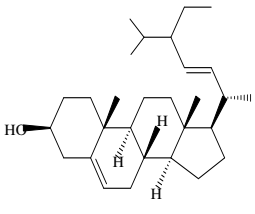

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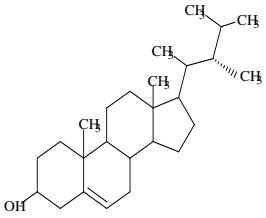

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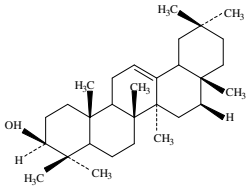

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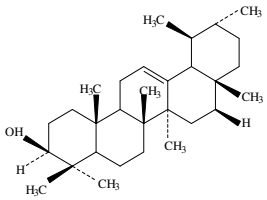

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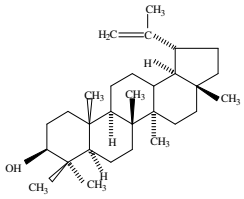

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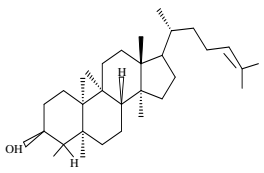

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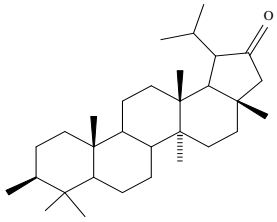

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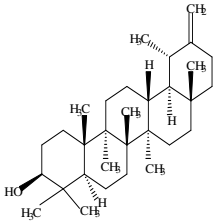

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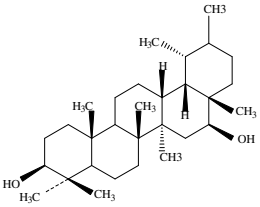

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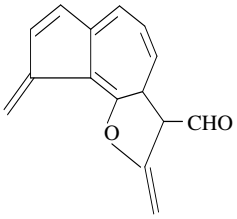

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PHARMACOLOGY

The bitter compounds in the leaves and root help stimulate digestion and are mild laxatives (**12**). These bitter principles increase bile production in the gallbladder and bile flow from the liver (**7**). Oral administration of extracts from the roots of *T. officinale* has been shown to act as a cholagogue, increasing the flow of bile (**25**). In German studies, dandelion leaf extracts increased bile secretion by 40% in rats (**7**). In French studies, giving dogs a decoction of fresh dandelion root doubled their bile output (**26**). In two Chinese studies of animals with gastric ulcers, gastric metaplasia and hyperplasia, dandelion-containing herbal combinations led to significant histologic improvement (**27, 28**).

The extracts of *T.officinale* have demonstrated antitumor (**29**), hypoglycemic (**30, 31**), diuretic (**32, 33**), antibacterial (**34**) and nitric oxide regenration activity (**35, 36, 37**). We need to focus on other pharmacological investigations particularly antioxidant activity and anti-inflammatory activities, which might explain use of *T.officinale* in liver diseases (**38**).

In vivo

Anti-inflammatory activity

Extracts of *T.officinale* has inhibitory effect on tumor necrosis factor-alpha production from rat astrocytes (**39**). Sesquiterpene glucosides isolated from fractionation of the extract of *T.officinale* have anti-leukotriene activity (19). Luteolin and luteolin-7-O-glucoside from flower of *T.officinale* has suppressive effect on iNOS and COX-2 in RAW264.7 cells (**40**). *T.officinale* has been reported to have protective effect against cholecystokinin-induced acute pancreatitis in rats (**41**).

Antioxidant activity

Hydro-alcoholic acid of *T.officinale* roots demonstrated anti-oxidant activity in rats. Extract of *T.officinale*, in the dose of 100 mg/kg, p.o., improved the superoxide dimutase, catalase, glutathione, and peroxidase levels decreased by CCl4 treatment (**42**).

Cholretic activity

Bile secretion was doubled in dogs by a decoction of fresh root (equivalent to 5 g dried plant); similar activity has been observed for rats (unpublished data).

In vitro

Antioxidant

Water and ethyl acetate fractions of *T.officinale* flower extract showed antioxidant activities in a stable 2, 2-diphenyl-1-picrylhydrazyl radical model and reduced the breakage of super coiled DNA strand induced by both non-site-specific and site-specific hydroxyl radical. Oxidation of structured phosphatidylcholine liposome induced by peroxyl radical was reduced in the presence of both water and ethyl acetate fractions of the extract. Luteolin and luteolin 7-glucoside were identified as potential antioxidant agents (**43**).

Flower extract of *T.officinale* resulted in oxidation of linoleic acid emulsion and suppressed superoxide and hydroxyl radical. The antioxidant activity of flower extract of *T.officinale* against Diphenylpicryl-hydrazyl and a synergistic effect with α-tocopherol were attributed to the reducing activity of flavonoids and coumaric acid derivatives present in the extract. The extract further inhibited peroxyl-radical-induced intracellular oxidation of RAW264.7 cells with range of concentrations (**40**).

Clinical studies

Chronic colitis

A study reported efficacy of polyherbal formulation containing *T.officinale* in chronic pain associated with colitis. Because multiple herbs were used, and this study was not well-designed or reported, the effects of dandelion are not clear (**44**).

Hepatitis B

One human study reported improved liver function in people with hepatitis B after taking a combination herbal preparation containing *T.officinale*, *Artemisia capillaries* Thunb (Asteraceae), *Taraxacum mongolicum* Hand-Mazz. (Asteraceae), *Plantago ovata*

Forssk.(Plantaginaceae), *Cephalanoplos segetum* (Bunge) Kitam (Asteraceae), *Hedyotis diffusa* Willd. (Rubiaceae), *Chrysanthemum indicum* Linn. (Asteraceae), *Smilax glabra* Roxb. (Smilaceae), *Astragalus membranaceus* (Fisch.ex Link.) Bunge (Fabaceae), *Salvia miltiorrhizae* Bunge. (Lamiaceae), *Polygonum orientalis* L. (Polygalaceae), *Paeonia alba* L. (Ranunculaceae), *and Polygonatum sibiricum* F. Daelaroche. (Convallariaceae). Since polyherbal preparation was used in the study, possible benefit of *T.officinale* remains to be explored (**45**).

CONCLUSION

Studies have indicated that chicoric acid inhibits the penetration of viruses in cells. Chicoric acid also acts as an antioxidant by preventing the oxidation of collagen and cells. Chlorogenic acid is cholagogue; its regular ingestion helps the flow of bile and thus reduces the adverse effects of bile stagnation. While chlorogenic acids are not the only compounds that serve well as cholagogues, the evidence for their effectiveness is by far the strongest (**46**). We conclude the review that chicoric and chlorogenic have action on the heaptobiliary apparatus and there possible role in extracts of *T. officinale* needs further exploration.

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