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Medicinal Plants Used in Liver Diseases: A Comprehensive Review of Their Phytoconstituents and Hepatoprotective Potential

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.Abstract

Liver disease doesn't get talked about with the same urgency as heart disease or diabetes, yet viral hepatitis, alcoholic and non-alcoholic fatty liver disease, drug-induced hepatotoxicity, cirrhosis, and jaundice (Kamala) between them account for an enormous and still-growing burden of illness, and conventional medicine still has surprisingly little to offer once liver damage has set in. Ayurveda took a different approach centuries ago, building up a working pharmacopoeia of single herbs, or Ekala Dravya, that classical authors grouped as Yakrit-uttejaka (hepatostimulant), Kamalahara (anti-jaundice), Pittahara, or Rasayana (rejuvenative) drugs. This review works through seven of the better-known ones — Daruharidra (Berberis aristata), Bhoomyamalaki (Phyllanthus niruri/amarus), Haritaki (Terminalia chebula), Kutaki (Picrorhiza kurroa), Yashtimadhu (Glycyrrhiza glabra), Kalmegh (Andrographis paniculata), and Punarnava (Boerhavia diffusa) — looking at how each is described in the classical Samhitas and Nighantus, what its Rasa Panchaka (taste, potency, and action profile) tells us, what compounds it actually contains, and what the modern pharmacological literature says about whether it protects the liver at all. Put together, the picture that emerges is fairly consistent: most of the hepatoprotection traces back to a handful of mechanisms — antioxidant activity, hepatocyte membrane stabilisation, anti-inflammatory suppression, and a broadly choleretic or detoxifying action — carried by alkaloids, lignans, tannins, iridoid glycosides, triterpenoid saponins, and diterpene lactones depending on the plant. Some of these drugs (Kutaki and Bhoomyamalaki, in particular) now have decent clinical trial support behind them; others rest mostly on animal studies and centuries of use. Both are worth taking seriously, but they are not the same thing, and this review tries not to blur that distinction.

Keywords: Hepatoprotective; Ayurveda; Yakrit Roga; Kamala; Daruharidra; Bhoomyamalaki; Haritaki; Kutaki; Yashtimadhu; Kalmegh; Punarnava; Phytoconstituents

1. Introduction

Ayurvedic physiology places the liver, or Yakrit, at the centre of a fair amount of what the body does with food. It's described as the seat of Ranjaka Pitta and is given credit for forming Rakta Dhatu — blood tissue — out of digested nutrients. When Pitta and

Kapha go out of balance, and metabolic waste (Ama) starts accumulating, the classical texts describe this showing up as Yakrit Vikara: Kamala (jaundice), Pandu (a kind of anaemia tied to poor liver function), Yakrit Vriddhi (an enlarged liver), Yakrit-Pleeha Vikara (liver-spleen involvement), and eventually Udara Roga, the ascites that comes with advanced hepatic decompensation. None of this maps perfectly onto modern hepatology, but the overlap with viral hepatitis, fatty liver disease, drug-induced injury, fibrosis, and cirrhosis is close enough to be genuinely useful, especially given how few good pharmacological options exist once serious liver damage has occurred.

What follows treats each of the seven drugs almost as its own short review: where it sits in the classical literature, its Rasa Panchaka, its known phytoconstituents, and then the actual experimental and clinical evidence for hepatoprotection. I've tried to pull in as many credible references as possible for each one rather than leaning on a single source, since the strength of a claim like this really does depend on how many independent studies are pointing the same direction.

2. Materials and Methods

Literature was gathered from PubMed, Scopus, ScienceDirect, Google Scholar, and ResearchGate, searching each plant's Latin binomial and its Ayurvedic name together with terms like 'hepatoprotective', 'phytoconstituents', 'liver', 'jaundice', and 'Kamala'. Classical classification — the Mahakashaya and Dashemani groupings in Charaka Samhita, the gana classification in Sushruta Samhita, and the varga divisions of Bhavaprakasha and other Nighantus — was drawn from standard Dravyaguna reference material rather than from direct verse citation, since pinning a claim to a specific chapter and verse without checking the original Sanskrit felt like more precision than could honestly be claimed. On the pharmacology side, only papers reporting actual phytochemical data or in-vitro, in-vivo, or clinical hepatoprotective findings were used.

3. Drug-wise Review

3.1 Daruharidra (Berberis aristata DC.)

Fig. Daruharidra (Berberis aristata)

Of the seven drugs covered here, Daruharidra is probably the one with the clearest, most continuous textual thread running from the earliest Samhitas right through to modern pharmacology — a Pitta-Kapha pacifying bitter that classical physicians reached for in liver complaints long before anyone had isolated berberine.

Sanskrit / Ayurvedic Synonyms: Daruharidra, Daruhaldi, Darvi, Chitra, Indian Barberry

Botanical Source: Berberis aristata DC.

Family: Berberidaceae

Part Used: Stem, root, and root bark

Distribution: Himalayan region from Kashmir to Sikkim, Nepal, and Pakistan at altitudes of 1800–3600 m

Literary Review — Citation in Classical Ayurvedic Texts

- Charaka Samhita — Sutrasthana (Kushthaghna,Arshoghn and Lekhaniya Mahakashaya)
- Sushruta Samhita — Sutrasthana (Mustadi gana, Lodhradi gana)
- Ashtanga Hridaya
- Ashtanga Sangraha
- Bhavaprakasha Nighantu (Haridradi Varga)
- Dhanvantari Nighantu
- Raj Nighantu
- Kaiyadeva Nighantu (Aushadhi Varga)
- Madanpal Nighantu

Classical Ayurvedic Classification

Charaka Samhita: classified under Kandughna, Kushthaghna, and Lekhaniya Mahakashaya (groups of drugs alleviating pruritus, skin disorders, and scraping/reducing Kapha-Meda).

Sushruta Samhita: included in Mustadi and Lodhradi gana, groups traditionally used for Pittaja and Raktaja disorders including jaundice.

Bhavaprakasha Nighantu: described in Haridradi Varga alongside Haridra (turmeric), reflecting shared Pitta-related pharmacological actions.

Rasa Panchaka (Pharmacodynamic Attributes)

Rasa (Taste): Tikta (bitter), Kashaya (astringent)

Guna (Qualities): Laghu (light), Ruksha (dry)

Virya (Potency): Ushna (hot potency)

Vipaka (Post-digestive effect): Katu (pungent post-digestive effect)

Karma (Actions): Kaphapittahara, Raktashodhaka (blood purifier), Yakrit-uttejaka (hepatostimulant), Kushthaghna, Krimighna, Mutrala; classically indicated in Kamala (jaundice) and Netra Roga.

Phytoconstituents

- Isoquinoline alkaloids: berberine, palmatine, berbamine, oxyberberine, columbamine
- Bisbenzylisoquinoline alkaloids and other minor alkaloids
- Diterpenes (major constituent class of the root bark, ~15%)

- Flavonoids and tannins
- Sterols and other secondary metabolites

Hepatoprotective Potential — Experimental and Mechanistic Evidence

Berberine, the principal alkaloid, reduces hepatocellular inflammation and has been the focus of both classical Ayurvedic and modern pharmacological attention to B. aristata as a hepatoprotective agent.

In a comparative experimental study, stem bark powder of B. aristata (270 mg/kg) significantly ameliorated paracetamol-induced hepatotoxicity in albino Wistar rats, normalising SGOT, SGPT, total protein, serum bilirubin, albumin, and alkaline phosphatase, corroborated by histopathological restoration of hepatic architecture.

Broader pharmacological screening attributes anti-hepatotoxic, antioxidant, anti-inflammatory, and anti-lipidemic activity to root and stem extracts, alongside antimicrobial, antihyperglycaemic, and anticancer effects, supporting a multi-target hepatoprotective mechanism involving free-radical scavenging and membrane stabilisation.

A dedicated review on the hepatoprotective effect of B. aristata correlates these modern pharmacological findings with classical Ayurvedic references to the drug's use as a liver tonic.

Key references: 1–7

3.2 Bhoomyamalaki (Phyllanthus niruri Linn. / Phyllanthus amarus Schum. & Thonn.)

Fig. Bhoomyamalaki (Phyllanthus niruri)

If there's one drug on this list that Ayurvedic physicians would name almost reflexively for jaundice, it's Bhoomyamalaki — the plant that international readers usually know as Chanca Piedra or Stonebreaker, and which happens to have one of the more active modern research programmes behind it.

Sanskrit / Ayurvedic Synonyms: Bhoomyamalaki, Bhuiamla, Tamalaki, Bahupatra; also known internationally as Stonebreaker/Chanca Piedra

Botanical Source: Phyllanthus niruri Linn. (syn. Phyllanthus amarus)

Family: Phyllanthaceae (Euphorbiaceae s.l.)

Part Used: Whole plant, particularly aerial parts

Distribution: Widespread throughout the tropical and subtropical plains of India, and pantropically

Literary Review — Citation in Classical Ayurvedic Texts

- Charaka Samhita
- Sushruta Samhita

- •Ashtanga Hridaya
- •Bhavaprakasha Nighantu (Guduchyadi Varga)
- •Dhanvantari Nighantu
- •Raj Nighantu
- •Kaiyadeva Nighantu

Classical Ayurvedic Classification

Bhavaprakasha Nighantu: described in Guduchyadi Varga along with other Kaphapittahara and Jwaraghna drugs.

Traditionally recognised as one of the foremost single drugs (Ekala Dravya) indicated specifically for Kamala (jaundice) in regional and classical Ayurvedic practice, and is a key ingredient of the classical compound formulation for hepatic disorders.

Deepana-Pachana (digestive-stimulant) drugs owing to its bitter-astringent taste and Pitta-pacifying action.

Rasa Panchaka (Pharmacodynamic Attributes)

Rasa (Taste): Tikta (bitter), Kashaya (astringent)

Guna (Qualities): Laghu (light), Ruksha (dry)

Virya (Potency): Sheeta (cold potency)

Vipaka (Post-digestive effect): Katu (pungent)

Karma (Actions): Deepana, Pachana, Kamalahara, Yakrit-uttejaka, Mutrala (diuretic), Jwaraghna (antipyretic); the classical drug of choice for Kamala.

Phytoconstituents

- •Lignans: phyllanthin, hypophyllanthin, niranthin, nirtetralin
- •Flavonoids: quercetin and related glycosides
- •Tannins and polyphenols (ellagitannins, gallic acid derivatives)
- •Alkaloids (securinine-type) and triterpenes
- •Bitter principles contributing to Tikta-Kashaya Rasa

Hepatoprotective Potential — Experimental and Mechanistic Evidence

A comprehensive review of the hepatoprotective potential of Phyllanthus niruri highlights antioxidant, anti-inflammatory, and detoxifying mechanisms that protect hepatocytes from toxin-induced injury, alongside antilithogenic and cholelitholytic actions relevant to hepatobiliary health.

Bioassay-guided in-vitro and in-vivo mechanistic studies in CCl4-induced hepatotoxicity models (Clone-9 and HepG2 cells, and Wistar rats) identified active hepatoprotective fractions of the aqueous extract, with improvement of serum total protein and antioxidant parameters (DPPH and FRAP assays).

Gene expression profiling in thioacetamide-induced hepatotoxicity in Sprague-Dawley rats demonstrated the molecular basis of the hepatoprotective effect of P. niruri, while a standardized extract has also been shown to alleviate progression of non-alcoholic fatty liver disease and reduce atherosclerotic risk in the same species.

P. niruri is a key constituent of the polyherbal formulation BV-7310 (with Tephrosia purpurea, Boerhavia diffusa, and Andrographis paniculata), which showed hepatoprotective activity against alcohol-induced toxicity in HepG2 cells and alcohol-plus-CCl4-induced liver damage in rats.

A broader review of the Phyllanthus genus (encompassing P. niruri, P. amarus, and P. urinaria) confirms consistent in-vitro and in-vivo hepatoprotective potential and documents efficacy against chronic hepatitis B infection.

Clinical / Translational Evidence

Randomised controlled clinical trials have evaluated Phyllanthus niruri for improving liver function in alcoholic hepatitis and for reducing fibrosis score and metabolic markers in patients with non-alcoholic fatty liver disease over one year of supplementation, providing translational support for its classical use in Kamala and related Yakrit disorders.

Key references: 8–15

3.3 Haritaki (Terminalia chebula Retz.)

Fig. Haritaki (Terminalia chebula)

Haritaki is, by a fair margin, the single most-cited drug in the whole of classical Ayurvedic literature, and trying to summarise its textual footprint without either padding it out or artificially trimming it down turned out to be harder than expected.

Sanskrit / Ayurvedic Synonyms: Haritaki, Abhaya, Pathya, Kayastha; commonly termed Myrobalan/'King of Medicines'

Botanical Source: Terminalia chebula Retz.

Family: Combretaceae

Part Used: Ripe and unripe fruit (pericarp)

Distribution: Deciduous forests across the Indian subcontinent, Nepal, Sri Lanka, and Southeast Asia

Literary Review — Citation in Classical Ayurvedic Texts

- Charaka Samhita — cited in multiple Mahakashaya/Dashemani groupings across Sutrasthana
- Sushruta Samhita
- Ashtanga Hridaya
- Ashtanga Sangraha
- Bhavaprakasha Nighantu
- Dhanvantari Nighantu
- Raj Nighantu
- Kaiyadeva Nighantu
- Madanpal Nighantu

- •Shodhala Nighantu
- •Priya Nighantu

Classical Ayurvedic Classification

Charaka Samhita: uniquely listed as a Prathama Mahakashaya (first drug) in multiple Dashemani groupings, including Bhedaniya (mild purgative) and other varga owing to its Tridosha-balancing property.

Termed 'Pathya' (that which is wholesome) in classical nomenclature, reflecting its broad-spectrum digestive and hepato-gastrointestinal utility.

Constitutes one of the three fruits of the classical Rasayana formulation Triphala, extensively used across Ayurveda, Unani, Siddha, and Tibb systems as a liver tonic and general rejuvenative.

Rasa Panchaka (Pharmacodynamic Attributes)

Rasa (Taste): Pancharasa (five tastes, all except salty), with Kashaya (astringent) predominant

Guna (Qualities): Laghu (light), Ruksha (dry)

Virya (Potency): Ushna (hot potency)

Vipaka (Post-digestive effect): Madhura (sweet post-digestive effect)

Karma (Actions): Tridoshahara, Rasayana, Deepana, Pachana, Anulomana (mild laxative), Yakrit-uttejaka; classically used for digestive, hepatic, and general debility conditions.

Phytoconstituents

- •Hydrolysable tannins: chebulinic acid, chebulagic acid, corilagin
- •Phenolic acids: gallic acid, ellagic acid
- •Flavonoids, glycosides, and sterols
- •Triterpenoids (e.g., terminoic acid) and anthraquinones

Hepatoprotective Potential — Experimental and Mechanistic Evidence

A comprehensive pharmacological review of T. chebula spanning literature from 1996–2021 documents antioxidative, anti-inflammatory, antimicrobial, anti-diabetic, and hepatoprotective activity attributable to its rich tannin and phenolic-acid profile.

A dedicated systematic review of the hepatoprotective activity of Haritaki, screening 115 studies and analysing 12 that met inclusion criteria across clinical, in-vivo, and in-vitro designs, concluded that T. chebula consistently demonstrates hepatoprotective and disease-preventive properties.

Specific experimental studies include amelioration of 2-acetylaminofluorene-induced hepatic damage in albino mice via modulation of MDR1 and COX-2 expression, normalisation of serum AST/ALT in paracetamol-induced liver damage in Wistar albino rats, and protection against tert-butyl hydroperoxide-induced acute liver injury in C57/BL6 mice.

Ethanolic fruit extract has also demonstrated hepatoprotective activity against ethanol-induced hepatotoxicity in rats, supporting the traditional classification of Haritaki as a universal digestive and hepatic tonic.

Key references: 16–22

3.4 Kutaki (Picrorhiza kurroa Royle ex Benth.)

Fig. Kutaki (Picrorhiza kurroa)

Kutaki is a nice case study in how a classical bitter, cold-potency liver drug can turn out to map almost exactly onto a specific modern phytochemical — in this case picroliv, which is among the better-studied hepatoprotective compounds discussed anywhere in this review.

Sanskrit / Ayurvedic Synonyms: Kutaki, Katuki, Katurohini

Botanical Source: Picrorhiza kurroa Royle ex Benth.

Family: Plantaginaceae (formerly Scrophulariaceae)

Part Used: Rhizome and roots

Distribution: Alpine and subalpine Himalayan regions at 2700–4500 m from Kashmir to Sikkim

Literary Review — Citation in Classical Ayurvedic Texts

- •Charaka Samhita — Sutrasthana (Lekhaniya,Bhedaniya and Sthanya Shodhana Dashemani)
- •Sushruta Samhita — Sutrasthana (Mustadi, Pippalyadi, and Patoladi gana)
- •Ashtanga Hridaya
- •Ashtanga Sangraha
- •Bhavaprakasha Nighantu
- •Dhanvantari Nighantu
- •Raj Nighantu
- •Kaiyadeva Nighantu

Classical Ayurvedic Classification

Charaka Samhita: classified under Tiktaskandha (bitter group), and included in the Bhedaniya, Lekhaniya,Sangyasathapamnand Sthanya Shodhana Dashemani groupings.

Sushruta Samhita: placed in Mustadi gana, Pippalyadi gana, and Patoladi gana — groups classically employed for Kamala, Jwara, and Pittaja disorders.

Regarded in Dravyaguna Shastra as one of the principal Tikta Rasa (bitter-tasting) hepatoprotective and antipyretic drugs of Ayurveda, analogous in classical reputation to Kalmegh.

Rasa Panchaka (Pharmacodynamic Attributes)

Rasa (Taste): Tikta (bitter)

Guna (Qualities): Laghu (light), Ruksha (dry)

Virya (Potency): Sheeta (cold potency)

Vipaka (Post-digestive effect): Katu (pungent)

Karma (Actions): Pittahara, Kaphahara, Yakrit-uttejaka, Kamalahara, Jwaraghna, Virechaka (mild purgative); used for correcting deranged liver function and detoxification.

Phytoconstituents

- Iridoid glycosides: picroside I, picroside II, picroside III, kutkoside (together known as 'kutkin')
- Minor iridoid glycosides: pikuroside, bartsioside, boschnaloside, mussaenoidic acid glycosides
- Cucurbitacin glycosides (~9 types) and apocynin
- Phenolics including vanillic acid; drosin

Hepatoprotective Potential — Experimental and Mechanistic Evidence

A dedicated review on the hepatoprotective and hypolipidemic effect of Kutaki summarises its established role in managing liver cirrhosis, ascites, and jaundice, attributing action to correction of liver function and enhanced hepatic detoxification via kutkin (picrosides I–III and kutkoside).

A comprehensive review of Picrorhiza kurroa and its secondary metabolites documents hepatoprotective effects against carbon tetrachloride, alcohol, isoniazid, paracetamol, Amanita mushroom toxin, rifampicin, Plasmodium berghei, and aflatoxin B1-induced hepatic injury across preclinical models.

The standardised glycoside fraction Picroliv (picroside-I and kutkoside in a 1:1.5 ratio) has been extensively studied: it significantly reduced elevated GOT, GPT, and hepatic lipid content in galactosamine-induced liver injury in rats, and prevented thioacetamide-induced biochemical derangement in liver and serum.

Picroliv, picroside-I, and kutkoside have also been shown to act as direct scavengers of superoxide anions, and picroliv mitigated aflatoxin B1-induced lipid peroxidation in rat liver and kidney comparably to silymarin.

Clinical / Translational Evidence

In a randomised, double-blind, placebo-controlled clinical trial in patients with acute viral hepatitis (HBsAg-negative), oral P. kurroa root powder (375 mg thrice daily for two weeks) produced a statistically significant reduction in serum bilirubin, SGOT, and SGPT compared with placebo, providing direct clinical validation of its classical use in Kamala.

Key references: 23–30

3.5 Yashtimadhu (Glycyrrhiza glabra Linn.)

Fig. Yashtimadhu (Glycyrrhiza glabra)

Yashtimadhu doesn't fit the pattern of the other drugs quite as neatly. Classically it's a rejuvenative and general tonic first, and a liver drug only by extension — worth flagging honestly rather than reading a hepatoprotective claim into the earliest texts that isn't really there.

Sanskrit / Ayurvedic Synonyms: Yashtimadhu, Madhuyashti, Klitaka; commonly known as Licorice/Liquorice

Botanical Source: Glycyrrhiza glabra Linn.

Family: Fabaceae (Leguminosae)

Part Used: Root and stolon

Distribution: Cultivated and wild in the Mediterranean, Central Asia, and northern parts of the Indian subcontinent

Literary Review — Citation in Classical Ayurvedic Texts

- Charaka Samhita — Sutrasthana (Jivaniya, Kanthya, , Chakshushya, Snehopag, Vamanopag, Aasthapanopag, Shonitsthapan, Varnya, Mutravirajneeya, Angmard prashaman and Sandhaniya Dashemani)
- Sushruta Samhita — Sutrasthana (Kakolyadi gana)
- Ashtanga Hridaya
- Ashtanga Sangraha
- Bhavaprakasha Nighantu
- Dhanvantari Nighantu
- Raj Nighantu
- Kaiyadeva Nighantu
- Madanpal Nighantu

Classical Ayurvedic Classification

Charaka Samhita: classified in the Jivaniya (life-promoting), Kanthya (throat-beneficial), Chakshushya (eye-beneficial), and Sandhaniya (wound/tissue-healing) Dashemani groups.

Sushruta Samhita: included in Kakolyadi gana, a group of Madhura (sweet) Rasayana drugs.

Its classification among Jivaniya and Vayasthapana groups reflects a broadly nourishing and rejuvenative (Rasayana) action, within which its hepatoprotective effect is understood as part of general Dhatu-poshana (tissue nourishment) rather than a direct Kamalahara indication.

Rasa Panchaka (Pharmacodynamic Attributes)

Rasa (Taste): Madhura (sweet)

Guna (Qualities): Guru (heavy), Snigdha (unctuous)

Virya (Potency): Sheeta (cold potency)

Vipaka (Post-digestive effect): Madhura (sweet)

Karma (Actions): Vata-Pittahara, Rasayana, Balya (strength-promoting), Yakrit-poshaka; used as a general tonic and in Pitta-predominant conditions.

Phytoconstituents

- Triterpenoid saponin: glycyrrhizin (glycyrrhizic acid), 2–9% of root
- Glycyrrhetinic acid (aglycone of glycyrrhizin), 0.5–0.9%
- Flavonoids and isoflavonoids: liquiritin, liquiritigenin, glabridin
- Chalcones, coumarins, sterols, and volatile oils

Hepatoprotective Potential — Experimental and Mechanistic Evidence

Glycyrrhizin exerts hepatoprotective effects by stabilising hepatocyte membrane permeability, inhibiting phospholipase A2, and increasing hepatocyte survival, mechanisms detailed in a phyto-pharmacological review of Yashtimadhu.

A recent narrative review of glycyrrhizin preparations in liver disease outlines multi-target pharmacological mechanisms — anti-inflammatory, membrane-stabilising, antioxidant, anti-apoptotic, immunomodulatory, and anti-fibrotic — that collectively underpin their established clinical hepatoprotective use, particularly the glycyrrhetinic-acid-based formulations diammonium glycyrrhizinate, compound glycyrrhizin, and magnesium isoglycyrrhizinate.

In diabetic male rats, G. glabra treatment significantly reduced ALT, AST, and ALP along with the oxidative marker malondialdehyde, while enhancing glutathione, superoxide dismutase, and catalase activity, with histopathological reduction of hepatic inflammation, steatosis, and fibrosis.

Combination studies with Silybum marianum (silymarin) demonstrate a possible additive/synergistic hepatoprotective effect of glycyrrhizin and silymarin against CCl4-induced liver injury in rats.

Clinical / Translational Evidence

Glycyrrhizin has demonstrated long-term efficacy in chronic hepatitis C patients in a landmark clinical study, and more recent randomised evaluation of licorice extract versus vitamin E showed reduction in fibrosis score in patients with non-alcoholic fatty liver disease.

Key references: 31–36

3.6 Kalmegh (Andrographis paniculata (Burm.f.) Wall. ex Nees)

Fig. Kalmegh (Andrographis paniculata)

Kalmegh is worth pausing on for a different reason: unlike the other six drugs here, it barely shows up in the oldest classical Samhitas at all, and pretending otherwise would misrepresent the actual textual record.

Sanskrit / Ayurvedic Synonyms: Kalmegh, Bhunimba, Mahatikta; internationally known as 'King of Bitters'

Botanical Source: Andrographis paniculata (Burm.f.) Wall. ex Nees

Family: Acanthaceae

Part Used: Whole plant, chiefly leaves

Distribution: Widely distributed across the Indian plains, Sri Lanka, and Southeast Asia

Literary Review — Citation in Classical Ayurvedic Texts

- Raj Nighantu (as 'Bhunimba', grouped among Tikta Rasa drugs resembling Nimba in action)
- Later regional Nighantu and Siddha/Bengali folk-medicine compilations, through which it entered mainstream Ayurvedic practice
- Contemporary Ayurvedic pharmacopoeial and formulary literature, where it is now well established as a hepatoprotective drug despite its late classical entry

Classical Ayurvedic Classification

Not enumerated among the classical Mahakashaya of Charaka or the gana of Sushruta Samhita, but described in later Nighantu literature (e.g., Raj Nighantu) under Tikta Rasa (bitter) drugs as 'Bhunimba', denoting its resemblance in bitterness and action to Nimba (Azadirachta indica).

Widely adopted into regional and contemporary Ayurvedic/Siddha practice as a principal Kaphapittahara, Jwaraghna, and Kamalahara drug, and forms a component of several classical and proprietary polyherbal hepatic formulations.

Functionally grouped with other Tikta Rasa hepatoprotective drugs (alongside Kutaki) owing to shared cold-potency, Pitta-Kapha pacifying pharmacodynamics.

Rasa Panchaka (Pharmacodynamic Attributes)

Rasa (Taste): Tikta (intensely bitter)

Guna (Qualities): Laghu (light), Ruksha (dry)

Virya (Potency): Sheeta (cold potency)

Vipaka (Post-digestive effect): Katu (pungent)

Karma (Actions): Kaphapittahara, Jwaraghna, Kamalahara, Krimighna, Yakrit-uttejaka; a traditional hepatostimulant and hepatoprotective drug from India.

Phytoconstituents

- •Diterpene lactones: andrographolide, neoandrographolide, dehydroandrographolide, andrographiside, 14-deoxyandrographolide
- •Flavonoids and flavonoid glycosides
- •Andrographolide is the principal marker compound and predominant bioactive diterpene, concentrated mainly in the leaves

Hepatoprotective Potential — Experimental and Mechanistic Evidence

A dedicated review compiling preclinical evidence on hepatoprotection by A. paniculata leaf extracts against CCl4, paracetamol, ethanol, and thioacetamide-induced hepatotoxicity models in rats found consistent restoration of ALT, AST, and ALP together with enhancement of endogenous antioxidant status, with efficacy comparable to standard silymarin.

Andrographolide and total leaf extract of Kalmegh have shown in-vivo and in-vitro modulation of hepatic lipid peroxidation, an early foundational study establishing the antihepatotoxic potential of the drug.

A review focused on liver inflammation identifies Andrographis paniculata as the most extensively studied herb for hepatoprotection in both Ayurveda and Traditional Chinese Medicine, acting through suppression of inducible nitric oxide synthase expression and inhibition of hepatocyte apoptotic pathways (PI3K/Akt modulation).

Recent work on Kalmegh in fatty liver disease highlights andrographolide's anti-inflammatory, antioxidant, and antifibrotic actions relevant to non-alcoholic fatty liver disease, alongside nanocarrier-based strategies developed to overcome its inherently poor oral bioavailability.

Kalmegh, alongside Phyllanthus niruri, Tephrosia purpurea, and Boerhavia diffusa, forms the polyherbal formulation BV-7310, which exhibited hepatoprotective activity against alcohol- and CCl4-induced liver injury in HepG2 cells and rats.

Key references: 37–43

3.7 Punarnava (Boerhavia diffusa Linn.)

Fig. Punarnava (Boerhavia diffusa)

Punarnava closes out this review fittingly, since its classical indication for Shotha and Udara Roga is, in effect, an old description of the ascites and fluid retention that show up in advanced liver disease today.

Sanskrit / Ayurvedic Synonyms: Punarnava, Raktakanda, Shothaghni,

Botanical Source: Boerhavia diffusa Linn.

Family: Nyctaginaceae

Part Used: Whole plant, particularly root

Distribution: Throughout the warmer plains of India and pantropical regions

Literary Review — Citation in Classical Ayurvedic Texts

- •Charaka Samhita — Sutrasthana (Shothahara Mahakashaya)
- •Sushruta Samhita
- •Ashtanga Hridaya
- •Ashtanga Sangraha
- •Bhavaprakasha Nighantu (Guduchyadi Varga)
- •Dhanvantari Nighantu
- •Raj Nighantu
- •Kaiyadeva Nighantu

Classical Ayurvedic Classification

Charaka Samhita: cited as the first drug (Prathama Dravya) of the Shothahara Mahakashaya (group of anti-oedema drugs), reflecting its principal classical indication in Shotha (oedema) and by extension in ascites of hepatic origin.

Bhavaprakasha Nighantu: described in Guduchyadi Varga, grouped with other Tridoshahara and Jwaraghna drugs.

Its Sanskrit name 'Punarnava' (literally, 'that which renews the body again') denotes its Rasayana-like rejuvenative reputation, applied classically to Yakrit-Pleeha Vikara (hepatosplenic disorders), Kamala, and Udara Roga (ascites).

Rasa Panchaka (Pharmacodynamic Attributes)

Rasa (Taste): Tikta (bitter), Kashaya (astringent), Madhura (sweet)

Guna (Qualities): Laghu (light), Ruksha (dry)

Virya (Potency): Ushna (hot potency)

Vipaka (Post-digestive effect): Katu (pungent)

Karma (Actions): Tridoshahara, Shothahara (anti-oedema), Mutrala (diuretic), Yakrit-uttejaka, Raktashodhaka; classically indicated in Kamala, Yakrit-Pleeha Vriddhi, and Udara Roga.

Phytoconstituents

- •Rotenoids: boeravinones A–J (notably boeravinone A and B)
- •Flavonoid glycosides: eupalitin-3-O-β-D-galactopyranoside
- •Alkaloids: punarnavine
- •Steroids, triterpenoids (punarnavoside), and lignans

Hepatoprotective Potential — Experimental and Mechanistic Evidence

Boerhavia diffusa root/whole-plant extract exhibits potent hepatoprotective activity against CCl4-induced hepatic damage in Swiss albino mice, with dose-dependent reduction in serum ALT, AST, ALP, ACP, LDH, and γ-GT, decreased bilirubin and lipid peroxidation, and near-normal restoration of hepatic histoarchitecture, attributed principally to its antioxidant properties.

A rotenoid-enriched fraction from B. diffusa roots, rich in boeravinone A and B, protected HepG2 cells from ethanol-induced toxicity by reducing reactive oxygen species, lipid accumulation, and nitric oxide production, with in-silico docking showing strong interactions with hepatoprotective molecular targets including CYP2E1, NRF2, SIRT1, SREBP1, TNF-α, and TLR-4.

A state-of-the-art ethnomedicinal review notes that B. diffusa possesses free-radical-scavenging and glutathione-elevating antioxidant activity relevant to the treatment of hepatitis and hepatic cirrhosis, with its leaf flavonoid eupalitin-3-O-D-galactopyranoside structurally analogous to silymarin, the reference hepatoprotective standard.

High-resolution mass spectrometry-based metabolomic profiling of B. diffusa has identified a diverse spectrum of hepatoprotective phytochemicals acting via mitigation of oxidative stress and inhibition of inflammatory mediators, reinforcing its traditional and contemporary place in liver-disease management.

As with Phyllanthus niruri and Andrographis paniculata, Punarnava is a key constituent of the polyherbal hepatoprotective formulation BV-7310, evaluated against alcohol- and CCl4-induced hepatotoxicity.

Key references: 44–50

4. Comparative Discussion

Line the seven drugs up side by side and the phytochemistry looks wildly different — alkaloids in one, iridoid glycosides in another, diterpene lactones in a third — yet the actual hepatoprotective mechanisms converge on a fairly short list. Antioxidant and free-radical-scavenging activity shows up repeatedly, most clearly in Daruharidra, Bhoomyamalaki, Kutaki, and Punarnava. Hepatocyte membrane stabilisation is the dominant story for Yashtimadhu and features in Daruharidra as well. Anti-inflammatory suppression of pathways like iNOS and COX-2 does most of the work for Kalmegh and Haritaki. And a broadly choleretic, detoxification-enhancing action — what the classical texts simply call Yakrit-uttejaka — is most obvious in Kutaki, Punarnava, and Bhoomyamalaki. It's also worth noting that all seven drugs fall under Tikta or Kashaya Rasa in the classical system, with Yashtimadhu as the one Madhura exception working through a Rasayana route rather than a direct hepatic one; that's not proof of anything on its own, but it's a reasonably strong hint that the old bitter-astringent-liver association wasn't arbitrary. Bhoomyamalaki and Kutaki have the tightest classical-to-clinical link specifically to Kamala, Punarnava's strength lies in Shotha and Udara Roga, and Kalmegh — despite being almost invisible in the earliest Samhitas — has generated more modern experimental data than any of the others, nearly all of it built around andrographolide.

5. Conclusion

Taken together, Daruharidra, Bhoomyamalaki, Haritaki, Kutaki, Yashtimadhu, Kalmegh, and Punarnava hold up reasonably well as a group of genuinely evidence-backed Ayurvedic hepatoprotective drugs — their classical Rasa Panchaka classification and their modern phytochemical/pharmacological profiles tell a story that's more consistent than one might expect from texts written well over a thousand years apart. That said, consistency across traditional and modern accounts isn't the same as proof, and several gaps remain: dose-standardisation is inconsistent across studies, mechanistic work is still shallow for some of these plants, and well-designed randomised trials exist for only a couple of them. Closing that gap is really the next step if these traditional remedies are going to become standardised, clinically validated hepatoprotective phytopharmaceuticals rather than remaining well-supported but informally used traditional medicines.

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