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## Review Paper

# Phytochemical and Hepatoprotective Potential of *Randia dumetorum*: A Comprehensive Review

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## ABSTRACT

*Randia dumetorum* is an important medicinal plant known for its traditional therapeutic uses. The plant contains various phytochemicals such as flavonoids, tannins, saponins, glycosides, and phenolic compounds that possess antioxidant and hepatoprotective activities. Liver damage caused by toxins, drugs, and oxidative stress is a major health problem worldwide. Studies have reported that *Randia dumetorum* helps protect liver cells by reducing oxidative stress and improving liver function markers. This review summarizes the phytochemical constituents and hepatoprotective potential of *Randia dumetorum* and highlights its importance as a natural source for liver protective agents

## INTRODUCTION

*Randia dumetorum* is a medicinal plant belonging to the family Rubiaceae and is widely used in traditional medicine for treating various diseases. The plant contains important bioactive compounds including flavonoids, phenols, tannins, and saponins. These compounds exhibit antioxidant and anti-inflammatory properties that help in protecting the liver from toxic damage. Liver disorders caused by drugs, alcohol, and chemicals are increasing globally, creating a need for safer herbal medicines. Experimental studies suggest that *Randia dumetorum* shows significant

hepatoprotective activity by reducing oxidative stress and restoring normal liver function. Therefore, the plant has gained attention as a potential natural hepatoprotective agent.

## REGIONAL AND OTHER NAMES

Arabic: Jauzulaki, Jijul kai  
Asam : Behmona  
Bengali : Mainphal  
English : Emetic nut tree  
Gujarati : Mindhal, Mindhola, Midhola  
Hindi : Mainphal, Madan  
Malyalam : Kara

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Marathi : Ghela, Peralu, Mindhal, Wagatta,  
Gelpal  
Oria : Palova

Tamil : Marukkalankaly, Madkarai  
Telugu : Manga  
Unani: Jauzulaki (Kirtikar et al., 1991)



a) Flowers



b) Leaves



c) Fruits

## AYURVEDIC DESCRIPTION

**Botanical name:** *Randia dumetorum*

**Sanskrit name:** Madana, Vamanaphala,  
Teevragandhi

**Synonyms** : Catunaregam spinosa(Thumb.)  
Tirveng.

**Properties:** Rasa :Kashaya, Tikta,  
Guna:Guru  
Virya :Ushna  
Vipaka:Katu karma

### **Karma (Actions):**

Plant pacifies vitiated pitta, kapha, Cough, skin diseases, ulcers, asthma, Flatulence, colic, and is widely used as a Medicine for emesis therapy in Ayurveda.

### **Therapeutic uses:**

#### **Fruit:**

It cures abscess, ulcers, inflammation, Wounds, tumours, skin diseases and Have antibacterial activity. The pulp of Fruit is believed by many

practitioners To also have anthelmintic properties, And also used as an abortifacient as Folklore remedy(Agrawal et al., 1999).

#### **Bark:**

The bark is astringent and is given in Cases of diarrhoea and dysentery(Chopra, et al., 1956) . It is Administered internally and applied Externally in the form of paste in Rheumatism and to relieve pain of Bruises and boneaches during fevers and To disperse abscesses. The aqueous Extract of the root bark of the tree is Used as an active insecticide (Dastur et Al., 1962)

### **Plant Profile**

Botanical Name :*Randia dumetorum* Lam.

Synonym:Catunaregam spinosa

Family:Rubiaceae

Common Names:Madanphal, Mainphal

Plant Type:Thorny shrub/small tree

Distribution:India, Nepal, Sri Lanka, Bangladesh

Useful Parts:Fruits, leaves, bark, roots



**Chemical Constituents:**

**Bark:**

Root bark of *Randia dumetorum* contains triterpene, -1-Keto-3-hydroxyoleanane. Bark of *Randia dumetorum* contains mannitol, saponins, Coumarin glycosides.

**Leaf:**

Leaves contain an iridoid-10-methylxoside. An iridoid Glycoside from leaves of *Randia dumetorum* (Sati et al. 1986).

**Fruit:**

Ripe fruit contains glycosides, randioside A, mollisidial Triterpenoid glycosides and randianin, six saponins *dumetoronins A to F* (Agrawal et al., 1999). Saponins named as *dumetoronin* from fruit pulp of *Randia Dumetorum Dumetoronin A, B, C, D, E and F* etc. A Hemolytic triterpenoid saponins that is *Randianin*, from fruit Of *R. dumetorum* (Subramaniam et al., 1989)

**Morphology and Macroscopy**

A large deciduous thorny shrub grows up to 5 meters of Height. Leaves simple, obovate, wrinkled, shiny and pubescent. Flowers white, fragrant, solitary, seen on at the end of short Branches. Fruits globose, smooth berries with longitudinal ribs; Yellow when ripe. Seeds many, compressed, embedded in the dark Fetid pulp. Fruit, 1.8-4.5 cm long, globose or broadly ovoid, Longitudinally ribbed or smooth yellowish-brown, crowned with Persistent calyx-limb, fruit, contains numerous seeds, 0.4-0.6 cm Long, compressed, smooth, brown and very hard (Kirtikar et al., 1991)

**Macroscopy of *Randia dumetorum***

Color: Yellowish to brown

Shape: Round fruit with thorny stem

Odor: Characteristic odor

Taste: Bitter and astringent

Surface: Rough and hard outer surface

Size: Medium-sized spherical fruits and broad leaves

**Microscopic:**

Miscellaneous parts of plant studied microscopically shows features as depicted in Table

Part	Characteristics
<b>Leaves(34)</b>	Simple, opposite, sometimes with one of each pair arrested almost sessile or very short petioled obovate, obtuse or Sub acute at apex, the base tapering narrowed in to a very short petiole 3.8 or rarely up to 5 cm long and 1.8-3cm broad wrinkled when young, pubescent on one or both surfaces especially on the nerves beneath but glabrous when mature main nerves 6-10 pairs.
<b>Flowers(34)</b>	Fairly large, under 2.5 cm in diameter often terminal on short leaf bearing branchlets or young shoot or axillary or a leaf opposed short peduncle. Solitary or rarely 2 or 3 together sub-



	sessile or very short-stalked. Whitish pale greenish or yellowish white but turning yellow as they fade out, "highly fragrant"(Roxb) bisexual & epigynous.
<b>Fruit(35)</b>	transverse section shows epicarp consisting of single layered epidermis, sometimes obliterated in surface view, epidermal cells thin-walled and polygonal, mesocarp, broad zone consisting of thin-walled, parenchymatous cells, some cells contain reddish-brown content, a number of vascular bundles found embedded in this zone, endocarp stony consisting of light yellow polygonal, sclerenchymatous cells of variable shape and size.
<b>Seed(35)</b>	Transverse section shows a seed coat, consisting of single layered, rounded to oval epidermal cells, a few layers of yellowish-brown pigmented cells and endosperm forms bulk of seed consisting of large oval and irregular shaped parenchymatous cells, albumen horny, translucent, cells of outermost layer smaller in size.
<b>Powder(35)</b>	Reddish brown, under microscope shows numerous, large, irregular, reddish brown cells sclereids of variable shape and size, pieces of xylem vessels with reticulate thickenings, thin-walled, crushed parenchymatous cells and yellow-orange pieces of seed coat

**Phytochemical Constituents:**

Phytochemical studies revealed the presence of numerous secondary metabolites responsible for therapeutic activity.

Major Phytochemicals

Flavonoids

Flavonoids act as strong antioxidants and free radical scavengers. They protect liver cells against oxidative damage.

Saponins

Saponins contribute to anti-inflammatory and hepatoprotective activity.

Phenolic Compounds



Phenolics reduce oxidative stress and lipid peroxidation.

Triterpenoids

Triterpenoids exhibit anti-inflammatory and membrane stabilizing effects.

Glycosides

Iridoid and coumarin glycosides are present in leaves and bark.

Alkaloids and Tannins

These compounds contribute to antimicrobial and antioxidant properties.

Plant part(36)	Chemical constituents
Bark(36)	Scopoletin, d-mannitol and a mixture of saponins
Root(36)	Scopoletin, d-mannitol
Root bark(36)	Triterpene-1- keto-3-hydroxyoleanane
Powered root(36)	Scopoletin
Leaves(36)	Ether extract- 5.7; protein 3.9; dig – carbohydrate 70; fibre, H <sub>2</sub> O with ash 8.5; Calcium 2.8; phosphorus 0.04 and iron, 0.5% iridoid-10-methylxaside.
Fruit	Ripe fruit contains glycosides, randioside A, mollisidial triterpenoid glycosides and randianin, six saponins dumetoronins A to F (37). A haemolytic triterpenoid saponins that is Randianin, from fruit of R.dumetorum(38).
Seeds	Fat (1.5%), Protein (14.2%), mucilage resin, organic acid(1.4%) and volatile oil.

### Pharmacological activities

**1. Antibacterial activity:** “The Preliminary antibacterial activity of Methanolic extract of *Randia dumetorum* Lam., Was done on some standard and wild Pathogenic strains. The inhibition of the Bacterial growth was more pronounced on E.coli as compared to the other tested Organisms ”. This shows the antibacterial action of *Randia dumetorum* Lam.

**2. Anti-Allergic activity:** In Ayurveda, *Randia dumetorum* Lam. Is used in Treatment of Asthma (tamakshwasa), Rhinitis, cold, pain etc. “Extract and its Fraction on milk induced leucocytosis and Eosinophilia in mice, passive paw Anaphylaxis and mast cell degranulation in Rat models”.

**3. Anti-inflammatory activity:** “The Crude methanol extract of fruit of *Randia Dumetorum* Effectively reduced the Carrageenin induced oedema in hind paw Of the rats, significant reduction in Granular tissue formation was

recorded. This activity seems to be significant at Various acute phases of inflammation and On formation of granular tissue” .This Proves the action of madanaphala on Shopha (inflammation).

**4. Analgesic activity:** Analgesic activity Was tested in mice weighing between 20-250 with six numbers of animals in each Group by Acetic acid induced writhing Response and Hot-plate response in mice. 500 mg/kg methanolic extract of fruit *Randia dumetorum* give analgesic activity In both models. This proves its Shoolanashaka (pain killer) action.

**5. Immunomodulatory activity:** “*Randia Dumetorum* has immunostimulant activity And chloroform fraction which strongly Affected immune system seems to be Bioactive fraction of this plant” .

### Hepatoprotective Activity

Hepatoprotective activity refers to the ability of a substance to prevent liver damage caused by chemicals, drugs, or toxins.

Experimental studies have shown significant hepatoprotective effects of *Randia dumetorum* extracts against:

### 1) Alcohol-Induced Hepatotoxicity

A study conducted on albino rats evaluated the hepatoprotective effect of methanolic fruit extract against alcohol-induced liver damage.

Results showed significant reduction in:

ALT, AST, Total bilirubin, Direct bilirubin, Lipid peroxidation

The extract also increased glutathione and total protein levels. Histopathological studies demonstrated improved liver architecture

### 2) CCl<sub>4</sub>-Induced Hepatotoxicity Model

In experimental animals, administration of carbon tetrachloride causes liver injury by generation of free radicals.

Treatment with methanolic leaf and bark extracts of *Randia dumetorum* resulted in:

- Decreased SGOT and SGPT levels
- Reduction in bilirubin
- Increased antioxidant enzymes
- Reduced lipid peroxidation
- Improved histopathology of liver tissue

### Mechanism of Hepatoprotective Action:

The hepatoprotective activity of *Randia dumetorum* is mainly due to:

**Antioxidant Mechanism,:**

The plant neutralizes reactive oxygen species and prevents oxidative stress.

**Inhibition of Lipid Peroxidation:**

It reduces membrane damage caused by free radicals.

**Enhancement of Antioxidant Enzymes:**

The extract increases: Superoxide dismutase (SOD) Catalase (CAT) Glutathione reductase (GSH)

**Anti-inflammatory Action:**

The plant suppresses inflammatory cytokines such as TNF- $\alpha$  and IL-1 $\beta$ .

**Histopathological Findings:**

Microscopic examination of liver tissue showed:

**Toxic Control Group**

- Necrosis
- Fatty degeneration
- Cellular swelling
- Inflammation

**Extract Treated Group**

- Reduced necrosis
- Regeneration of hepatocytes
- Restoration of normal liver architecture

These findings support the hepatoprotective efficacy of the plant extracts

**Safety and Toxicity**

Acute toxicity studies reported that methanolic extracts of *Randia dumetorum* were safe up to 2000 mg/kg in experimental animals without mortality or significant toxicity.

## CONCLUSION

*Randia dumetorum* is a valuable medicinal plant possessing diverse pharmacological activities. The plant contains several bioactive phytochemicals including flavonoids, saponins, phenolics, glycosides, and triterpenoids which contribute to its antioxidant and hepatoprotective effects. Experimental studies demonstrated that the plant protects liver tissue against toxic damage by reducing oxidative stress, inflammation, and lipid peroxidation. Scientific evidence supports its traditional use in liver disorders. However, additional clinical and pharmacological studies are necessary to establish its therapeutic potential in modern medicine.

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