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Review Article

Rediscovering the Therapeutic Potential of Rhus Species - A Review

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ABSTRACT

The genus Rhus (family Anacardiaceae) includes over 200 species distributed across tropical, subtropical, and temperate regions. Traditionally, these species have been used in African, Asian, and Native American medicine for their healing properties. Recent studies have brought attention to their rich phytochemical profiles, which contribute to a variety of pharmacological activities, such as antimicrobial, anti-inflammatory, antioxidant, and anticancer effects. Key bioactive compounds in Rhus species include flavonoids, tannins, and essential oils, which are responsible for their therapeutic effects. This review summarizes the botanical characteristics, traditional medicinal uses, and pharmacological potential of Rhus species. It also highlights the promising therapeutic possibilities these plants offer, suggesting that further research could lead to new drug development. As Rhus species demonstrate considerable promise in modern medicine, they provide valuable opportunities for exploring novel therapeutic agents derived from natural sources.

INTRODUCTION

Since nature contains a wide variety of plants species with medicinal properties, it has long been considered as world's first pharmacy. Globally, communities used plants to treat illness, pain, and other disease long before modern medicine came into existence, Rich in organic components, these plants have served as the foundation of standard therapeutic methods and still gives information for modern medical procedures.

The idea behind herbal medicine is to treat various disease and preserve health by using compounds present in the plants. In divergence to important nutrients found in vegetables or crops, medicinal herbs are prized for their bioactive substances, including tannins, alkaloids, flavonoids, and essential oils, etc. which can affect physiological functions. Leaves, flowers, roots, bark, and seeds are just a few of the plant parts from which these can be obtained.[1]

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Although the difference between herbs and spices can be small or minor difference, they are frequently classified into different types. spices are made from dried seeds, roots, or bark, whereas herbs are soft, green portions of plants that are utilized in fresh or dry form. However, depending on the situation, both may have cooking and therapeutic uses.[2]

These traditional herbs have a lot to teach in modern medicine. Most of pharmacological medications or modern medication are either derived directly from plants or are based on chemicals found in plants. Over past few decades world is moving towards herbal medicine or showing interest towards herbal medicine. Herbal medicines are becoming more and more appealing to a variety of demographics due to factors including cultural familiarity, low cost, and less adverse effects.

Medicinal herbs acts as essential resource for plant based medicine, combining traditional wisdom with contemporary science to cure diseases and future health problems.[3]

Plant description

Rhus chinensis, commonly known as Chinese sumac or Chinese gall tree, it is a deciduous shrub or small tree that typically grows between 2 to 12 meters in height. The bole of plant can be 6 - 18cm in diameter, The plant has a broad, rounded crown with spreading branches and thrives in temperate to subtropical climWates. The leaves of *Rhus chinensis* are pinnately compound, usually bearing 7 to 15 lance-shaped leaflets with serrated margins. Each leaflet measures about 5 to 15 centimeters in length and is dark green on the upper surface and lighter underneath. The bark of the tree is greyish-brown and rough, and the wood is moderately hard. In autumn leaves turns brilliant shades of red and orange, adding significant ornamental value.[4]

Scientific Classification[5]

- **Scientific Name**: *Rhus chinensis* Mill.
- **Kingdom**: Plantae
- **Subkingdom**: Tracheobionta – Vascular plants
- **Superdivision**: Spermatophyta – Seed plants
- **Division**: Magnoliophyta – Flowering plants
- **Class**: Magnoliopsida – Dicotyledons
- **Subclass**: Rosidae
- **Order**: Sapindales
- **Family**: Anacardiaceae – Cashew or Sumac family
- **Genus**: *Rhus* L. – Sumac
- **Species**: *Rhus chinensis* Mill.
- **Synonyms**: Chinese sumac, Chinese gall tree, Nutgall tree, Wu Bei Zi

General Description:[6]

- **English Name**: Chinese sumac
- **Telugu Name**: Chines sumak *(less commonly used)*
- **Tamil Name**: Cheena Sumac *(rarely referred locally)*
- **Hindi Name**: Chinai Sumach, Balela
- **Chinese Name**: Wū Bèi Zǐ
- **Parts Used**: roots, fruits, Leaves, bark, galls (especially Galla Chinensis).

Traditional use:

Indigenous peoples have traditionally used Rhus chinensis and its gall, Galla chinensis, among other species for therapeutic purposes Different elements of this tree, including the root , bark, stem, leaf, fruit, blossoms, seed,& gall, are said to have a variety of therapeutic qualities.[7]

Medicinal use
Depurative[8], can stimulate blood circulation[9], hemoptysis[10], inflammations[11], laryngitis[12], stomachache[13] , traumatic fractures[12], spermatorrhea,[14] snake bite[15], antitussive[15], diarrhea[15].
Colic[13], diarrhea[13], dysentery[13], jaundice[13] and hepatitis[13].
Coughs[13], dysentery[28], fever[24], jaundice[13], hepatitis[13], malaria[16] and rheumatism[16].
Diarrhea[13], spermatorrhea[14], malaria[16], antitussives[15], treatments of anasarca[17], jaundice[13] and snake bite[15].
Diarrhea[13], diabetes mellitus[18], antiseptic[20], antiphlogistic[19], astringent[21], haemostatic[21], urorrhoea[12], bloody sputum[12], burns[22], hemorrhoids[23], oral diseases[16], fever[24], malaria[16], inflammation[11], toxicosis[25], sore[25], skin infections[26], rectal and intestinal cancer[27].

Phytochemical investigation:

Phytochemical of rhus species are characterized in several compounds such as flavonoids, biflavanoids, Anthocyanins triterpenoids, phenolics, tannins, aromatic alkanes, Essential oils like Leaves contain palmitic acid, phytol, and n-heptacosane, etc[29],[30].

In Rhus coriaria it contains of various range of volatile compounds in its fruits and leaves, including more than 260 identified substances. In these primarily include terpene hydrocarbons such as α-pinene, β-caryophyllene, and cembrene, along with oxygenated terpenes, various aldehydes, and phenolic acids, the fruits mainly consist of gallic acid derivatives and high-molecular-weight tannins, which will significantly contribute to their strong antioxidant potential[31].

Rhus chinensis is mainly known for its high content of hydrolysable tannins, especially in its galls (*Galla Chinensis*), which contains around 50–70% of compounds such as pentagalloylglucose and other galloyl-glucose derivatives. In addition to tannins, it also contains a variety of phenolic and flavonoid compounds, also includes gallic acid, methyl gallate, fisetin, and several phenol glycosides and lignans, and triterpenoids and sterols like oleanolic acid, moronic acid, and betulonic acid have been identified in its chemical profile. The leaves contains essential oil constituents, notably palmitic acid, phytol, and n-heptacosane, contributing to its broad range of pharmacological properties[32]

Pharmacological activities of Rhus Species:

Table 1: Pharmacological activities of Rhus Species

Rhus Species	Part Used / Extract	Pharmacological Action	Study Type	Mode of Action
Rhus chinensis [33]	Fruits	Antidiabetic	In vivo (mice, rats)	↓ blood glucose, HbA1c; improved insulin signaling; antioxidant effects
Rhus coriaria [34]	Fruits	Hepatoprotective / Anti-cholestasis	In vivo (mice)	↓ ALT, AST, TNF-α, IL-6; ↑ antioxidant activity; improved bile transporters
Rhus chinensis [35]	Fruits	Anti-ulcer	In vivo (mice)	Prevented gastric ulcer by ↓ ulcer index & pepsin activity
Rhus chinensis [32]	Fruits	Anticancer (antiangiogenic)	In vivo (mice, tumors)	Pentagalloylglucose inhibited angiogenesis & tumor growth
Rhus chinensis [32]	Galls	Antidiabetic (α-glucosidase inhibition)	In vitro	Strong α-glucosidase inhibition; reduced postprandial glucose in rats
Rhus chinensis [36]	Seeds	Antioxidant	In vitro	DPPH scavenging, ferric reducing antioxidant power

Rhus chinensis [36]	Seeds	Anti-inflammatory	In vitro	Inhibition of protein denaturation; RBC membrane stabilization
Rhus chinensis [37]	Whole plant extract	Anti-colitic, Anti-hyperuricemia, Anti-nephropathy	In vivo (mice)	Suppressed colitis & uric acid nephropathy; modulated NF-κB/NLRP3 pathways
Rhus coriaria [38]	Galla chinensis tannins	Wound healing	In vivo	Excision wound model in rats
Rhus coriaria L. [39]	Plant extract	Antibacterial, Antibiofilm, Antioxidant, Antigenotoxic	In vitro	Disrupts bacterial membrane; inhibits biofilm adhesion & quorum sensing
Rhus verniciflua Stokes [40]	Extract	Anticancer / Immuno-oncology	In vitro (ex vivo PBMCs)	Enhanced T-cell cytotoxicity; ↓ PD-1 expression → restored T cell function
Rhus semialata Murr. [41]	Fruit methanol extract	Anti-diarrhoeal	In vivo	↓ Defecation rate (up to 80.7%); ↓ intestinal transit & PGE_2-induced enteropooling
Rhus succedanea[42]	Leaf & root ethanolic extracts; alkaloid & flavonoid fractions	Antibacterial	In vitro	Flavonoid & alkaloid fractions showed higher potency (zones of inhibition, MIC) than crude extracts
Rhus punjabensis[43]	Plant extract-mediated CuO nanoparticles	Antibacterial, Anticancer	In vitro	CuO NPs showed antibacterial activity against B. subtilis, E. coli; cytotoxic activity (HL-60 IC_{50} 1.82 µg/mL, PC-3 IC_{50} 19.25 µg/mL); some NF-κB inhibition
Rhus typhina[44]	Fruit extract	Antimicrobial, Antioxidant	In vitro	Broad-spectrum antibacterial (MIC 0.10% for B. cereus, H. pylori); strong DPPH scavenging (IC_{50} 0.016 mg/mL), reducing power (IC_{50} 0.041 mg/mL)
Rhus trilobata[45]	Stems (aqueous & methanol extracts, fractions)	Antioxidant	In vitro	Free radical scavenging (DPPH, ORAC); inhibits xanthine oxidase; high polyphenol content
Rhus trilobata[46]	Aerial parts (aqueous extract, fractions F2–F6)	Anti-inflammatory	In vitro	Downregulates IL-1β, IL-6, TNF-α, COX-2 & PGE_2; reduces inflammatory infiltration
Rhus glabra[47]	Whole plant methanol extract	Antimicrobial	In vitro	Active compounds (methyl gallate, 4-methoxy-3,5-dihydroxybenzoic acid) disrupt bacterial cell walls and metabolic processes; tannins and phenolics bind proteins and inhibit microbial enzymes
Rhus copallinum[48] (winged sumac)	Pentagalloyl glucose (PGG)	Anti-glycation	In vitro	PGG inhibits early, middle, and late stages of protein glycation by blocking the Maillard reaction steps, preventing AGE formation and protein cross-linking
Rhus aromatic[30] (fragrant sumac)	Root / stem bark aqueous extract	Antiviral (HSV-1, HSV-2)	In vitro	Interacts with viral envelope & host cell surface; blocks adsorption & penetration (no effect post-entry)

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