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Review Article

Whole-Plant Insights into *Lannea coromandelica*: Ethnomedicine, Bioactive Compounds, and Multi-Organ Pharmacology

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ABSTRACT

Lannea coromandelica is a traditionally valued medicinal tree widely used in Ayurveda and various indigenous systems of medicine across South and South east Asia. The present review provides a comprehensive whole-plant perspective integrating ethnomedicinal relevance, phytochemical diversity, pharmacognostic characteristics, and multi-organ pharmacological activities. Different plant parts including bark, leaves, gum, roots, fruits, and stem have been traditionally employed for managing inflammatory disorders, wounds, fractures, gastrointestinal disturbances, ulcers, and infectious diseases. Phytochemical investigations reveal a rich spectrum of bioactive constituents such as flavonoids, tannins, phenolic acids, saponins, alkaloids, steroids, triterpenoids, glycosides, polysaccharides, and natural antioxidants, which collectively contribute to its therapeutic efficacy. Experimental pharmacological studies demonstrate significant antioxidant, anti-inflammatory, antimicrobial, wound-healing, hepatoprotective, gastroprotective, anti-diabetic, anti-arthritis, and cytotoxic potentials. Mechanistically, these activities are associated with free radical scavenging, inhibition of pro-inflammatory mediators, membrane stabilization, modulation of enzymatic pathways, and enhancement of endogenous antioxidant defense systems. Toxicological evaluations indicate a favorable safety profile in acute models, supporting its traditional usage. However, despite promising preclinical evidence, limitations persist regarding extract standardization, molecular mechanism elucidation, metabolomic profiling, and well-designed clinical trials. Overall, this review consolidates dispersed scientific data into a unified framework, highlighting the plant's multi-organ therapeutic potential and emphasizing the need for translational research to validate and develop standardized phytopharmaceutical formulations. A whole-plant investigative approach may facilitate novel drug discovery and promote evidence-based utilization of this ethnomedicinal resource.

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INTRODUCTION

The deciduous tree *Lannea coromandelica* (Houtt.) Merr. (Anacardiaceae), also referred to as the Indian ash or "jingini " is found throughout South and Southeast Asia and has long been used in traditional medical systems to cure a wide range of illnesses. Because this species various plant parts bark, leaves, fruit, and roots are utilized by many groups, interest in it has increased significantly. This provides a rich substrate for phytochemical and pharmacological research that connects ethnobotany with contemporary drug-discovery initiatives. ^[1] The wide range of bioactivity of *L.coromandelica* is thought to be due to its diverse phytochemical landscape, which is rich in secondary metabolites such as phenols, flavonoids, tannins, saponins, and other useful components. In addition to other components like quercetin derivatives and fatty acids, phytochemical investigations have revealed important substances including gallic acid, catechins, chlorogenic acid, and caffeic acid in bark extracts, indicating their antioxidant and therapeutic potential. ^[2] Polyphenols (phenolic acids, flavonoids, condensed tannins), terpenoids, saponins, and alkaloids dominate the heterogeneous profile revealed by phytochemical surveys of *L.coromandelica* HPLC and HPTLC fingerprinting across multiple studies have identified specific markers such as gallic acid, catechins, chlorogenic and caffeic acids, which likely underlie many of the plant's bioactivities. It has frequently been suggested that standardized phytochemical mapping and marker-based quality control (HPTLC/HPLC) provide repeatable pharmacology and facilitate lead molecule isolation. ^[3] Indigenous and rural communities have long revered this tree for its therapeutic properties. It is used for healing wounds, fever, diarrhea, gastrointestinal issues, and general debility is frequently reported in ethnobotanical

surveys, demonstrating its ingrained involvement in traditional medical practices. Scientific interest in confirming and comprehending the underlying underpinnings of its therapeutic efficacy has been directed by these ethnomedical applications. ^[4]

Botanical Description -

Nomenclature and Taxonomy

Lannea coromandelica is a member of the Sapindales order, specifically the Anacardiaceae family. A group of tropical deciduous trees with major ethnobotanical significance is the genus *Lannea*. and locally known as Modhad, Moi, or other similar vernacular names in India and nearby regions, the Indian ash tree is commonly described to in English as *Lannea coromandelica* (Houtt.) Merr., which is the accepted botanical name. ^[5]

Habit and Morphology

Lannea coromandelica is a moderate- to large-sized deciduous tree reaching approximately 10–24 m in height. The trunk is covered with coarse, fibrous bark that peels off in uneven flakes, displaying a grey to dark brown exterior. The young branchlets are characteristically covered with fine stellate (star-shaped) trichomes. Leaves are arranged alternately and are imparipinnate, bearing 5–11 leaflets that range from oblong-ovate to lanceolate in shape. The leaflet surface is generally smooth (glabrous), although young leaves may exhibit slight pubescence during early developmental stages.

Scientific names –



Language	Name
Botanical name	<i>Lannea coromandelica</i> (Houtt.) Merr.
English	Indian Ash Tree
Hindi	Jhingan
Marathi	Moi
Tamil	Udai
Telugu	Jidigam
Kannada	Nandi
Sanskrit	Sriparni

Ethnomedicinal Uses- ^[8]

Bark- The bark of *Lannea coromandelica* is widely utilized in traditional medicine for the management of wounds and ulcerative conditions. It is commonly applied topically in various formulations, including decoctions, poultices, and paste preparations, to alleviate inflammation and enhance the healing process. Indigenous communities employ these preparations on cuts, persistent wounds, and inflamed tissues to facilitate tissue regeneration and reduce inflammatory responses, as documented in ethnomedicinal reports.

Roots- The roots of *Lannea coromandelica* are employed for the treatment of various gastrointestinal disorders, including dysentery and abdominal discomfort. Typically administered as decoctions or macerated infusions, root preparations are used to improve digestive function and alleviate gastrointestinal ailments in indigenous medicinal practices.

Fruit - Ethnomedicinal documentation indicates that the fruits of *Lannea coromandelica* are traditionally employed in the management of fish poisoning and as a supportive remedy for digestive

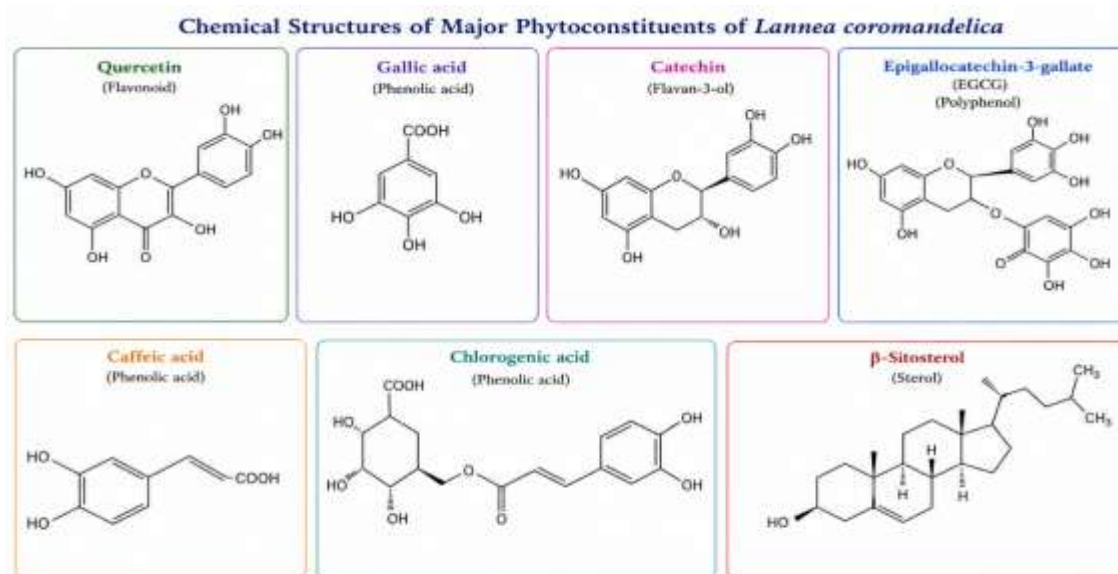
health. The fruits are commonly crushed or otherwise processed before administration to improve gastrointestinal function. Their therapeutic value is also associated with the presence of bioactive phytoconstituents that may exert antioxidant effects.

Leaves - In traditional medical systems, the leaves of *Lannea coromandelica* are prepared as extracts or topical pastes to treat boils, ulcerative lesions, edema, and associated pain. The expressed leaf juice is administered either externally or orally to relieve inflammatory conditions. Experimental ethnopharmacological studies further substantiate these traditional claims by demonstrating significant antinociceptive (analgesic) activity of leaf extracts in validated animal models.

Stem bark - The stem bark and wood of *Lannea coromandelica* are commonly formulated as decoctions or topical pastes for their astringent properties. These preparations are used internally to manage conditions such as diarrhea and externally for treating ulcerative and inflammatory lesions. The observed astringent activity is primarily attributed to the abundant tannin content present in the woody tissues.

*Lannea coromandelica***Phytochemistry of Plant -**

Plant Part	Phytochemical Constituents	Specific Compounds Identified	Remarks / Biological Significance	References
Bark	Flavonoids, Tannins, Phenolic acids, Sterols, Fatty acids	Quercetin, Protocatechuic acid, <i>p</i> -Hydroxybenzoic acid, β -sitosterol derivatives, Aralia cerebroside, Gallic acid, Catechin, Epigallocatechin-3-gallate (EGCG), Chlorogenic acid, Caffeic acid	Strong antioxidant activity due to high phenolic and flavonoid content; confirmed by HPLC profiling	[3,8]
Leaves	Flavonoids, Steroids, Saponins, Terpenoids, Tannins, Phenolics, Glycosides	Flavonoid-rich fractions, Steroidal compounds, Glycoside-like substances, Saponins	Contributes to antioxidant and antibacterial activity; supports traditional medicinal uses; high total phenolic content correlates with bioactivity	[9,10]
Fruits	Phenolics, Flavonoids, Antioxidants, Vitamin C (reported but not fully quantified)	Not well-characterized individually	Exhibits antioxidant and antibacterial properties; presence of bioactive phytochemicals suggested	[10]
Roots	Alkaloids, Phenolic acids, Tannins, Secondary metabolites	Not specifically characterized in detail	Limited studies available; general presence of bioactive secondary metabolites reported in <i>Lannea</i> species	[1]



Note: Structures are drawn in standard chemical representation. These compounds are key contributors to the pharmacological activities of *Lannea coromandelica*.

Pharmacological Activities

Wound Healing Activity:

Hemostasis, inflammation, proliferation (including fibroblast migration and collagen deposition), and remodeling are all part of the intricate physiological process of wound healing. By encouraging fibroblast proliferation, boosting collagen production, lowering oxidative stress, and having antimicrobial properties that stop infection-related healing delays, plant-derived bioactive substances can positively affect these phases. In ethnomedicine, the traditional application of *Lannea coromandelica* bark and leaf extracts for wounds and skin injuries suggests inherent qualities that favorably impact tissue regeneration processes, including collagen deposition.^[8]

Anti-inflammatory Activity-

Many chronic diseases, such as liver damage, neurodegeneration, arthritis, cardiovascular ailments, and metabolic syndromes, are primarily caused by inflammation. Inflammatory responses are mediated by cyclooxygenase enzymes (COX-

1 and COX-2) and pro-inflammatory cytokines such TNF- α , interleukin-1 β (IL-1 β), and interleukin-6 (IL-6). *L. coromandelica* has historically been used medicinally to treat wounds, pain, swelling, fever, and gastrointestinal inflammation. This shows that the plant may work by modifying these inflammatory mediators. Phytochemical studies have shown that *L. coromandelica* polyphenolic compounds, especially phenolic acids (gallic acid, chlorogenic acid, caffeic acid) and flavonoids (catechin, epicatechin, quercetin derivatives), which are well known for their capacity to inhibit COX enzymes and suppress prostaglandin synthesis. These substances can mimic the action of non-steroidal anti-inflammatory drugs (NSAIDs) but may be less toxic by directly interfering with the metabolism of arachidonic acid and reducing the production of pro-inflammatory prostaglandins.^[11] Experimental studies using in vivo inflammatory models have provided evidence for the COX-mediated anti-inflammatory action of *L. coromandelica*. Ethanolic and methanolic bark extracts significantly reduced paw edema and inflammatory cell infiltration in animal models, indicating suppression of prostaglandin-dependent

inflammatory pathways. Such effects are consistent with inhibition of COX-2 expression and downstream inflammatory mediators, supporting the traditional use of bark preparations for pain and inflammation. [2]

L. coromandelica's anti-inflammatory properties are intimately associated with its antioxidant signaling pathways at the molecular level. Bark extract has been demonstrated to indirectly reduce inflammatory signaling cascades, including NF- κ B-mediated cytokine production, via activating the Nrf2/HO-1 pathway. *L. coromandelica* inhibits the redox-sensitive amplification of inflammatory cytokine production by boosting cellular antioxidant defense and lowering reactive oxygen species (ROS). [3] Crucially, *L. coromandelica* is positioned as a multi-target anti-inflammatory drug due to its combination suppression of pro-inflammatory cytokines and inhibition of COX enzymes. For chronic inflammatory disorders, where prostaglandin synthesis and cytokine signaling both contribute to the course of the disease, such dual regulation is especially pertinent. The plant's potential therapeutic use in inflammatory liver illnesses, neuroinflammation, gastric damage, and other inflammation-driven pathologies is supported by its pleiotropic anti-inflammatory profile [5,8].

Antioxidant Activity: DPPH and FRAP Assays Show Strong Activity

A major factor in the pathophysiology of many chronic diseases, such as inflammation, neurodegeneration, and liver damage, is oxidative stress, which arises from an imbalance between endogenous antioxidant defenses and reactive oxygen species (ROS). Free radicals can be neutralized by natural antioxidants found in medicinal plants, shielding cellular constituents from oxidative damage. *L. coromandelica* has long been used to treat conditions where oxidative

stress is a factor. This has led to research into the plant's antioxidant potential using well-established tests like FRAP (Ferric Reducing Antioxidant Power) and DPPH (2,2-diphenyl-1-picrylhydrazyl) tests. Leaf extracts from *L. coromandelica* exhibit potent free-radical scavenging action in DPPH tests, according to quantitative in vitro research. With an EC₅₀ value of 63.9 ± 0.64 μ g/mL, the ethyl acetate fraction (EAF) of methanolic leaf extract demonstrated exceptional DPPH scavenging, indicating strong hydrogen-donating and electron-transfer antioxidant ability. Increased radical neutralization capacity is strongly correlated with high total phenolic and flavonoid contents in these fractions, highlighting the function of phenolic phytochemicals in antioxidant activity. In vivo evidence further supports antioxidant efficacy: ethyl acetate fractions of leaf extract enhance hepatic antioxidant enzyme activity and decrease lipid peroxidation products (like MDA) in chemically intoxicated animal models, validating both preventive and therapeutic potential against oxidative damage. Phenolic compounds are widely recognized as principal drivers of antioxidant activity. Correlative studies between total phenolic content and DPPH/FRAP values in *L. coromandelica* confirm a strong positive relationship, indicating that higher concentrations of phenols and flavonoids enhance radical scavenging and reducing power. [13] Similarly, studies comparing DPPH scavenging between plant parts confirm that *L. coromandelica* methanolic extracts from both bark and leaves exhibit significant free radical scavenging, with IC₅₀ values in the low tens of μ g/mL, reflecting high antioxidant potency relative to standard antioxidants like ascorbic acid. These findings establish that different plant parts possess robust radical-quenching activity, further validating the whole-plant relevance of *L. coromandelica*. [14]



Ferric reducing antioxidant power (FRAP) evaluations, which test plant extracts' capability to convert Fe^{3+} to Fe^{2+} , offer supplementary measurements of antioxidant capacity in addition to DPPH experiments. High reducing power is positively correlated with total phenolic content, showing significant electron transfer ability, according to research on *L.coromandelica* and other phenolic-rich plant extracts. Analogous antioxidant assessments reveal that fractions with significant phenolic and flavonoid contents consistently exhibit enhanced FRAP values, suggesting robust reductive antioxidant capability, even though particular FRAP values for *L. coromandelica* are less commonly published.^[15] Overall, the antioxidant activity of *L.coromandelica* demonstrated through multiple assays (DPPH and FRAP) substantiates its therapeutic relevance in counteracting oxidative stress. This activity provides a biochemical basis for its traditional use in disorders involving oxidative damage, and supports further development of *L.coromandelica* derived phytochemicals for antioxidant therapy.

Antimicrobial Activity: Wide-ranging Antifungal and Antibacterial Characteristics

The limits of traditional antibiotics and the rising incidence of antimicrobial resistance have rekindled scientific interest in antimicrobial medicines derived from plants. The extensive antibacterial and antifungal properties of *Lannea coromandelica*, which is traditionally used in Ayurvedic and folk medicine to treat infectious illnesses like dysentery, wounds, sore eyes, and genital sores, has been studied. Secondary metabolites like tannins, flavonoids, phenols, saponins, and terpenoids have been linked to the antimicrobial activity of many plant components, especially bark and leaves. These compounds can damage microbial cell walls, prevent enzyme

activity, and obstruct microbial replication. *L.coromandelica* extracts have been shown in numerous in vitro investigations to have strong antibacterial activity against both Gram-positive and Gram-negative bacteria. For instance, bark extracts in ethanol and ethyl acetate prevented the growth of *Vibrio parahaemolyticus*, *Pseudomonas* species, *Staphylococcus aureus*, and *Escherichia coli*, demonstrating broad spectrum antibacterial effectiveness. These effects were more noticeable in extracts with higher polarity, probably as a result of better extraction of flavonoid and phenolic components, which are known to inhibit enzymes and disturb membranes.^[16] According to a study that used agar well diffusion experiments, ethanolic bark extracts of *L. coromandelica* inhibited clinically significant bacterial pathogens, such as *Streptococcus pyogenes* and *Staphylococcus aureus*, with zones of inhibition larger than 16 mm at higher extract concentrations. The plant's ethnobotanical application in bacterial and fungal diseases was supported by the same extracts' antifungal effectiveness against *Candida albicans*, a common opportunistic fungal pathogen.^[17] Studies evaluating the suppression of wood-rot fungi (*Schizophyllum commune*) by bark and stem extracts have shown that *L.coromandelica* extracts have antifungal qualities in addition to antibacterial activity. Fungal mycelial growth was significantly inhibited at higher extract concentrations, indicating a dose-dependent antifungal effectiveness. These results point to prospective uses of *L.coromandelica* in natural preservation and biocontrol, where fungal contamination is a problem, in addition to medical settings.^[18] The antibacterial activity of various plant parts of *L. coromandelica* against pathogens linked to skin and gastrointestinal infections, such as *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Pseudomonas aeruginosa*, *Propionibacterium acnes*, *Escherichia coli*, *Salmonella typhi*, *Shigella dysenteriae*, and *Vibrio*



cholerae, is further confirmed by additional research concentrating on leaf extracts. These findings demonstrate the plant's broad antibacterial range and imply that both leaves and bark may be investigated for the development of antimicrobial treatments. ^[19,20] In conclusion, *Lannea coromandelica* has a wide range of antibacterial properties against bacterial and fungal infections that are clinically significant. These results highlight the plant's potential as a natural source of new antibacterial chemicals for upcoming pharmaceutical development and validate its historic usage for treating infectious disorders.

Gastroprotective Activity: Anti-Diarrheal and Anti-Secretory Actions

Traditional medical systems frequently treat gastrointestinal diseases, such as diarrhea and damage to the stomach mucosa. Throughout its native region, *Lannea coromandelica* has been used ethnomedically to treat diarrhea, dysentery, and general gastrointestinal pain, suggesting that it may have gastroprotective properties. Its historic use in gastrointestinal disorders and scientific investigation of its anti-diarrheal and anti-secretory properties are supported by phytochemical constituents such as tannins, flavonoids, and saponins, which are known to decrease intestinal secretion and motility. In models of chemically induced gastric damage, *L. coromandelica* shows protective benefits on the stomach mucosa beyond diarrhea. In rats with stomach injury caused by mefenamic acid, an ethanolic stem bark extract dramatically restored the architecture of the gastric mucosa and decreased the infiltration of inflammatory cells. Although thorough mechanistic research is still required, this mucosal repair indicates that *L. coromandelica* has gastroprotective effects that may include enhancing defensive variables like

mucus and bicarbonate secretion and reducing inflammatory insult to the gastric lining. ^[21] Research employing *L. coromandelica*'s methanolic bark extract shows strong anti-diarrheal effects in lab animals. Methanolic bark extract given at doses of 100–200 mg/kg body weight significantly decreased the frequency and intensity of diarrheal stools in mice with castor oil-induced diarrhea and magnesium sulfate induced diarrhea as compared to control groups. In charcoal meal transit tests, the extract also markedly reduced gastrointestinal motility, suggesting reduction of hyperactive intestinal transit, a crucial mechanism in anti-diarrheal therapy. These effects are in line with conventional assertions that it can be used to treat diarrhea since they show a decrease in intestinal peristalsis and secretion. ^[22]

L. coromandelica exhibits anti-secretory properties in addition to reducing inflammation. In mouse models, a pharmacological assessment of methanolic leaf extracts revealed a marked reduction in the amount and acidity of gastric juice together with a concurrent rise in gastric pH, suggesting suppression of aggressive gastric secretory processes that lead to the development of ulcers. Its function as a gastroprotective drug was supported by these effects, which were shown in conjunction with decreases in the ulcer index and protection against aspirin-induced stomach mucosal damage. ^[23]

The gastroprotective effects of *L. coromandelica* extract are probably multifactorial in nature.

- anti-secretory properties decrease the production of fluid and gastric acid;
- Mucosal tissues are shielded from oxidative and inflammatory damage by anti-inflammatory and antioxidant properties (such as flavonoid-mediated suppression of pro-inflammatory pathways);



- Antimicrobial activities may lessen gastrointestinal irritation brought on by pathogens, helping to alleviate the symptoms of dysentery and diarrhea. ^[24]

Collectively, these pharmacological attributes reinforce the ethnomedicinal claims of *Lannea coromandelica* for gastrointestinal ailments and support its continued exploration as a natural gastroprotective agent with both anti-diarrheal and anti-secretory mechanisms.

Hepatoprotective: Protection from chemical-induced liver damage.

The liver plays a key role in detoxification and maintaining metabolic balance, which renders it vulnerable to harm from xenobiotics like carbon tetrachloride (CCl₄), thioacetamide (TAA), and acetaminophen. These substances induce oxidative stress, lipid peroxidation, and disruption of hepatocyte membranes. It has been demonstrated that medicinal plants containing antioxidant phytochemicals can protect the liver by reducing oxidative stress, maintaining membrane integrity, and normalizing biochemical parameters in experimental liver injury models. ^[25] *Lannea coromandelica* bark has been traditionally used in ethnomedicine for liver-related conditions such as hepatitis and jaundice, indicating a possible hepatoprotective effect associated with its phytochemical constituents, including flavonoids, phenols, tannins, and terpenoids. An important experimental study examined the hepatoprotective and antioxidant effects of *L. coromandelica* bark extract (LCBE) on TAA-induced hepatotoxicity in rats. Serum liver enzymes (AST, ALT, ALP) and bilirubin levels rose significantly due to TAA administration, indicating liver damage. In contrast, oral treatment with LCBE at doses of 200–400 mg/kg led to a marked reduction of these serum parameters in a dose-dependent manner, suggesting the restoration of liver function. The

hepatoprotection was concurrently supported by antioxidant activity demonstrated through DPPH radical scavenging (IC₅₀ ≈ 83 µg/mL), suggesting that phenolic groups and flavonoids contribute directly to free radical neutralization and liver protection. ^[26] Studies comparing other medicinal plants corroborate the significance of antioxidant mechanisms in liver protection. In treatments employing CCl₄-induced hepatic injury models, plants rich in phenolic and flavonoid compounds have been shown to consistently normalize elevated serum transaminases, decrease levels of malondialdehyde (MDA), a marker of lipid peroxidation, and restore reduced antioxidant enzyme activities. This further underscores the importance of antioxidant action in protecting the liver from toxic damage. ^[27] Hepatoprotective botanicals often restore biochemical markers and exhibit histological preservation of liver architecture, preventing centrilobular necrosis, cellular degeneration, and inflammatory infiltration. This structural protection is ascribed to diminished oxidative and inflammatory signaling in hepatocytes, resulting in enhanced liver regeneration and function. Although there are not many detailed histopathological studies specifically on *L. coromandelica*, such effects have been extensively documented in other hepatoprotective plant models. This reinforces the idea that effective hepatoprotection is based on antioxidants and anti-inflammatory phytochemicals. ^[28] Overall, the hepatoprotective effects of *Lannea coromandelica* shown against liver damage caused by chemicals are closely associated with its antioxidant properties, which alleviate oxidative stress, stabilize hepatocyte membranes, reduce enzyme leakage, and aid in tissue regeneration. The results confirm customary ethnomedicinal applications and establish *L. coromandelica* as a promising natural source of hepatoprotective phytotherapeutics.



Anti-diabetic: Enzyme inhibition and glucose tolerance improvement

Lannea coromandelica (Houtt.) Merr., which is commonly employed in traditional medicinal practices throughout Asia for the treatment of metabolic disorders, has been ethnobotanically acknowledged for its possible antidiabetic properties. The traditional uses of the substance have spurred preclinical studies examining its impact on glucose regulation and related metabolic parameters in experimental models. Phytochemical investigations reveal that *L.coromandelica* comprises a variety of bioactive components, including flavonoids, phenolic acids, tannins, and other polyphenols, which are recognized for their role in regulating carbohydrate metabolism and insulin signaling pathways. An important in vivo experiment evaluated the potential of *L. coromandelica* leaf water extract to act as an antidiabetic agent in Wistar rats with diabetes induced by streptozotocin (STZ). Due to its selective damage to pancreatic β -cells, the STZ model is commonly employed to replicate the pathophysiology of both type 1 and type 2 diabetes, which leads to increased blood glucose levels. The aqueous extract, when administered orally, resulted in a significant reduction of fasting blood glucose levels in diabetic rats compared to untreated controls. This suggests that the plant extract has a hypoglycemic effect. The glucose-lowering effect was ascribed to improved peripheral glucose utilization and heightened hepatic glycogen synthesis, in line with the effects of flavonoids and phenolic compounds present in the plant. [29] The mechanisms that underlie the action of diabetes medications seem to be multifaceted, encompassing both enhancements in glucose homeostasis and diminutions in oxidative stress an important factor in pancreatic β -cell dysfunction. Research into the antioxidant profile of *L.*

coromandelica found that its bark extract significantly boosted the expression of antioxidant enzymes through NRF2/HO-1 signalling in vitro. This enhancement is associated with a reduction in oxidative damage to metabolic tissues and improved insulin sensitivity. This antioxidant mechanism bolsters the idea that *L.coromandelica* could shield pancreatic cells from oxidative damage, which plays a crucial role in the advancement of diabetes. [3] Although there are limited direct studies of in vitro enzyme inhibition specific to *L. coromandelica*, research on medicinal plants suggests that extracts high in flavonoids can inhibit carbohydrate-digesting enzymes such as α -glucosidase and α -amylase. This leads to a postponement of glucose absorption and an improvement in postprandial glycaemic control. Given the high concentrations of flavonoids and phenolics in *L.coromandelica*, similar mechanisms are probable and warrant investigation through targeted biochemical studies in future research. [8] In a recent experiment, the potential of an ethanol extract of plant leaves to act as an antidiabetic agent was assessed in male mice with alloxan-induced diabetes. The authors dosed diabetic mice with the ethanolic leaf extract in amounts of 10, 20, and 40 mg/kg body weight, while also using glibenclamide (0.65 mg/kg) as a positive control. The results showed that all doses of the *L. coromandelica* leaf extract led to a significant reduction in blood glucose levels when compared to the vehicle control. This suggests a strong hypoglycaemic effect, likely due to flavonoids and glycosides found in the leaves that are known to promote insulin secretion or glucose uptake. [30] Comparative evidence from systematic reviews underscores that the antidiabetic effects of *L. coromandelica* extracts tend to show glycemic improvement, although some studies indicate variable statistical significance that may be attributed to differences in extract preparation, dosages, and treatment durations. Nevertheless,

data compiled from various research reports indicate a promising yet still insufficiently investigated antidiabetic profile, especially when combined with synergistic botanical compounds or through enriched extract formulations.^[31] Preclinical findings collectively suggest that *Lannea coromandelica* may serve as an antidiabetic phytotherapeutic by reducing blood glucose levels, providing antioxidant support to insulin-producing cells, and possibly modulating carbohydrate metabolism. To confirm its potential therapeutic use in diabetes management, further research focusing on dose optimization, detailed enzyme inhibition studies, and clinical trials will be essential.

Anti-arthritic & Antinociceptive effect

Arthritis and impaired fracture healing are characterized by inflammation and degeneration of the joints. A variety of traditional medicinal systems, such as Ayurveda and tribal healing practices, utilize botanicals known for their anti-inflammatory, analgesic, and tissue-regenerative effects to address issues like arthritic pain, swelling, and bone injuries. Ethnobotanically, *Lannea coromandelica* is reported to be used for pain, inflammation, sprains, bruises, and aches, which culturally overlaps with indications similar to arthritis and fracture healing. Traditionally, the bark, leaves, and resinous extracts have been used as poultices or decoctions to alleviate joint and musculoskeletal pain, in accordance with ancient practices for treating inflammatory conditions.^[32] While there are not many scientific studies that directly assess the anti-arthritic effects of *L. coromandelica*, its anti-inflammatory and antinociceptive activities offer significant mechanistic support for its potential therapeutic use in arthritis-related conditions. Ethanol extracts from *L. coromandelica* leaves show considerable antinociceptive effects in mice subjected to

chemical and heat-induced pain, indicating the involvement of both peripheral and central analgesic mechanisms. These effects are pertinent to arthritis, where pain and inflammation are the main symptoms, and may indicate the plant's capacity to regulate pathways involved in joint pain.^[33]

L. coromandelica's anti-inflammatory profile also bolsters its possible significance in relation to anti-arthritis. Phytochemical investigations demonstrate that the plant includes flavonoids, polyphenols, tannins, and various other bioactive substances, all of which have been broadly linked to the suppression of pro-inflammatory mediators (such as prostaglandins and cytokines). While these phytochemicals may downregulate pathways that contribute to joint inflammation and pain in arthritis, specific studies using *L. coromandelica* extracts have yet to be reported.^[8] Although there is no direct pharmacological evidence specific to *L. coromandelica* for arthritis or fracture repair in published studies, broader research on *Lannea* and related anti-inflammatory medicinal species suggests that it is mechanistically plausible. Other species within the *Lannea* genus and related Anacardiaceae plants are traditionally used for conditions such as rheumatism, swelling, and pain. Their bioactive components demonstrate anti-oxidant, anti-inflammatory, and anti-nociceptive effects in validated models, which serve as the basis for anti-arthritic effects.^[1] To sum up, although there is currently a lack of direct experimental data on the anti-arthritic and fracture-healing effects of *Lannea coromandelica*, its traditional uses for treating inflammation, pain, body aches, and sprains along with preclinical findings demonstrating antinociceptive and anti-inflammatory effects suggest that it may have biological relevance for arthritis-related conditions. It will be essential for future studies employing specific models of arthritis and



fractures to validate these time-honored assertions and clarify exact molecular processes.

Cytotoxic potential: Preliminary anticancer findings.

Due to the limitations of conventional chemotherapeutics, such as toxicity and drug resistance, the search for new anticancer agents derived from medicinal plants has intensified in recent years. *Lannea coromandelica*, which has been utilized in traditional medicine for various health issues, is gaining scientific attention for its cytotoxic properties against cancer cell lines. This interest reflects its wide range of bioactivities that may be associated with phenolic and flavonoid phytochemicals. The cytotoxic effects of *L.coromandelica* extracts may be mechanistically linked to the presence of polyphenols (such as quercetin and catechin), triterpenoids, and other bioactive classes that phytochemical profiling studies have identified as abundant in the bark and leaf tissues.^[8] A recent in vitro investigation demonstrated that extracts of *Lannea coromandelica* bark exhibit significant anticancer activity against the B16F10 melanoma cell line, with both ethanol and aqueous extracts showing cytotoxic effects in the MTT assay. The ethanol extract showed strong cytotoxic effects, with an IC_{50} of $9.69 \pm 0.68 \mu\text{g/mL}$, in contrast to the aqueous extract ($IC_{50} = 75.49 \pm 5.95 \mu\text{g/mL}$). This suggests that lipophilic and moderately polar compounds from the bark can compromise cancer cell viability. The formation of apoptotic bodies, as seen through DAPI staining, provided additional evidence for the initiation of programmed cell death. This study utilized molecular docking analysis alongside standard cytotoxic assays to investigate the interactions of key phytoconstituents (such as quercetin, catechin, and myricadiol) with the melanoma-related target tyrosinase-related protein 1 (TYRP1). The

findings indicated strong binding affinities. These computational findings support the idea that secondary metabolites plentiful in *L. coromandelica* may engage with cancer-related proteins, possibly aiding in growth inhibition.^[34] Previous screening studies have also recognized the cytotoxic potential of ethanol-water extracts from *L.coromandelica* twigs on human hepatocellular carcinoma (HepG2) cells. In a comparative assessment, the crude twig extract exhibited moderate cytotoxicity in HepG2 cells and induced apoptosis in over 50% of treated cells, as shown by DAPI staining and DNA fragmentation assays, highlighting its apoptosis-mediated anticancer effect.^[35] Although these findings are preliminary and mainly based on in vitro assays, they emphasize the anticancer potential of *L.coromandelica* and warrant further investigation using broader cell line panels, in vivo tumor models, and mechanistic assessments (e.g., cell cycle arrest, reactive oxygen species modulation, caspase activation). Such research could shed light on how clinically relevant the cytotoxicity observed is, and assist in singling out lead compounds for anticancer drug development.

Wound Healing Activity:

Hemostasis, inflammation, proliferation (including fibroblast migration and collagen deposition), and remodeling are all part of the intricate physiological process of wound healing. By encouraging fibroblast proliferation, boosting collagen production, lowering oxidative stress, and having antimicrobial properties that stop infection-related healing delays, plant-derived bioactive substances can positively affect these phases. In ethnomedicine, the traditional application of *Lannea coromandelica* bark and leaf extracts for wounds and skin injuries suggests inherent qualities that favorably impact tissue



regeneration processes, including collagen deposition. [8].

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