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A Comprehensive Review on Cinnamomum Tamala : Phytochemistry , Pharmacological Activities and Therapeutic Potential

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Abstract: *This article outlines the external appearance, chemical constituents, and therapeutic relevance of Cinnamomum tamala, a member of the Lauraceae family. This species thrives naturally across regions such as the Khasi range, the Nilgiri mountains, the warm–temperate Himalayas, and the foothills surrounding Sikkim.The aromatic foliage, commonly recognized as Indian bay leaf, represents an underappreciated culinary ingredient utilized throughout South Asia. These dried blades impart a soothing, spicy, clove-like and cinnamon-resembling aroma to numerous traditional preparations. Beyond flavor applications, the leaves have long been employed in folk practices for addressing assorted ailments and are associated with multiple claimed physiological benefits.The Yunani, Aurvedic, and other traditional medical texts mention them. Cinnamomum tamala is recognized as an aromatic medicinal herb valued for its extensive therapeutic attributes. This summary integrates diverse scientific findings regarding its chemical constituents, healing mechanisms, and possible medical applications. Its foliage and additional botanical sections are rich in multiple secondary metabolites such as terpenoids, essential oils, phenolic derivatives, and numerous physiologically active molecules responsible for various advantageous effects. Research observations reveal notable glucose-lowering, free-radical-neutralizing, lipidbalancing, antimicrobial, ulcer-protective, inflammation-reducing, heart-supporting, and tissuepreserving actions. These biological outcomes are associated with modulation of metabolic functions, enhancement of digestive tract protection, attenuation of oxidative injury, and regulation of key enzymatic activities. However, despite substantial laboratory evidence confirming its therapeutic value, consistent dosing guidelines, prolonged safety assessment, and human-based confirmation are still insufficient.*

Keywords: Cinnamomum tamala, Tejpatta, eugenol, antidiabetic, antiinflammatory, anticancer, anti ulcer

I. INTRODUCTION

The fragrant medicinal plant Introduction:-The plant identified as Cinnamomum tamala, attributed to Buchanan-Hamilton, Nees, and Ebermayer, bears the traditional names Tejpata and Indian culinary foliage. It is classified within the Laural botanical group and thrives across the mountainous zones spanning Indian territories, Nepali landscapes, and Bhutanese highlands, a Myanmar are home to this medium-sized evergreen tree, which is indigenous to the Indian subcontinent. In addition to being a common spice and seasoning in Indian cooking, the leaves of C. tamala have important medicinal uses in traditional medical systems including Ayurveda, Siddha, and Unani (1)The plant is well known for its distinctive scent. C. tamala has been acknowledged for its pharmacological qualities, which include antioxidant, antidiabetic, antibacterial, antiinflammatory, cardioprotective, and hepatoprotective effects, in addition to its culinary significance. The plant's leaves, bark, and roots are all used to treat conditions like rheumatism, respiratory conditions, diarrhea, indigestion, and diabetes.[1] . The herb is recognized for its strong fragrance and its broad benefits for general health. Interest among researchers has steadily increased because different sections of the plant hold many useful natural materials. These include scented extracts, active plant molecules, and protective plant nutrients that, according to experiments, play important roles in offering different soothing, healing, and body-supporting effects.(2)

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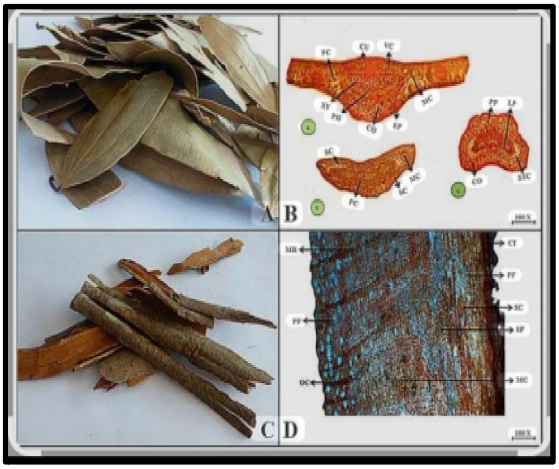
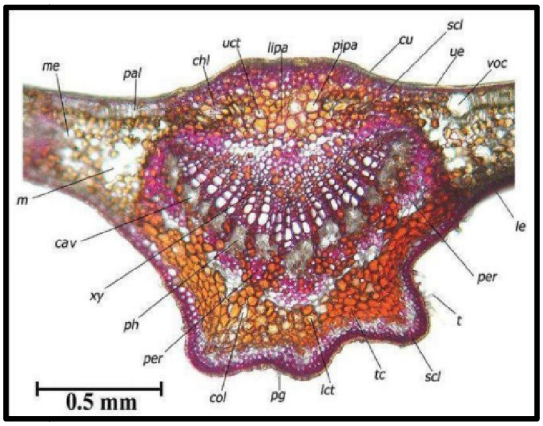
Synonyms : Indian bay leaves, Tejpatta, Tejptra ,
Biological source : It consist dried leaves of Leafy structures from Cinnamomum tamala.• Taxonomic Category :- Laural Lineage

Geographical Source

This botanical species is endemic to territories across the Indian realm, Nepali highlands, Bhutanese landscapes, and adjoining Southeast Asian areas.Its sun-dried leaf blades function as a gastronomic additive, aroma-producing component, and age-old therapeutic resource.It is native to the subcontinental zone and occurs extensively within tropical and mild-tropical environments of India, Nepal, Bhutan, and the Myanmar region.For countless centuries, the plant has been incorporated into traditional healing knowledge and valued as a spice element in Indian and Southeast-Asian culinary systems.(3)



Macroscopic Characters • Leaf : Simple, alternate, lanceolate, leathery texture, aromatic odour • Dimensions :- Approximately 5–15 centimeters in length and 2–5 centimeters across. • Colour : Dull green when fresh, olive or brownish-green when dried. • Surface : Smooth and glossy on the upper surface; slightly rough below • Venation : Prominent three parallel veins running from base to apex (characteristic feature). • Odour : Strong, aromatic (cinnamon-like • Taste : Slightly bitter, spicy, and aromatic (3).
Microscopic Characters • Epidermis : Single-layered with cuticle; both surfaces show paracytic stomata (rare on upper surface). • Mesophyll : Internal Leaf Tissue: :- Organized into columnar chlorenchyma and loosely arranged aerated cells, with aromatic reservoirs and specialized secretory elements present.• Oil glands : - Scattered, secreting volatile oils. • Islet Density: :- Measured at six to eight structures in every mm².• Vein End Density: :- Recorded at seven to nine tips per square millimetre.• Epidermal Outgrowths: :- Simple, unicellular, occasionally present on lower surface.(4)



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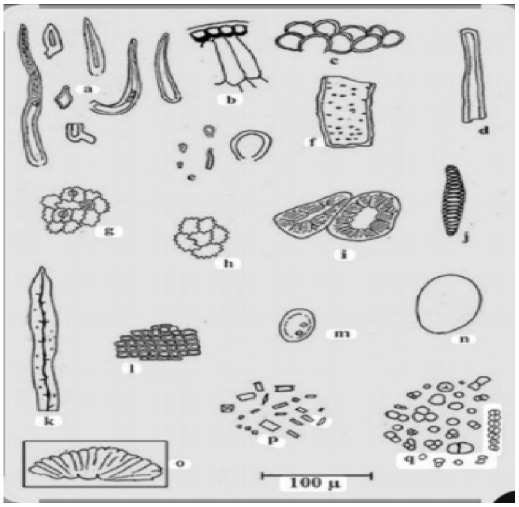
Powder Characteristics Colour :Brownish-green • Odour : Aromatic • Taste : Pungent and spicy. • Microscopic Features : Fragments of epidermal cells with stomata, oil globules, calcium oxalate crystals, tracheids, and fibers observed under microscope.(5)**.**

Epidermal cells are polygonal, wavy-walled cells, some of which have globules of oil. The majority of stomata are paracytic, meaning they have two subsidiary cells that run parallel to the guard cells. Crystals of calcium oxalate can be prismatic or micro-rosette. The scent is caused by oil cells, which are numerous and contain volatile oil. Fibers: You may see long, narrow, lignified fibers. Parenchyma fragments: Containing brown-colored material and starch granules. Vessels: There are pitted and spiral vessels. Trichomes: There may be simple, uniseriate covering trichomes. (6)

Chemical Constituents

The plant contains a "encompasses diverse biologically influential substances, including fragrant phytochemical essences"o Essential oils (for example ., cinnamaldehyde, eugenol, linalool) o Alkaloids 5o Tannins o Glycosides o Flavonoids :- The essential oil obtained from its leaves contains major constituents such as cinnamaldehyde, eugenol, linalool, and β-caryophyllene, "valued for their powerful pathogen-suppressing, oxidative-stress-lowering, and swelling-controlling activities."o Volatile oils: Cinnamaldehyde, eugenol, linalool, β-caryophyllene, and cinnamyl acetate. o Flavonoids: Quercetin, kaempferol, and catechin. o Tannins, alkaloids, and glycosides. These compounds are responsible for its therapeutic and aromatic properties. **(7)**



Ethnomedicinal Uses

In traditional medicine, the foliage and outer stem layers .• They are employed for managing gastrointestinal issues."disorders (flatulence, indigestion) • Respiratory ailments (cough, bronchitis) • Diabetes mellitus • Cardiac and hepatic dysfunctions :- Indian cassia, referred to botanically as Cinnamomum tamala, represents a long-living tropical species categorized under the Lauraceae lineage. It serves as a common aromatic enhancer in various dishes and is frequently included in therapeutic formulations due to its glucoseregulating impact, energizing effects, and gas-relieving actions. The leaf blades function as a culinary condiment, imparting a clove-resembling flavour and a sharp, spicy scent. The extracted aromatic liquid from these leaves shows strong suppression of harmful microbes. Numerous scientific evaluations have been carried out on the essential-oil profile of this species; however, its oleoresin components remain relatively under-investigated. The current work, undertaken within an active research framework, presents a detailed overview of the chemical constituents and pharmacodynamic significance of its volatile extract and associated compounds. The central purpose of this article is to offer a comprehensive phytopharmaceutical survey of C. tamala.This species holds an established position in ancient Indian therapies. Its leaf surfaces and bark layers exhibit fragrant, toning, energizing, and digestive-soothing properties and are applied for joint stiffness, intestinal cramps, loose stools, queasiness, and retching. Classical manuscripts document that in early centuries A.D., preserved leaves and bark were recommended for elevated temperature, blood-deficiency conditions, and unpleasant bodily scent. The

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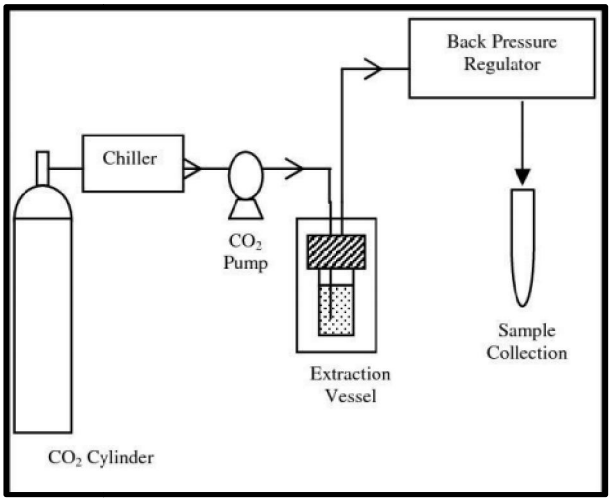
seeds were powdered and mixed with honey or sugar, administered to children suffering from intestinal disturbances or respiratory irritation.(8)

Extraction of Eugenol From Tejpatta "Supercritical extraction represents a superior procedure for recovering the eugenol-intensive component present in Cinnamomum tamala."Nees (Bay Leaf)-process analysis and phytochemical characterization . Aromatic



Method about extraction : Material Cinnamomum tamala leaves Preparation of sample : The Tejpatta leaves Grind with the help of mixter Grinder. And prepare a fine Pawder . Extraction Methodology:The average particle size of the bay leaf granules was found to be 0.05 cm, estimated through screen-fractionation procedures, where the ground sample was distributed across graded metallic sieves on a vibrating analyzer.Carbon Dioxide Extraction of C. tamala:The eugenol-rich fraction was obtained using pressurized CO_2. A 10-gram batch of crushed foliage was combined with the leaf powder and loaded into a polypropylene centrifugation tube fitted with a tight-seal lid before initiating the extraction run.Traditional Extraction Techniques:A water-distillation process was conducted using 10 g of powdered leaves for five hours in 300 mL of deionized water, employing a classic distillation unit connected to a Clevenger trap.A solvent-shaking method was additionally performed with identical raw material quantities and 50 mL of culinary-grade ethanol, maintained at 30°C for five hours with 190-rpm orbital agitation.All obtained extracts were thickened using a vacuum-rotation evaporator (Buchi Rotavac system, Switzerland) under 50-mbar negative pressure at 50–55°C, followed by final dehydration through mild nitrogen flushing.The concentrated samples were placed in dark-amber glass vials with screw closures and refrigerated at 4°C for subsequent testing.(9)

Pharmaceutical Activities 1.Immunosuppressive effect Major Procyanidin Derivatives :- Tejpat leaves provide significant quantities of polymeric catechin compounds, such as cinnamtannin B1, cinnamtannin D1 (CTD-1), parameritannin A1, procyanidin B2, and procyanidin C1. These metabolites possess immunity-weakening attributes and help modulate biological defense pathways in experimental models. [4]2. Immune-Regulating Activity :- Alcoholic fractions (both ethanol and methanol) obtained from C. verum contain trans-cinnamaldehyde along with associated analogs, which produced marked corrective outcomes ($p<0.05$) following two days of therapy.[4]3. Anti-Depressant & Stress-Relief Properties ;- Extracts of Cinnamomum tamala exhibited anti-depressive potential equivalent to imipramine at a 400 mg/kg dose. These preparations influenced depression-linked behavioural tests, including despair paradigms, helplessness behavior, and tail-suspension models. The herb also demonstrated pronounced anti-anxiety effects, highlighting its clinical usefulness for psychological and emotional conditions.[6]104 . Anti Oxidants Activities Cinnamaldehyde, eugenol, linalool, and other phenolic and flavonoid chemicals foundBioactive molecules including cinnamic aldehyde, eugenolic compounds, linalool, and numerous other phenolic and flavan-based constituents detected in the leaves and woody layers of C. tamala exhibit high antioxidative potential, effectively guarding living

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cells against reactive oxygen–induced harm.A range of evaluation methods—such as the peroxide number, anisidine value, TBA assay, and carbonyl quantification technique—have been adopted to measure the oxidative-stability enhancing action of cinnamomum essential oil and oleoresin extracts in mustard oil systems.Further studies have explored the protective action of tejpat oleoresins and aromatic oils using the linoleic acid autoxidation system and their DPPH free-radical neutralization performance.Additional analysis of the antioxidant activity of tejpat oleoresins and essential oils in the linoleic acid system and their scavenging action on DPPH.5. Antimicrobial and Antifungal Activity The essential oil has broad-spectrum antibacterial activity against Candida albicans, S. aureus, P. aeruginosa, and E. coli . Used traditionally for infections and as a natural preservative.[5] Reports utilized in the assessment of agar diffusion are examined by several studies. This plant's oil has strong antifungal properties against a variety of fungi. Additionally, it helps prevent food deterioration. The agar diffusion method is used to evaluate the antibacterial properties of the tejpatta bark extract. Additionally, these studies demonstrate the antibacterial properties of plant bark extract. 6. Antidiabetic Activity By increasing insulin secretion and glucose absorption, C. tamala leaf extracts lower blood glucose levels .May inhibit "the enzymes responsible for starch and sugar breakdown, α-amylase and α-glucosidase"A-amylase inhibition assays were used to screen for Inhibitory biochemical tests were applied to determine glucose-management activity in the methanol-derived and later water-based extracts obtained from the bark of Cinnamomum tamala. The outer woody layer of C. tamala was found to have percentage inhibition values of 97.49% and 93.78%, respectively. Similarly, the Cinnamomum tamala's IC50 values for methanol and subsequent water extract were 1.80 and 5.53, respectively. Compared to the subsequent water extract of Cinnamomum tamala2, the methanol extract exhibited more powerful action. and Immunologic Reactions

Certain HLA (human leukocyte antigen) alleles are connected to drug-induced hypersensitivity:HLA-B*15:02: Unequivocally related with Stevens-Johnson Disorder / poisonous epidermal necrolysis when treated with carbamazepine, particularly in Southeast Asian populations.HLA-B*57:01: Related with touchiness to abacavir (an HIV switch transcriptase inhibitor).

Inflammation-modulating and Analgesic Properties :- During laboratory animal assessments, researchers observed that the plant-derived solution exhibited membrane-shielding capability, rising proportionally with doses reaching 1 mg/ml.11The hydrous extract limited paw inflammation produced by carrageenan application in rats and further curbed capillary seepage triggered by acetic-acid exposure.8. Neuroprotective activity It possess sedative and hypnotic effect. Antioxidant constituents protect neurons from oxidative stress and neurodegeneration.[4] 9. Cardioprotective Tejpatta reduce cholesterol, triglycerides, and LDL levels and Improves lipid metabolism and reduces oxidative stress in cardiac tissue. 10. Anticancer Activity Leaf extracts show cytotoxic and antiproliferative effects against several cancer cell lines and Cinnamaldehyde and eugenol induce apoptosis (programmed cell death).[4] 11 . Wound healing Researchers have shown that the ethanolic extract from tejpatta leaves has the ability to cure wounds. Previous studies have demonstrated that elevated glucose levels cause wounds and any incision to heal more slowly.According to this review, administering an the spirit-extracted Tejpatta leaf preparation provided to rats with elevated blood sugar promotes healing efficiency by diminishing glycemic values and improving the closure progression of cuts. The plant's numerous bioactive components, which include phenolic compounds, tannins.12 . Antihyperlipidemic : The aqueous ethanol Investigations demonstrate that the leaf preparation obtained from this botanical source produces a hypolipidemic response. For ten days, test rats received 400 mg/kg orally, ethanol and aqueous leaf extract. Continuous leaf extract administration has been shown to prevent or lower elevated leading to decreased circulatory total sterols, adverse low-density particles, very-low-density lipoprotein units, and additional lipid indicaton. 13.Ulcer-protective effects :-The ethanol–water leaf preparation of C. tamala demonstrated preservation of the stomach lining, preventing erosive injury and mucosal breakdown.Next steps — purification & activity studies:Subsequent separation and pharmacodynamic screening aim to discover new bioactive molecules useful for treating gastric erosions, inflammatory conditions, microbial infections, and dysregulated metabolic states(1**0**).

Therapeutic Potential of Tejpatta

Medicinal promise of TejpattaLocal healers employ Tejpatta to manage aches and inflammatory conditions in individuals suffering from rheumatism. The species is rich in constituents such as cinnamaldehyde, cinnamic acid and

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various cinnamate derivatives alongside an array of other bioactive molecules that display anticancer, anti-inflammatory, cardioprotective and neurotherapeutic effects. Polyphenols present in the leaves exhibit strong free-radical scavenging, anti-inflammatory, antidiabetic, antimicrobial and tumor-inhibitory actions. The foliage is a source of essential micronutrients including manganese, iron, dietary fibre and calcium. Apart from culinary applications, the desiccated leaves are used medicinally by indigenous communities: leaf poultices are applied for many complaints and are reputed to promote health. Traditionally, dried leaves and bark were used to treat fever, anaemia and body odour; chewing the dried lamina is practiced to conceal foul breath. Leaves and bark have fragrant, tonic, stimulating and carminative qualities and are indicated in ethnomedicine for rheumatic pain, intestinal colic, diarrhoea and emesis. The seeds, when pulverized and mixed with honey or sugar, are traditionally given to children for dysentery or cough relief.Extracts of Cinnamomum tamala influence several physiological systems, notably immune function, gastrointestinal physiology and liver health. The woody outer tissue is sometimes incorporated into culinary preparations as a flavouring agent. Texts from Ayurveda and Unani describe therapeutic use of this taxon going back to early centuries A.D. Preparations such as bark powder and volatile oils exhibit a spectrum of activities — antioxidant, antidiabetic, antiinflammatory, anticancer and antimicrobial. Essential oil from C. camphora demonstrates antifungal and pesticidal effects against gall midge and lepidopteran larvae, fruit flies and fire ants, and has shown activity against human breast carcinoma cells. C. glaucescens fruit oil displays nematode-killing, termite-control and larval toxicity. Oil from C. tamala is larvicidal toward mosquitoes and toxic to fire ants. The species is under investigation for possible benefits in Alzheimer's disease, diabetes, arthritis, atherosclerotic conditions, malignancies, inflammatory disorders, heart protection and neural dysfunctions

Applications of Cinnamomum tamala across disease conditions

Central nervous system actions: Experimental work indicates antidepressant-like effects comparable to imipramine at a dose of 400 mg/kg. The herb also shows anxiolytic activity, supporting its use in anxiety and related neuropsychiatric disorders.13Gastroprotective activity: Leaf extracts protect the gastric mucosa. Oral dosing regimens in rats (50, 100 and 200 mg/kg twice daily for five days) attenuate ulcers induced by stress, ethanol and pyloric ligation, demonstrating preventative efficacy.Renoprotective effects: Tejpatta leaf extracts protect against gentamicin-induced renal damage in rabbit models, with improvements observed in serum creatinine, creatinine clearance, uric acid, urine output, BUN, body mass and urinary protein loss and corroborated by histological analysis.Onco-therapeutic indications: Leaves contain major bioactive agents, including bornyl acetate, which have shown cytotoxicity against ovarian tumor lines; evidence suggests reduction in prostate enlargement and suppression of abnormal cell proliferation coupled with antiinflammatory benefits.Glycaemic control and diabetes management: Research shows procyanidins and other phytochemicals enhance insulin production and preserve pancreatic β-cells, conferring antihyperglycaemic effects. Ethanol extracts increase insulin and improve glucose tolerance, thereby promoting wound repair in diabetic subjects due to phenolic and flavonoid mediated effects.Gastric ulcer prevention: Hydro-alcoholic leaf fractions mitigate ulcer formation by protecting mucosal barriers, reducing injurious secretions and inhibiting mechanisms like H^+/K^+-ATPase

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activity, thereby lowering acid output.Antimalarial potential: Hydro-alcoholic preparations demonstrate inhibitory effects on Plasmodium falciparum, indicating antimalarial potential.Control of food spoilage organisms: Leaf oil exhibits antifungal properties against spoilage and pathogenic fungi such as Aspergillus niger, A. fumigatus, Candida albicans, Rhizopus stolonifer and Penicillium spp., helping to prevent food decay and associated foodborne illnesses.

Traditional Use of Cinnamomum tamala

For centuries, this species has been incorporated into diverse Indian healing systems—Ayurveda, folk remedies, and regional medicinal traditions—due to its therapeutic potential, pleasant aroma, and culinary relevance. A detailed overview is given below:Historically, tejpatta has been incorporated into numerous food preparations such as beverages, savoury dishes, pickles, and various fast foods as a flavour-enhancing botanical or aromatic spice.Because of its refreshing taste and fragrant quality, the plant is also included in chewing confectioneries and is considered helpful in managing halitosis and other breath-related concerns.Powdered leaf material is traditionally used for oral discomfort, particularly for easing toothache.In folk practices, the plant has been employed for alleviating a broad spectrum of disorders—colorectal malignancy, hyperglycaemia, cardiac complications, neurological disturbances, bleeding irregularities (notably for improving uterine circulation), decreased appetite, dryness of mouth, unpleasant oral odour, rheumatic complaints, and several other conditions.The leaves and bark also demonstrate astringent, antiemetic, antidiarrhoeal, anti-inflammatory, wound-mending, and flatulence-relieving characteristics.ncology / Cancer Treatment

II. CONCLUSION

Since ancient eras, medicinal plants have played a pivotal role in sustaining community wellbeing. Among the most commonly utilised aromatic agents in Indian gastronomy is Cinnamomum tamala (tejpatta). Beyond its culinary significance, the species exhibitsconsiderable healing value.Different parts of the plant contain a wide array of important phytocompounds, including kaempferol, eugenol, 3,4,5,7-tetrahydroxyflavone, 3,3,4,5,6-pentahydroflavone (non-glycosidic flavones), cinnamaldehyde, and trans-cinnamaldehyde. These constituents display a broad range of pharmacodynamic actions, such as glucose-lowering, anti-inflammatory, antibacterial, antidiarrhoeal, antifungal, and liver-protective effects. Consequently, they are useful in addressing various ailments including cancer, diabetes, peptic ulcers, and digestive infections.Multiple scientific reports consistently indicate that Cinnamomum tamala may offer significant benefits for individuals with diabetes, making it an important plant for future therapeutic research.

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