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Review Article

Recent Advancement in Pharmacological Activity of Tectona Grandis

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ABSTRACT

Sagwan, the local name for Tectona grandis Linn (Teak), is a member of the Lamiaceae family. Because of its stunning surface and ability to withstand termite and fungal damage, it is among the most precious timbers in the world. A member of the Verbenaceae family, Tectona grandis, also referred to as teak, is a highly esteemed timber plant in the world. Because of its remarkable hardness and resistance to deterioration, even without paint or preservatives, teak wood is highly valued for its exceptional qualities, such as stability, durability, and aesthetic appeal. As a result, it is a preferred choice for a variety of applications, including furniture, flooring, shipbuilding, and construction. One of the most complicated processes in human physiology is the changeover of processes that occurs during wound healing. The healing process of a wound involves a complex set of cellular and molecular activities, including reactions and interactions between mediators and cells.

INTRODUCTION

Generally speaking, a wound is a raw area of skin brought on by a variety of illnesses or injuries. While we recognise that not all wounds have lost their surface epithelial covering, as we may observe on skin, such as with bruises from direct injury, the most general concept of a wound is associated to its bare surface.[1] The process of wound healing is intricate and requires the coordinated activity of numerous tissues and cell types. It necessitates careful coordination of angiogenesis, inflammation, matrix deposition, migration, and proliferation of cells. Larger injuries from trauma, acute illness, or major surgery can take weeks to heal, leaving behind a fibrotic scar that might affect tissue function, while minor skin wounds heal in a matter of days.[2]

Classification

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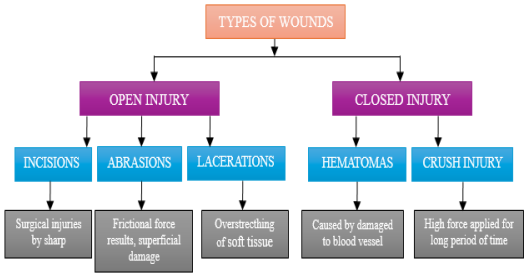

Fig 1. Classification of wounds [3]

Phases Of Wound Healing

Hemostasis (coagulation)

Initial vasoconstriction of blood vessels.
Platelet aggregation.
Stopping the loss of blood.

Inflammation (early/ late inflammation)

Vasodilation › influx of inflammatory cells.
Release of mediators and cytokines.
Promotion of the thrombosis, angiogenesis and re-epithelialization. Formation of collagen fibers.

Proliferation (migration/epithelialization/granulation)

Formation of granulation tissue.
Re-epithelialization.
Neovascularization.

Regeneration (maturation/repair)

Reorganization of new tissue.
Reduction of the excess of collagen.
Contraction of the wound tissue and acquirement of the maximum tensile strength.[4]

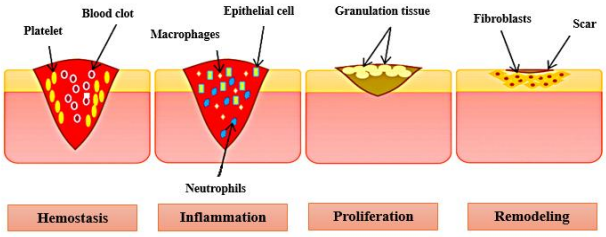

Fig 2. Phases of wound healing [5]

Tectona Grandis used for treating different types of wounds

It is true that the tree known as Tectona grandis, or teak, has a number of therapeutic uses in traditional medical systems such as Ayurveda. Herbal treatments have utilised the leaves, bark, and roots of the teak tree to cure a variety of illnesses.[6]Numerous research groups have looked into the pharmacological and phytochemical properties of various plants. One notable example of such a plant is Tectona grandis. [7,8] Tectona grandis is a well-known wood species that is known around the world for its stability in size. The alien species Tectona is common in the topic area. It is also very common in South Asian countries like India. [9].

Fig 3. Taectona grandis Leaves

Table 1. Taxonomical classification of Tectona grandis [10]

Kingdom	Plantae
Phylum	Magnoliophyta
Class	Magnoliopsida
Subclass	Asteridae
Order	Lamiales
Family	Verbenaceae
Genus	Tectona

Phytochemical Constituents

Leaves-

- Tectoleafquinone, Tannins (6%)
- Dye, proteins (7.1%)
- Crude fibers (22.3%)
- Calcium (3%)
- Phosphorus (0.46%)
- Monoterpene, betulinic acid.
- Anthraquinones, tectoinolos- B (14)
- Lapachol, tectoquinone.

Root-

- Tectoquinone.
- b-sitosterol.
- New diterpene.
- 1-hydroxy-2 methyl anthraquinone.
- Each basin.
- Tectol.
- Tectograndinol.
- 5-dihydroxy 2methyl-9,10 anthraquinone. [11]

Seed-

- Seed oil contains the amount of fatty acid as caprylic acid (1.45%)
- Capric acid (0.76%)
- Lauric acid (6.77%)
- Myristic acid (2.86%)
- Palmitic acid (12.12%)
- Stearic acid.

Wood-

- Resin.
- Silica.
- Calcium phosphates.
- Ammonium phosphates.
- Magnesium phosphates.
- Anthracene-2- carboxylic acid.
- Triterpenes, and hemiterpenes.
- Dehydro- a -lapachone lapachol.
- 5-hydroxy-lapachol.
- Methylquinizarin.
- 5- hydroxy- 2 -methyl-9,10- anthraquinone. [12]

Bark-

- Tannin (7.14%)
- Obtusifolina, (7.14 %)
- 5-hydroxy-1,4-napthalenedione(VI)(juglone)
- Obtusifolina(VII)
- Desidro-α lapachona(VIII).[13]

Pharmacological Activity

Fig 4. Pharcological Activity of Tectona Grandis [13]

Antibacterial activity

Additionally, the antibacterial properties of Tectona grandis Linn's methanolic leaf extract were investigated. The antibacterial activity in this study was assessed using the disc diffusion method at a 500 g/disc concentration. Good action against Staphylococcus aureus and Staphylococcus epidermidis is demonstrated by the leaves, which are employed in the study both fresh and fallen. Compared to fallen leaves, fresh teak leaves prevent Propionibacterium acnes from growing.[14] In contrast to the chloroform extract, which was the least efficient, the methanolic extract of teak leaves was strongly limiting bacterial growth. One

potential substitute for artificial food preservatives is teak leaves.[15] Studies also demonstrate that the leaves extract of Tectona grandis. For organisms that are resistant to many drugs, linn can be employed as an antibacterial agent. Maximum synergistic action is demonstrated by the methanolic extract against several gram-positive and gram-negative bacteria.[16]

Antifungal activity

Teak's antifungal properties were tested on both plants and people.The antifungal properties of teak leaf extract are demonstrated by the study conducted on Arthriniumphaeospermum, one of the fungi that causes decay on Albizia falcataria (L). Synthetic fungisides have the potential to harm the environment and human health. The antifungal activity of the methanol extract of air-dried teak leaves was evaluated using the well diffusion method on potato dextrose agar (PDA). Tests were conducted on leaf extracts at 0.5%, 1%, 2%, and 4% (w/v). The solvent and control were sterile distilled water with 0.2% Tween-80. [17]Teak leaf extracts in ethanol, methanol, and n-hexane have been evaluated against two clinical strains of Aspergillus fumigatus and Aspergillus flavus that have been obtained from HIV patients in comparison to itraconazole. According to the study, teak leaf extracts are highly efficient against both strains of Aspergillus. The hydro-alcoholic extract proved the most active.[18]

Antioxidant activity

Stem bark extract's antioxidant capacity was investigated. The test for DPPH free radical scavenging was used to determine antioxidant activity. different amounts of Tectona grandis ethanolic extract (10 g/ml, 20 g/ml, 50 g/ml, and 100 g/ml). Linn exhibits strong antioxidant properties. Chemical components such as flavonoids, alkaloids, tannins, anthraquinones, and saponins are primarily responsible for the teak extract's antioxidant activity.[19] Three tests were used to assess the antioxidant activity of the leaves: the phosphomolybdenum method, the reducing power antioxidant assay, and 1,1'-diphenyl-2-picrylhydrazyl free radical (DPPH). In this investigation, Tectona grandis was proven. Linn exhibits strong antioxidant properties.[20]

Anti-inflammatory activity

One well-established cause of inflammation is protein denaturation. The Tectona grandis extracts. Linn has strong antiproteinase properties. Tectona grandis methanolic extract. Linn exhibits the highest level of inhibition. Compared to water extract, the methanolic and ethanolic extracts have the strongest proteinase inhibitory efficacy. The greatest inhibitory activity of the common medication aspirin was approximately 92.83%, whereas the methanolic and ethanolic extracts displayed approximately 83.90% and 81.17% activity, respectively. These can be utilised to treat disorders caused by xanthene oxidase since the solvent portion has a modest xanthene oxidase inhibitory effect. Thus, Tectona grandis extract. Linn can be utilised to create a strong anti-inflammatory drug and cure a number of illnesses, including diabetes, leprosy, dysentery, hyperacidity, and inflammatory diseases.[21]

Wound healing

Tectona grandis's ability to heal wounds. Rats with excision wounds were used to study linn leaf extract. 5% Tectona grandis ointment, according to this study. Within four days, linn leaf extract demonstrated a decrease in the area of the wound. According to these research, the reduction in wound area becomes significant after 8 days. Likewise, 10% Tectona grandis ointment. When compared to the control, the amount of linn leaf extract in the wound region decreased significantly after 4 days.[22]

Gastroprotective activity

Tectona grandis ethanolic extract's gastroprotective properties. Rats with ethanol-induced ulcers were used to study Linn. Superoxide dismutase, catalase, reduced

glutathione, lipid peroxidation, and the pH of gastric juice were among the antioxidant parameters examined in this ulcer indux study. Tectona grandis administration. At the chosen dosages of 100 and 200 mg/kg p.o. per day, linn extract reduces the ulcer index. The extract demonstrated protective levels of 54.17 and 63.01%, respectively, in comparison to the conventional medication Omeprazole (75.61).[23]

Tocolytic activity

Tectona grandis's impact. Linn on frog smooth muscle blood vessels was investigated. The grandis Tectona. Significant vasodilation of the frog's smooth muscle and blood arteries is demonstrated by linn extract at several doses (16, 32 mg). This outcome is comparable to that of nifedipine (0.18 mg) and magnesium sulphate (75 mg). Tectona grandis's impact. When applied to frog hearts at varying doses (16,32,64,128,256 mg), linn stem extract significantly reduced heart rate, tone, and amplitude in a dose-dependent manner, similar to that of magnesium sulphate. A 256 mg dose of Tectona grandis was shown to cause cardiac stoppage.150 mg of magnesium sulphate was found to contain linn stem extract. [24]

Traditional uses

It has astringent, anthelmintic, depurative, and constipation-relieving properties. It can aid with burning sensations, tough labours, diabetes, leprosy, bronchitis, hyperacidity, dysentery, and skin conditions. Diarrhoea and dysentery are among the digestive issues that can be treated with teak tree bark.Cooling, equilibrium, cleansing, anti-inflammatory, and vulnerability are among the therapeutic qualities of leaves. They help with inflammatory diseases, stomatitis, pruritus, indolent ulcers, haemorrhages, and haemoptysis. Because of its anti-inflammatory and febrifuge qualities, teak leaves are frequently used to lower fever and inflammation.[25] these are beneficial for urine retention and anuria.They treat bronchitis, urine discharge, and biliousness and are caustic, bitter, and dry. The Unani medical system states that the oil extracted from the blooms promotes hair growth and is good for scabies. Because teak extracts have antibacterial and anti-inflammatory properties, they are used to treat skin conditions like rashes, eczema, and itching.[26]

Fig 5. Traditional uses of tectona grandis [13]

CONCLUSION

Tectona grandis, or teak, has a wide range of pharmacological and phytochemical applications, particularly in the treatment of wounds. Tannins, flavonoids, anthraquinones, and saponins are just a few of the bioactive substances found in this prized plant, which is well-known for its longevity and traditional use. All stages of wound healing—hemostasis, inflammation, proliferation, and tissue remodeling—benefit from the plant's antibacterial, antifungal, antioxidant, anti-inflammatory, and regenerative properties. Its extracts have

demonstrated notable effectiveness in decreasing the size of wounds, speeding up the healing process, and preventing infections. In addition, Tectona grandis has additional pharmacological characteristics, such as antinociceptive, tocolytic, and gastroprotective actions. Its leaves, bark, roots, and other parts have long been used in traditional medicine to treat a wide range of illnesses, from inflammation and digestive issues to diabetes and skin diseases. Tectona grandis offers enormous potential for creating contemporary natural remedies, especially in the areas of wound care and medication formulations, due to its rich phytochemical profile and wide range of therapeutic uses.

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