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A Detailed Pharmacological Approach on Albizia Amara: A Review

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ABSTRACT: Albiziaamara belongs to Fabaceae family. Variety of essential activities are found in plant such as emetic property, cough reliever, antiulcer, antidandruff and antimicrobial. On the basis of different papers this plant also has anti-inflammatory activity. In different types of skin diseases and in poisonous bites this is effective. Seeds of Albiziaamara have astringent, antidiarrheal, antileprotic and anticancer properties. Plant has been found rich in various bioactive constituents such as macrocyclic spermine, alkaloids, phenols, saponins, flavonyl glycosides, sterols and tannins. Ethanolic extract of Albiziaamara contains alkaloids, tannins, phenols and cardiac glycoside. Acetone extract comprises of phenols, alkaloids and other important components. Albiziaamara is widely distributed in Sudan, Ethiopia, Zimbabwe, Botswana, Transvaal and India. In India it is mainly found in Tamil Nadu, Andhra Pradesh and Karnataka. This paper explored pharmacological approached properties of Albiziaamara. Several activities of Albiziaamara are discussed in this paper. Overall this investigational study showed that there are various significant roles of herbal Albiziaamara.

KEYWORDS: Albiziaamara, Pharmacological Property, Phytochemical, Siris, Phytochemistry

I. INTRODUCTION

Albiziaamara, commonly referred to as siris, is a tree that holds a venerated position in the realm of medicinal plants due to its widespread use in traditional medicine across India's dry forests and other tropical regions [1, 2, 3].

Albizia Amara, known commonly as the silk tree, is not just a mid-sized, deciduous beauty but a font of health benefits. Through its extensive medicinal uses, it has become a pillar in folk medicine, ayurveda, and various traditional healing practices [34].

As a species that thrives in diverse habitats extending from Africa to parts of Asia, this tree's utility spans from its antimicrobial activity to its role in treating a spectrum of ailments including leprosy, skin conditions, and toxic diseases [1,3].

The versatility of Albiziaamara, encompassing its strong wood used in construction and cabinets, to its bioactive components beneficial in pharmaceutical compounds, paints a rich portrait of a tree deeply embedded in both ecological and medicinal landscapes [1].

Fig. 1. Albiziaamara

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TAXONOMICAL CLASSIFICATION OF PLANT-

Kingdom	Plantae
Subfamily	Mimosaceae
Family	Fabaceae
Subclass	Magnoliidae
Tribe	Ingae
Genus	Albizia
Class	Magnoliopsida
Phylum	Tracheophyta
Class	Equisetopsida
Species	amara
Order	Fabales

VERNACULAR NAMES OF PLANT:

English	Bitter albizia wheel tree, Oil cake tree, Bitter albizia
Hindi	Krishna siris
Irula	Arappuunjamaram, Bannimaram, Vanni
Kannada	Chigare, Chujjulu

GEOGRAPHICAL SOURCE-

Orrisa, Andhra Pradesh, Gujarat, Kerala, Karnataka, Madhya Pradesh, Chhattisgarh, Tamil Nadu, Maharashtra are the Indian states where there is always maximum possibility that plant is found. Out of the India there is Africa where in the sandy forests it is found growing from Sudan to Ethiopia to Zimbabwe, Transvaal and Botswana.

HISTORICAL USES OF ALBIZIA AMARA

It is evident that this tree has been a cornerstone in traditional medicine across various cultures. The applications of different parts of the tree are as varied as they are significant.

Leaves and Flowers:

- As an remedy for cough leaves of Albiziaamara are used. Other uses of leaves are in for malaria, dandruff, ulcer and as an emetic [4].
- These are used in treatment for boils, eruptions, and swellings [2].
- These are involved in the treatment of erysipelas, boils, skin issues, and poisonous bites [5].
- Young leaves are dried and powdered for hair wash [7].

Seeds:

- Seeds are known to be an treating piles, leucoderma, erysipelas, astringent, diarrhea, leprosy, and abscesses [4].
- Gonorrhea and piles can be treated with seeds. Seed-derived pharmaceutical compounds have demonstrated a wide range of possible anticancer action [5].

Bark and Wood:

- Poisonous bites and skin diseases can be treated using leaf and bark paste [2].
- The bark is used to treat different illness in children [7].
- Use of wood comes in construction, furniture, as firewood, offering environmental benefits such as soil erosion control and serving as a windbreak. Historically, while in India the wood was extensively used as fuel in railway [5].

Albiziaamara is not only a medicinal powerhouse but also plays a crucial role in environmental conservation and serves various practical purposes. Its drought tolerance, resistance to shade, and hardiness make it an ideal species for reforestation efforts and as an ornamental tree in urban areas [3,5]. Additionally, the leaves serve as fodder for cattle, sheep, and goats, though they are considered less palatable than other forages [6]. In ethnoveterinary medicine, preparations of leaves mixed with other foliages are used to cure mastitis, and mites and ticks infestations in cows [6]. This multifaceted use of Albiziaamara underscores its importance in both traditional medicine and ecological sustainability.

MECHANISM OF ACTION-

The unique chemical makeup of Albiziaamara is what sets it apart and is essential to its pharmacological effects. Its medicinal flexibility is highlighted by the presence of a variety of bioactive chemicals, such as flavonyl glycosides, phenols, triterpene saponins, sterols, and macrocyclic spermine alkaloids [8]. Because of its antibacterial broad-spectrum action against both types as Gram-positive and Gram-negative bacteria as well as yeasts, the chemical Budmunchiamine-A (BUA) stands out among the others [1]. Additionally, BUA has shown considerable antioxidant activity, as evidenced by a percentage inhibition of β-carotene/linoleic acid of 67.8% and an inhibitory concentration 50% (IC 50) value of 400 µg/mL in the 2,2-diphenyl-1-picrylhydrazyl

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(DPPH) test [1]. This highlights the potential of Albiziaamara in contributing to antioxidant therapies.

The extracts of Albiziaamara exhibit a diverse range of phytochemicals, influencing its mechanism of action in various therapeutic applications:

- **Ethanol Extract**: Contains tannins, alkaloids, cardiac glycosides, phenols, steroids, terpenoids, and indicating a broad spectrum of potential health benefits [4].

- **Acetone Extract**: Comprises alkaloids, phenols, and cardiac glycosides, but lacks flavonoids, steroids, saponins, glycosides, and terpenoids, suggesting a more targeted therapeutic application [4].

- **Water Extract**: Encompasses all tested phytochemicals, positioning it as the richest source of beneficial compounds within the plant. This extract's comprehensive chemical profile may contribute significantly to its pharmacological efficacy [4].

Significantly, the pharmacological actions of Albiziaamara are mediated through the synergistic effects of its phytochemical constituents. For instance, plant steroids are recognized for their cardiotonic, insecticidal, and antimicrobial properties, while saponins have been utilized in treatments for hypercholesterolemia, hyperglycaemia, anticancer, and anti-inflammatory conditions [4]. Additionally, glycosides play a important role in the plant's defense mechanism against predation and are implicated in heart failure and cardiac arrhythmia due to their effect on the Na+/K+ pump [4]. The therapeutic potential of these compounds, particularly in addressing lipid levels, underscores the need for further investigation into the mechanisms of action of Albiziaamara, which could unveil novel targets for drug development [10].

PHARMACOLOGY OF ALBIZIA AMARA-

Anticancer and Antihyperlipidemic Effects:

- Exhibits anticancer properties, with the methanolic extract of seeds containing macrocyclic pithecolobine alkaloids, Budmunchiamines A-C, showing enhanced potential of cytotoxicity towards cultured mammalian cell lines [8].
- Its potent antihyperlipidemic activity is attributed to the reduction of blood levels of triglycerides (TGs), cholesterol, very low-density lipoprotein (VLDL), low-density lipoprotein (LDL), and the elevation of high-density lipoprotein (HDL) [11,15].

Anti-inflammatory, Antimicrobial, and Analgesic Activities:

- Plant has next level broad-spectrum antimicrobial activity against different kinds of bacteria and fungi can be observed by the ethanolic leaf and bark extracts. Meaningful analgesic and anti-inflammatory activity is also shown by these extracts, matching standard treatments for pain and inflammation [8].
- Alkaloid Budmunchiamine-A (BUA) from Albiziaamara has antimicrobial activity of kind of broad spectrum against various bacteria and fungi [1].
- Higher antibacterial and antifungal activity against 21 microbes was demonstrated by the chloroform leaf extract containing alkaloids and steroids [8].

Antioxidant Properties:

- Shows a modest level of antioxidant activity; in the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, BUA indicates an inhibitory concentration 50% (IC50) value of 400 μg/mL, and in the β-carotene/linoleic acid assay, it demonstrates 67.8% inhibition [1].
- The methanolic leaf extract possesses strong free radical scavenging and antioxidant properties, indicating its potential as an antioxidant, comparable to standard antioxidant treatments [8].
- Albizia. amara initiated gold nanoparticles and these have extreme scavenging activity as compared to the aqueous leaf extract, showcasing the plant's potential in nanotechnology applications for enhancing antioxidant properties [12].

Skin and Ulcer Treatment:

Boils and ulcers are historically remedied using the leaves and flowers of Albiziaamara. To treat skin conditions and stop dangerous bites, a paste prepared from the leaves and root bark is applied [34, 35].

Digestive and Sexual Health:

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Seeds, recognized for their astringent properties,
are utilized in treating piles, diarrhea, and gonorrhea. This highlights the plant's role in addressing both digestive and sexually transmitted diseases [34, 35].

Respiratory and Malarial Remedies:

The flowers serve as a remedy for ulcers, cough, malaria and dandruff. Their application in treating such a wide range of conditions underscores the plant's versatility in traditional healthcare practices [34].

Pharmaceutical and Miscellaneous Use:

- The pharmaceutical compounds found in the leaves and seeds of Albizia Amara exhibit activities like anticancer and having potential broad spectrum effects, highlighting its significance in the medical field [36].
- Tannins obtained from the bark are used in the leather industry, while the leaves have been used as an adulterant for tea and in the making of soap and shampoo, demonstrating its versatile applications beyond mere agricultural or construction purposes [37].
- In India, Albiziaamara is incorporated into smallholding, rainfed agriculture, and diversified with crops like corn, cassava, and fruit trees such as papaya, mango, and orange, illustrating its role in sustainable farming practices. Additionally, its ornamental value cannot be overlooked, as it is planted in urban areas as an avenue tree, enhancing the aesthetic appeal of cities and towns [37].

Safety Profile:

- Histopathological evaluation of the plant extract proved its beneficial effects, and glutamate oxaloacetate transaminase and serum glutamate pyruvate transaminase levels showed that the extract was safe for the liver [11].
- Albiziaamara safety and effectiveness in pharmaceutical applications are further supported by the discovery of phytoconstituents including saponins, glycosides, and tannins in the extract, according to preliminary phytochemical investigation [11].

In summary, the diverse pharmacological properties of Albiziaamara, ranging from anticancer and antihyperlipidemic effects to anti-inflammatory, antimicrobial, analgesic, and antioxidant activities, underscore its potential as a valuable source of pharmaceutical compounds. The safety profile of the plant extract, particularly its liver safety, further enhances its appeal for therapeutic applications. These findings not only highlight the therapeutic potential of Albiziaamara but also underscore the need for further research to fully harness its pharmacological benefits.

Performing extensive toxicological studies is crucial for establishing the safety profile of Albiziaamara. These studies are vital for its development as a potential therapeutic agent, ensuring that its use is not only effective but also safe for human consumption [10].

Traditional Use and Pharmacological Synergy:

The bark of Albiziaamara (Roxb) Boiv. has been traditionally used in Indian medical practices to treat cardiovascular diseases, indicating a historical acknowledgment of its beneficial effects on heart health [11].

Exploring the development of a polyherbal formulation incorporating A. amara with other medicinal plants could potentially enhance its antihyperlipidemic activity, offering a novel approach to managing hyperlipidemia [10].

PHARMACOGNOSTIC PROFILE OF ALBIZIA AMARA-

Bioactive Compounds and Phytochemical Analysis:

The stem woods and leaves of SynadeniumglaucescensPax, a related species, were analyzed using the column chromatographic method, revealing the presence of compounds 5, 6, 7, and 8 for the first time [20]. Similarly, Albiziaamara leaves exhibit a rich phytochemical profile, with water extracts showing the highest content of phytonutrients, including alkaloids, steroids, tannins, phenols, saponins, terpenoids, cardiac glycosides, and glycosides [4, 2]. This diverse chemical composition underpins the plant's broad pharmacological activities.

Fluorescence analysis of the leaf powder of Albiziaamara demonstrated characteristic coloration upon treatment with various chemical reagents, suggesting the complex nature of its phytochemical constituents. FT-IR analysis then ensured the presence of variety of functional groups, providing a molecular basis for its medicinal properties [2].

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Mineral Content and Nutritional Value:

The mineral content analysis of Albiziaamara leaves revealed higher concentrations of major minerals such as sodium, potassium, phosphorus, calcium, sulfur, magnesium, and nitrogen, particularly in matured leaves [4, 2]. These findings support the plant's traditional use in nutritional and medicinal applications. Additionally, the leaves have been reported to contain 8% total polyphenols and 4% total extractable tannins, contributing to their pharmacological properties [6].

Structural Characteristics and Seasonal Variations:

The grey, scaly, and grainy bark of Albiziaamara is distinctive as its leaves, which include approx 15 side stalks pairs with small leaflets totaling 15–35 pairs. The flat pods, which are about 20 cm long, and the flowers, which resemble puffs which are whitish-yellow powder with long stamens and golden pollen, are what give the plant its unique appearance. The phenology of Albiziaamara is influenced by seasonal changes, leaves thinning out in February and March and regrowing in April, flowers blooming in May, and fruits ripening in October and November [5].

PHYTOCHEMISTRY OF ALBIZIA AMARA-

Phytochemical research into Albiziaamara has illuminated a rich tapestry of compounds that underscore its medicinal potential. The extracts from various parts of the plant have been shown to contain a diverse array of phytochemicals, each contributing to its broad spectrum of pharmacological activities. The following points highlight the significant bioactive compounds identified in Albiziaamara:

Macrocyclic Spermine Alkaloids and Triterpene Saponins:

Known for their potent cytotoxic activities, these compounds are particularly noteworthy for their role in combating various types of cancer cells and inhibiting key enzymes like Cyclooxygenase and HIV-Reverse transcriptase. Budmunchiamines A C, found in the methanolic extract of seeds, are prime examples of such alkaloids with so enhanced cytotoxic potential through cultured mammalian cell lines, including those of colon cancer, melanoma, human breast cancer, lung cancer, and [8, 12].

Phenols, Flavonols, Glycosides, and Tannins:

These constituents are pivotal for the plant's antioxidant, antimicrobial, and antihyperlipidemic effects. Preliminary phytochemical analysis has consistently revealed their presence across different extracts of Albiziaamara. Their roles extend beyond mere structural components, contributing significantly to the plant's therapeutic efficacy [1, 11].

Sterols and Fatty Acids:

β-Sitosterol, linoleic acid, and palmitic acid are among the compounds identified in the seed oil, offering insights into the plant's potential for addressing hyperlipidemia and providing cardiovascular benefits. The presence of sterols, in particular, has been linked to the plant's antifungal and antifumonisin activities, showcasing its utility in safeguarding food grains against fungal and mycotoxin contaminations [12, 13].

This phytochemical diversity not only corroborates the traditional uses of Albiziaamara but also positions it as a compelling candidate for drug development. The identification and characterization of these bioactive compounds pave the way for future research aimed at harnessing Albiziaamara's full therapeutic potential. The ongoing exploration of its phytochemistry is crucial for understanding the mechanisms underlying its pharmacological effects and for the development of novel pharmaceutical compounds.

POTENTIAL APPLICATIONS & USES-

Exploring the multifaceted applications and uses of Albiziaamara reveals its significant impact not only in traditional medicine but also in agroforestry, food safety, and industrial applications. The versatility of this plant is evident through its various uses:

Agroforestry and Environmental Applications:

- Reforestation of degraded sites and fuelwood plantations, highlighting its role in ecological restoration and sustainable energy sources [12].
- Utilization in agroforestry systems across Asia, demonstrating its adaptability and contribution to diversified farming practices [12].

a. **Traditional and Medicinal Uses**:

- A cornerstone in Ayurveda, Sidha, and Unani medicinal systems for treating a wide range of ailments including respiratory, skin, gastrointestinal, and oral disorders [12].

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- The ethanolic extract of seeds shows strong bactericidal properties against Salmonella Typhimurium, while the ethanolic leaf extract is effective against E. coli and Salmonella typhi, showcasing its potential in combating bacterial infections [2].
- Leaves, flowers, and seeds are used in various treatments, from stomach cancer and common cold to piles and gonorrhea, underscoring its broad therapeutic spectrum [21].

Industrial and Food Safety Applications:

- Potential use of wood in furniture making, agricultural implements, and construction, offering sustainable material alternatives [4].
- Budmunchiamine A from methanolic leaf extract presents a natural solution to pre and post- mycotoxin contamination in food grains and harvest fungal infestations, suggesting an alternative to chemical preservatives [8].
- Pyrolysis of Albiziaamara yields bio-oil with a maximum yield of 48.5 wt% at optimal conditions, which can serve as a low-grade fuel or as feedstock for chemical industries, thus providing a renewable energy source [23].

This exploration into the potential applications and uses of Albiziaamara highlights its versatility and importance across various sectors. From its significant role in traditional medicine and agroforestry to promising applications in food safety and industrial processes, Albiziaamara stands as a valuable resource with the potential to contribute to sustainable practices and natural therapeutics.

II. CONCLUSION

Through the extensive exploration of Albiziaamara, this review has illuminated the rich pharmacological profile and the multitude of therapeutic applications that this traditional medicinal plant offers. From its significant antihyperlipidemic, anticancer, and antioxidative properties to its potential in tackling neurological and mental health disorders, Albiziaamara presents a promising avenue for the development of novel therapeutic agents. The safety profiles and toxicological evaluations discussed affirm its potential for safe human use, amplifying its relevance in modern pharmacological research and traditional medicine applications.

However, the journey into fully unlocking the potential of Albiziaamara is far from complete. Future research directions, including optimizing its cultivation for environmental conservation, enhancing our understanding of its pharmacological mechanisms, and bridging the existing research gaps, are imperative.

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