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Review Article

Ailanthus Excelsa's Traditional Knowledge and Medicinal Applications

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ABSTRACT

Herbal medicine has become a commodity of worldwide significance, with financial as well as therapeutic consequences. The widespread use of herbs worldwide has raised serious questions about their quality, safety, and effectiveness. Maharukh or Tree is the popular name for Ailanthus excelsa Roxb. Is a medicinally significant tree endemic to India and commonly utilized in traditional medical practices like Ayurveda, Siddha, and Unani. The plant has been used to treat a variety of illnesses, including fever, skin infections, gastrointestinal problems, and respiratory problems, especially its bark, leaves, and gum. Recent pharmacological investigations have supported many of these traditional claims, underscoring its antioxidant, antidiabetic, anti-inflammatory, and antibacterial qualities. The tree species Roxb's Ailanthus excelsa, which belongs to the Simaroubaceae family, is native to central and southern India. This review's goal is to present a comprehensive summary of the traditional understanding and therapeutic promise of Ailanthus excelsa, highlighting the necessity for more study in order to turn it into evidence-based herbal medicine.

INTRODUCTION

The study of therapeutic plants encompasses a lot more than just the identification of novel pharmaceuticals. Natural products, whether in the form of pure compounds or standardized plant extracts, offer limitless possibilities for the new drug(1). The quality, safety, and effectiveness of medicinal plants have come to the forefront as a result of the rising worldwide demand for herbal medicines. The deciduous tree known as Maharukh or Tree of Heaven is a member of the Simaroubaceae family and is scientifically referred to as Excelsa Roxb. It is widely used in traditional systems of medicine like Ayurveda and Siddha, and it is native to the Indian subcontinent, particularly central and southern India. And Unani (2). The bark, leaves, gum, flowers, and other components of the plant have been used in the treatment of ailments like asthma, bronchitis, fever, dysentery, diarrhea, and skin illnesses (3). The leaves are used externally for skin conditions

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and wounds, whereas the bark is mostly utilized for its astringent, anthelmintic, and febrifuge effects (4). Recent Extracts from this plant have been shown in pharmacological studies to possess antibacterial, anti-inflammatory, anti-diabetic, and antioxidant capabilities (5). The plant is well-known for its significant commercial and economic value (6).

Distribution Of Plants:

Its trunk is 60-80 cm in diameter, and it grows to a height of 18-25 m as a big deciduous tree. The bark is light grayish-brown and harsh on big trees. The leaves are huge, 30-60 cm or more in length, alternate, pinnately compound, and have aromatic, somewhat bitter flavors. The leaflets have 8-14 or more pairs, are long-stemmed, and have an ovate or wide lance shape, 6-10/90 cm long, 3-5 cm wide, frequently twisted, with a long, pointed, hairy gland and extremely uneven base; edges coarsely toothed and frequently lobed. Flower cluster The leaves are shorter than the stems, have a lobed base, and are heavily branching. The blossoms are greenish-yellow in color, have a shorter stalk, and are found on different trees, with the majority being males and fermates. There are five lobes in the calyx, and there are five petals. Stamens 10; on other flowers, 2-5 individual pistils, each with an elliptical ovary, one ovule, and a thin type. Fruit a copper red, flat, lance-shaped, pointed at the ends, 5 cm long, 1 cm wide, strongly veined, and twisted at the base, seeded samara. The genus name The Indonesian name for Ailanthus moluccana, a tree of heaven, is ailaanthos, which is where the name ailanthus originates (7). The leaves are considered to be excellent, nutrient-dense feed for sheep. The wood is saintly and yellowish white, making it ideal for cabinet construction (8), and the average tree produces between 500 and 700 kg of green leaves twice a year, as well as goats.

Family: Simaroubaceae

Popular Names: Maharukh (India), Tree of Heaven

A deciduous tree that grows to a height of 18 to, peters

Leaves: big, pinnate with glandular teeth

Flowers: Little and yellow, arranged in big panicles

Fruits: Samaras with wings.

Preparations:

Most ayurvedic formulations, such as Pusyanuga churna, Brahat Gangadhara churna, and Aralu putpaka, which are used to treat a variety of ailments, contain ailanthus as a key component. Musaka, visaja roga, tvakroga, kushta, pravahika, grahani, prameha, gulma, swasa, chardi, krimi, atisara, arsa, and sannipatajwara (9). In fact, Dasmularista, a well-regarded ayurvedic preparation for exhaustion, is a blend of ten different herbs, one of which is Shyonak/Sonapatha. It promotes cellular regeneration by facilitating the removal of dead or dying cells and their replacement with healthy, vibrant ones (10).

Early Research on Phytochemicals:

Proteins: There are lots of proteins in leaves Where the cytoplasmic protein fraction may be eaten by humans, but the raw and chloroplastic fractions can be used as a nutritious feed for ruminants and non-ruminants. The protein content of the entire leaf was 20.86%, whereas the protein content of the cytoplasmic protein fraction of fresh leaves was 62.71%, according to proximate analysis of different fractions. The whole leaf and pressed cake had a lower crude fat content than the

fractions and unfractionated chloroplastic protein. The crude fiber content of protein fractions was lower than that of entire leaf and pressed cake. The protein sample's amino acid make-up revealed a great balance of the necessary amino acids. Compared to soybean protein (11-12), the pressed cake, and the full leaf, the protein components of the leaves were nutritionally better.

Alkaloids: A methanol extract from the root bark was obtained following solvent extraction with chloroform. The four alkaloids discovered were canthin-6-one, 1-methoxy canthin-6-one, 5-methoxy canthin-6-one, and 8-hydroxy canthin-6-one (70-72). In Eagles, these alkaloids were researched for nasopharynx cancer, but none of the chemicals were potent enough to satisfy the necessary standards. These alkaloids, on the other hand, have demonstrated considerable cytotoxicity against Epstein-Barr virus early antigen (EBV-EA) caused by 12-0-tetradecanoylphorbol-13-acetate, Canthin-6-one and 4-methoxy canthin-6-one have been shown to have strong antiulcerogenic effects. (13-14)

Quassinoids: The bitter-tasting and highly oxygenated triterpenes known as quassinoids are found in Simaroubaceae plants (15).

Traditional knowledge:

1.Ayurveda:

-In Ayurvedic literature, it is referred to as Aralu.

Categorized as:

Taste: Tikta (bitter), Kashaya (astringent)

Qualities (guna): Ruksha (dry)

Veerya (potency): Sheeta (cooling)

Vipaka (post-digestive effect): Katu (pungent)

Maintains the equilibrium between the Kapha and Pitta doshas.

-Applications in Ayurveda:

Bark is used as a tonic, febrifuge, anthelmintic, and expectorant. Decoction is used to treat fever, dysentery, coughing, bronchitis, and asthma. Following childbirth, bark decoction is used to alleviate abdominal discomfort and excessive bleeding (16).

2. Siddha System:

-The plant is regarded in Siddha as a cooling, astringent, and expectorant herb.

-Decoction of bark: recommended for dysentery, dyspepsia, fever, and bronchial asthma.

-Leaves: used externally for boils, edema, and skin rashes.

Bark and seeds are occasionally employed in remedies for abdominal ailments and intestinal worms (17).

3. Unani Medicine:

Known as Aralu / Mahrukh in Unani.

Classified as "Mufarreh" (exhilarant) and "Mubarrid" (cooling drug).

Medicinal actions:

-Bark: used as a blood purifier, anti-dysenteric, and expectorant.

Prescribed for bronchitis, piles, dyspepsia, and chronic respiratory disorders.

Used in tonic preparations to improve general health and reduce weakness after illness.

-Leaves: sometimes included in Unani formulations for skin diseases (18).

4. Folk and Tribal Knowledge (Linking Systems):

Nilgiri tribes (Tamil Nadu): bark and leaf extracts used as abortifacient and anti-implantation agents. Chhattisgarh & Marathwada tribes: Bark used in traditional cancer therapy(19).

Traditional Medicine's Use of Parts:

The plant is utilized in many ways for its therapeutic benefits:

1)Trunk/Steam:

The trunk and stem are straight, with graying bark that cracks with age. The inner bark is reddish-yellow and has a distinctive aroma and bitter taste. Phytochemical analysis has shown the presence of sterols like B-sitosterol and stigmasterol (20), flavonoids, tannins, saponins, alkaloids (canthin-6-one derivatives), and quassinoids (ailanthone, excelsin, glaucarubinone). The bark decoction is a bitter tonic, expectorant, febrifuge, and blood cleanser that is used in Ayurveda, Siddha, and Unani systems for treating bronchitis. As a postpartum tonic for relieving abdominal pain and excessive bleeding, as well as for treating asthma, chronic cough, dysentery, and fever (18,16). In terms of economics, the wood is prized in the match for being soft, coarse-grained, and not particularly long-lasting. Low-grade plywood (21), pulp and paper manufacturing, packing boxes, and industry.

2) Root:

In Ayurveda and folk medicine, Oroxylum is often replaced with root bark.

Indicum. Applications include fever, bronchitis, asthma, diarrhea, and dysentery (7).

Constituents said to be found in root/root bark:

Quassinoids (typical bitter triterpenoids of Simaroubaceae).

Triterpenoids (earlier claim of AECHL-1 from root bark, which was subsequently retracted). Flavonoids, alkaloids, and saponins (22).

3) Leaves:

The leaves are large, measuring 30-60 cm or more in length, alternate, pinnately compound, and have aromatic, somewhat bitter flavors. The leaflets are 6-10/90 cm in length, 3-5 cm in width, often twisted, and have a long stem with 8-14 or more pairs. They have an ovate or broad lance shape. Having a very uneven base and a lengthy, pointed, hairy gland; the borders are often lobed and coarsely toothed. The leaves are traditionally used in the treatment of cough, bronchitis, and asthma, where they function as expectorants and bronchodilators (7). Leaf extracts Their antimicrobial activity has been demonstrated, inhibiting both bacterial and fungal strains, indicating their promise in the treatment of Infectious diseases (23). Recent research has also emphasized their antioxidant potential, which is attributed to because of their phenolic composition, which is consistent with their traditional usage in oxidative stress-related disorders (24).

4)Flower:

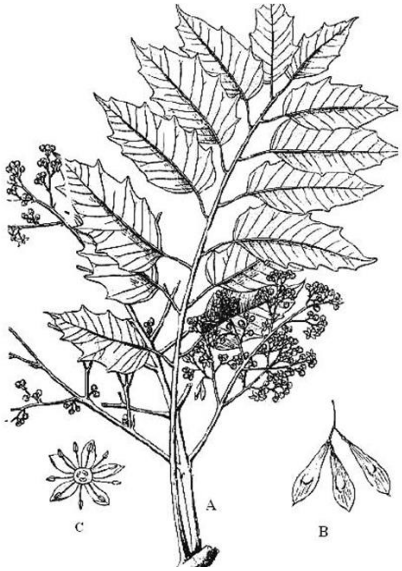
The blossoms have long, thin pedicels and are arranged in huge, open bunches among the leaves; sepals are ovate, pubescent, and five in number; petals are ovate-lanceolate reflexed, and five in number; the disc has ten lobes; Flowers are hermaphroditic: the disc petals, and sepals are

arranged as in male flowers; the pistillode is rudimentary; the anthers are oblong; the filaments are shorter than the anthers; and there are ten stamens implanted at the base disc. Ovary 2-5, partite, superior, sparsely hairy, ovule 1 in each cell; style free or connate; stigmas curling; stamens 2 or 3(25).

5) Fruit:

A samara is the fruit of the Ailanthus excelsa. A samara is a dry, indehiscent fruit with a papery, wing-like structure that facilitates wind dispersal. Each samara often has one seed in the center and is flat, oblong, and 4–5 cm in length. The fruit is able to spin as it falls thanks to the twisted wings, which facilitates efficient dissemination across great distances. The fruits are green when they are young, but they turn yellowish or reddish-brown as they ripen. The blooming period is followed by the fruit-bearing season, which typically occurs between February and April. One of the main adaptations for the species' successful spread in dry and open environments is the fruit's light and aerodynamic shape(26).

Fig. 1. (A) Ailanthus excelsa tree, (B) Leaves



Ailanthus excelsa is shown in Fig. 2: (A) a flowering branch, (B) fruits, and (C) a flower(27).

Medical and Pharmacological Uses:

1) Gastroprotective and Anti-ulcer Action:

The traditional medical use of Ailanthus excelsa Roxb. For stomach ailments is supported by the

tree's bark's potent anti-ulcer and gastroprotective properties. Different bark extracts, especially the diethyl ether extract (100 mg/kg), provided up to 83% protection against stomach lesions in experimental investigations using ethanol-induced ulcer models in rats. Comparable to cimetidine, the commonly used medication. The extract also demonstrated both antisecretory and cytoprotective effects by lowering gastric acid production and raising gastric pH. The presence of sterols, triterpenes, and quassinoids in the bark is thought to be responsible for these effects(28).

2) Antimicrobial Properties of Ailanthus excelsa:

Due to the presence of bioactive chemicals like quassinoids, flavonoids, and alkaloids, Ailanthus excelsa Roxb. Has been the subject of considerable research into its antibacterial capabilities. A number of Different plant extracts have been shown in studies to have varied amounts of antibacterial and antifungal properties. A methanolic extract of the bark was discovered to have Has strong inhibitory activity against both Gram-positive and Gram-negative bacteria, such as Staphylococcus aureus, Bacillus subtilis, Escherichia coli, and Pseudomonas aeruginosa. Among the different solvent fractions, The ethyl acetate fraction had the greatest antibacterial action, with a minimum inhibitory concentration (MIC) of 6 mg/disc (29). Leaf extracts made with methanol also demonstrated similar behavior. And chloroform displayed moderate antimicrobial activity, generating inhibition zones against Bacillus subtilis, E. coli, and Candida albicans in the range of 7 to 9 mm (30). The methanolic leaf extracts demonstrated potent antifungal action against Fusarium oxysporum, indicating that they may be used in agriculture to combat phytopathogens(31). In a different study, seed oil from A. excelsa showed limited antibacterial action, demonstrating just modest inhibition against Pseudomonas aeruginosa but no effect against S. aureus, E. coli, And Salmonella typhi (32). Additionally, recent studies have looked at the production of silver nanoparticles (AgNPs) using A. excelsa leaf extract, which displayed increased antibacterial potency against a number of human pathogens. It has been linked to the synergistic action of phytochemicals and the characteristics of nanosilver (33). Overall, these findings support the notion that Ailanthus excelsa has broad-spectrum antimicrobial activity, but the strength of this activity depends on the microbial strain tested, the extraction technique utilized, and the plant component used.

3)Bronchodilatory /Antiasthmatic Activity:

The antiasthmatic activity of Ailanthus excelsa (Roxb.), commonly known as the Tree of Heaven, has been extensively investigated for its bronchodilator and antihistaminic properties(34). the aqueous extract of the stem bark of Ailanthus excelsa and reported significant inhibition of histamine-induced contractions in isolated guinea pig ileum and goat tracheal chain preparations, indicating potent H_1-receptor antagonism responsible for bronchodilation. Further, in in-vivo experiments, oral administration of the extract to guinea pigs markedly prolonged the onset of preconvulsive dyspnea in histamine aerosol-induced bronchospasm, confirming its bronchodilator efficacy (35). the methanolic leaf extract of Ailanthus excelsa exhibited marked antiallergic and anti-inflammatory activities, further validating its traditional use in respiratory ailments(36).the methanolic leaf extract of Ailanthus excelsa exhibited marked antiallergic and anti-inflammatory activities, further validating its traditional use in respiratory ailments. Phytochemical investigations have revealed that the plant contains flavonoids (such as quercetin),

alkaloids, and terpenoids, which are likely responsible for its antihistaminic and smooth muscle relaxant actions(37).

4)Antipyretic (Fever-Reducing) Activity:

The ethanolic extract of Ailanthus excelsa leaves and observed a significant reduction in yeast-induced pyrexia in albino rats, indicating notable antipyretic activity comparable to standard antipyretic drugs(35).extracts of Ailanthus excelsa exhibited significant antipyretic activity in yeast-induced hyperthermic rats, lending further evidence to its potential as a natural fever-reducing agent. Collectively, these findings substantiate the traditional use of Ailanthus excelsa in treating fever and related inflammatory conditions(38).

5)Antidiarrheal Activity:

Several pharmacological studies have evaluated the antidiarrheal activity of Ailanthus excelsa (Roxb.).anti-inflammatory and antidiarrheal effects of stem bark of A. excelsa in mice and rats; the extract significantly inhibited castor oil-induced diarrhoea and reduced gastrointestinal motility in the activated charcoal meal test (39). ethanolic bark extracts of A. excelsa at 100, 200, and 400 mg/kg doses in castor oil-induced diarrhoea and normal defecation models in rats; the ethanolic extract showed a dose-dependent antidiarrheal activity, comparable to standard atropine sulphate (5 mg/kg)(40).

CONCLUSION:

The medicinally significant tree known as Maharukh, Ailanthus excelsa Roxb., is a member of the Simaroubaceae family and may be found throughout central and southern India. It has historically been valued in Ayurveda, Siddha, and Unani systems for treating fever, respiratory problems, skin infections, and digestive issues. In several preparations, such as decoctions, powders, and pastes, distinct portions of the plant are used, notably the bark, leaves, and gum. The substances that give A. excelsa its biological activity are alkaloids, flavonoids, tannins, saponins, and quassinoids, according to early phytochemical studies. Many traditional claims have been supported by contemporary pharmacological research, which has confirmed its antipyretic, antimicrobial, anti-inflammatory, antidiabetic, and antioxidant characteristics. The plant's promise as a natural source of bioactive substances for therapeutic uses is emphasized by these discoveries. To sum up, Ailanthus excelsa represents a crucial link between traditional medicine and contemporary pharmacology. Additional systematic investigation is required to fully utilize its therapeutic potential, with a focus on identifying bioactive substances, understanding mechanisms, standardizing herbal formulations, and evaluating clinical safety. These endeavors will be essential in converting conventional wisdom into evidence-based herbal therapy with worldwide applicability.

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