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Dr. Sumaiyya Riyaz Shaikh
Post Graduate Student, Department of Dravyaguna, CSMSS Ayurved Mahavidyalaya Sambhajinagar, Aurangabad, Maharashtra, India

Dr. Pankaj Surve
Professor, Department of Dravyaguna, CSMSS Ayurved Mahavidyalaya, Sambhajinagar, Aurangabad, Maharashtra, India

Corresponding Author:
Dr. Sumaiyya Riyaz Shaikh
Post Graduate Student, Department of Dravyaguna, CSMSS Ayurved Mahavidyalaya Sambhajinagar, Aurangabad, Maharashtra, India

A phytopharmacological review of potential drug Mahanimba (*Melia azedarach* Linn.)

Sumaiyya Riyaz Shaikh and Pankaj Surve

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Abstract
Ayurveda is time-tested science of treating disease with natural things like plant, animals and minerals. It remains one of the most ancient and yet living traditions practised widely in India and has a sound philosophical and experiential basis. Atharvaveda (around 1200 BC), Charak Samhita and Sushrut Samhita (1000-500 BC) are the main classics that give detailed descriptions of over 700 herbs[1] *Melia azedarach* is also called "Persian lilac" or "chinaberry''. This plant is closely relative to neem with specific characteristics. This potential drug has unique phytopharmacological properties.

Keywords: *Melia azedarach*, pentamerous, deciduous, phyto-constituents, wound healing activity, anti-diabetic, anti-viral, hepato-protective, analgesic, anti-cancer, anti-malarial

Introduction
Ayurveda is time-tested science of treating disease with natural things like plant, animals and minerals. It remains one of the most ancient and yet living traditions practised widely in India and has a sound philosophical and experiential basis. Atharvaveda (around 1200 BC), Charak Samhita and Sushrut Samhita (1000-500 BC) are the main classics that give detailed descriptions of over 700 herbs [1] *Melia azedarach* is also called "Persian lilac" or "chinaberry''. This plant is closely relative to neem. This plant is widely distributed in different tropical and subtropical countries. This plant is known for its ethnobotanical uses and important insecticidal properties [2].
Melia is a small genus of 2 species i.e. azedarach and azadirachta. *Melia azedarach* Family (Meliaceae) is the known species. It has derived its name from the classical Greek word *melia* for the manna ash or flowering ash, referring to the similarity of the leaves to that plant and azedarach from the name of an ancient poisonous tree, Azadaracht, now unknown [3].

Aim
To review important characteristics features of plant Mahanimba. (*Melia azedarach.* Linn).

Objectives
- To study the ayurvedic and modern texts of Botany, Pharmacognosy, Ayurvedic and other related texts.
- To study the references of Mahanimba (*Melia azedarach* Linn.) from various sources from web portals.
- To prepare the through review as per obtained data about Mahanimba. (*Melia azedarach.* Linn)

Table 1: Taxonomy of *M. azedarach*

1.	Subdivision	Angiospermae
2.	Class	Dicotyledonae
3.	Subclass	Polygonae
4.	Series	Disciflorae
5.	Order	Geraniales
6.	Family	Meliaceae
7.	Genus	Azedarach
8.	Species	*Melia*
9.	Latin name	*Melia azedarach* Linn.

Morphological Characteristics of Mahanimba (*Melia azedarach*. Linn)

Melia azedarach is a small to medium deciduous tree attaining a height up to 45 m tall; with a spreading crown and sparsely branched limbs. It is grown as an ornamental avenue tree and sometimes as a shade tree. The tree is hardy and drought-resistant and is found grown widely in the sub-Himalayan region up to 2000 m above sea level [6].

The plant regenerates freely from seeds during rain under natural conditions. It can also be artificially propagated by direct sowing, transplanting seedlings from a nursery, or by cutting and root suckers.

The bark is smooth, greenish-brown when young, turning grey and fissured with age.

Leaves are alternate, 20-40 cm long, bipinnate, or occasionally tripinnate. Leaflets 3-11, serrate, dark green on the upper surface and paler underneath. They produce a pungent odour when crushed.

The inflorescence is a long, axillary panicle up to 20 cm long.

Flowers are purple and fragrant, numerous on slender stalks, sepals 5-lobed, 1 cm long; pentamerous, each petal 5-lobed. 9 cm long petals 5-lobed, 0.9 cm long, pubescent; staminal tube deep purple-blue brown.0.6 cm long.

Fruit or berries are small, yellow drupe, nearly round, about 15 mm in diameter, smooth and hard as a stone, containing 4 to 5 black seeds.

Seed is oblongoid, 3.5 mm x 1.6 mm, smooth, brown, and surrounded by pulp [7, 8].

Phenology

Phenological features was different from the other countries.

Observable phenological growth, bud development, begins in March Leaf growth occures from April to September.

Flowering observes from May to June Fruits occure in May, Fruits remain on the tree a long time (16 months).

The tree is deciduous and falls the leaves in October-November in the ecology, To some different morphological data could be reached as being petal and stamen number [9].

Phytochemical Analysis

Preliminary phytochemical studies of methanol extract of root powder were carried out. Presence of various phyto-constituents like steroid, glycosides, saponin, flavonoid, alkaloids, phenols, tannins and amino acids were tested [10].

Chemical constituents according part of plants

- **Triterpenoids:** Azadirone, Meliatoxin, Salannin, Sendanin, Nimbin
- **Alkaloids:** Meliacine, Meliacinine, Parviflorine, Meliavine
- **Glycosides:** Meliaside, Meliacin glycoside
- **Flavonoids:** Quercetin, Kaempferol, Naringenin
- **Phenolic acids:** Gallic acid, Ferulic acid, Caffeic acid

Root bark

- **Limonoids:** A group of triterpenoids, including: Azadirone, Meliatoxin, Salannin, Sendanin
- **Alkaloids:** Such as: Meliacine, Meliacinine, Parviflorine
- **Glycosides:** Including: Meliaside, Meliacin glycoside
- **Flavonoids:** Quercetin, Kaempferol
- **Phenolic acids:** Gallic acid, Ferulic acid
- **Saponins:** A group of triterpenoid saponins
- **Essential oils:** Containing compounds like: Linalool, Beta-caryophyllene

Fruits

- **Alkaloids:** Meliacine, Meliacinine, Parviflorine, Meliavine
- **Glycosides:** Meliaside, Meliacin glycoside, Rutin
- **Flavonoids:** Quercetin
- **Phenolic acids:** Gallic acid, Ferulic acid, Caffeic acid

Pharmacological activities of *Melia azedarach* Linn. as per modern science

Antidiabetic activity

Leaf extract of *M. azedarach* exert a hypoglycemic effect on alloxan-induced diabetes in rats and one of the possible mechanisms of action is to increase the insulin secretion and enhances the glucogenesis process. Two compounds were isolated from root extracts that exert a-amylase sucrase and a-glucosidase inhibitory activities. *M. azedarach* bark also showed significant inhibitory activities against protein tyrosine phosphatase 1B (PTP1B), which might be attributed to the antidiabetic potential of this plant [15].

Hepatoprotective activity

Ethanolic extract of *M. azedarach* plant leaves has been documented to reduce the serum enzyme including glutamic oxaloacetic transaminase (SGOT) and serum glutamic pyruvate transaminase (SGPT), which is intoxicated by carbon tetrachloride (CCL) in mice; thus shown significant hepatoprotective activity. Liver biliary duct enzyme alkaline phosphate (ALP) and serum bilirubin are considered biomarkers for liver injury. A study reported that *M. azedarach* reduced the level of these mentioned parameters to normal levels after therapy.

Anticancer activity

Various parts of *M. azedarach* exerted cytotoxic and anti-proliferative property against various cancer cell lines such as human lung adenocarcinoma (A549), colorectal carcinoma (HT- 29), breast cancer (MCF, SK-BR-3), cervix hepatoma (HepG-2, SMMC-7721 and Hep3B), kidney epithelial cells (KB), prostate cancer (PC3), CNS (SH. SV5V, U251, SF539), B16F10 mouse melanoma cell-line. A study reported that the chloroform, butanol, crude, hexane, ethyl acetate and aqueous fractions of *M. azedarach* exhibit good cytotoxic activities.

Anti-viral activity

Wachsman *et al*., (1998) showed that the viruses that cause foot and mouth disease might be suppressed by a peptide named "Meliacine" that was produced from *M. azedarach*

leaves. The experiment had demonstrated that the isolated compound "Meliacarpin," which is the purified extract of *M. azedarach* leaves, inhibits the multiplication of both vascular stomatitis and herpes simplex virus, according to further investigation by Alche and his colleagues.

Wound healing activity

With the use of an alloxan-induced diabetic rat model, Vidya *et al*., (2012) investigated the ability of *M. azedarach* leaves to heal wounds. The ability of *M. azedarach* leaf extract applied topically to cure wounds was demonstrated in the alloxan-induced diabetic rat model. The study's control drug was povidone-iodine, and the trial results showed that administering a topical extract of *M. azedarach* leaf to diabetic rats facilitated wound healing. The anti-bacterial properties of *M. azedarach* leaf extract may be the cause of the diabetic rats' model's faster wound healing.

Analgesic activity

Melia azedarach, showed promising narcotic analgesic activity (mediated through opioidergic receptors).

Antimalarial study

Antimalarial effect of methanol extract of fruit, bark and leaves of *Melia azedarach* on mice against the malaria parasite Plasmodium berghei. The study showed that fruit and bark extracts have significant suppression effect on parasitaemia. It was concluded *Melia azedarach* has significant anti-malarial effect.

Conclusion

Melia azedarach Linn., known as *Mahanimba* in Ayurveda, is a medicinally significant plant with a long-standing tradition of therapeutic use across various traditional systems of medicine. This comprehensive review highlights its botanical characteristics, phytochemical constituents, and broad pharmacological activities. Rich in triterpenoids, alkaloids, flavonoids, and glycosides, *Melia azedarach* demonstrates potent biological properties including antidiabetic, hepatoprotective, anticancer, antiviral, wound-healing, analgesic, and antimalarial effects. These findings validate its traditional uses and support its continued relevance in modern therapeutic contexts. Furthermore, its adaptability, ecological resilience, and diverse bioactive compounds make it a promising candidate for future pharmacological research and drug development. Bridging ancient Ayurvedic knowledge with modern scientific validation enhances our understanding of Mahanimba's multifaceted benefits and encourages its integration into evidence-based medical practice. However, further clinical studies and toxicological evaluations are essential to fully harness its potential and ensure safe, standardized use in healthcare.

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