Review Article

Ethnopharmacological and phytochemical account of paradise tree (*Melia azedarach* L.: Meliaceae)

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Abstract
Plants being the prime source of medication since time immemorial have been consumed as a source of nutrition as well as therapy against different ailments and diseases. For Chinaberry (*Melia azedarach* L.), one of the important medicinal plants from *Meliaceae* family, medicinal properties by traditional practitioners are being quoted for each and every plant part. Pharmacological investigations verify different health maintenance activities of *M. azedarach* viz. anti-nephrolithiasis, hepatoprotective, antibacterial, anti-parasitic, antiulcer, anthelmintic, antioxidant and antipyretic action. There is also considerable literature available related to its chemistry. The present review presents an up to date literature survey of ethnomedicinal, phytochemical and pharmacological account of *Melia azedarach* L.

**Key words:** Dhrek; Traditional medicinal plant; Antioxidant; Pharmacological activities; Melianol; Active compounds.

**Introduction**
*Melia azedarach* L. is a small to medium, perennial, deciduous tree from the Meliaceae family (Fig.1) (available at: (i) [http://www.whitehorse.vic.gov.au/White-Cedar.html](http://www.whitehorse.vic.gov.au/White-Cedar.html) (ii) [http://www.delange.org/ChinaBerry/ChinaBerry.htm](http://www.delange.org/ChinaBerry/ChinaBerry.htm) (iii) [http://it.wikipedia.org/wiki/Melia_azedarach](http://it.wikipedia.org/wiki/Melia_azedarach) respectively) believed to derive its name from word *Melia* (Gr.) for the ‘manna or flowering ash’ pointing out the similarity of leaves of the tree to that plant and *azedarach* from the name of a poisonous plant “azedaracht” [1]. The tree is an original species of the South Asia (South of China, Iran, and India) that was introduced, cultivated and naturalized in the New World. Now, the plant is widespread in Pakistan, Indonesia, India and Australia, Brazil, Argentine, Philippines and many African and Arab countries [2].

**Synonym(s)**
*Melia japonica, Melia australis, Melia sempervivens.*

**Common name(s)**
Dhrek, Bkain, Chinaberry, White Cedar, Paradise tree, Syringa, Bead tree.
Phytochemistry

The prevalence of herbal preparations and healthcare remedies of plants origin has been traced to the natural chemical compounds with medicinal properties. The phytochemistry of *M. azedarach* is complex. Compounds purified and identified from different plant parts are given in Table 1. Structures of some of the lead components are illustrated in Fig. 2 and 3.

Table 1. Phytochemistry of Paradise Tree L. [1, 3-7]

<table>
<thead>
<tr>
<th>Plant part</th>
<th>Phytochemistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem</td>
<td>Kulinone, Melianin – A, 1,3,5,8-Tetrahydroxy-2-methyl anthraquinone; 8-Meth ether, 12-Acetoxymoorastatin, Galactopyranoside, α-Pinene, 7a-Acetoxyl14β,15β-epoxygedunanl-ene-3-O-β-D-glucopyranoside, 4',5-Dihydroxy flavone-7-O-u-Lrhamnopyranosyl-(1-4)-β-D-glucopyranoside, Fraxinellone, Amoorastatin, Kulactone, 12-Hydroxyamoorastatone, 3:Hydroxyeupha-7,24-diene-21,16-olide, 1,8-dihydroxy-2-methyl anthraquinone-3-O-α-L-rhamnopyranoside, K bullishactone, a-Terpinene, 3-O-α-L-rhamnopyranoside, β-Pinene,</td>
</tr>
<tr>
<td>Leaves</td>
<td>Palmitic acid, l-Cinnamoyl-3-methacrylyl-11-hydroxy meliacarpin, l-Cinnamoyl-3-acetyl-11-hydroxy meliacarpin, 1,3-Dicinnamoyl-11-hydroxy-2-neliacarpin, DeacetylSalannin, α-Pinene, α-Terpinene, β-Pinene, Kaempferol-3-O-β-rutinoside, α-Terpineol, Rutin, Kaempferol-3-L-rhamno-D-glucoside</td>
</tr>
</tbody>
</table>
Meliacarpin E, 4-Stigmastanen-3-one, Trichilin-D, 1-Cinnamoyl-3-acetyl-11-methoxy meliacarpin, 4-Campestene-3-one β-Sitosterol, 2α-Acetyl-29-deacetyl-29-isobutryl sendanin, 6-β-Hydroxy-4-Stigmasten-3-one, Trichilin-H, β-Sitosterol B-D-glucoside, Salannal, Azeclarachol, 6-β-Hydroxy-4-canpesten-3-one, Trans-cinnamic acid

### Fruits

### Seeds
Oleic acid, (±) pinoresinol, Melianolmeliacin, Daucosterol, Vanillic acid, Meldenin, β-D-glucopyranose, Meliartinenin,3β,7α-Dihydroxy-21,23-epoxyapotirucalla-14,24-diene-21-one, Linolenic acid, Linoleic acid, Campesterol, Stigmasterol, Benzoic acid, hydroxyl-3-methoxycinnamaldehyde, β-sitosterol, Vanillin, Meliacarpin, 6,11 diacetoxy-7-oxo-14 β-epoxymeliacin (1,5-diene-3-O-β-D-glucopyranoside), Vanillin

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**Fig. 2.** Highlighted ethnomedicinal and pharmacological activities of *M. azedarach* L.
Pharmacological Activities

According to data presented in a report by world health organization (WHO), in tropical countries, infectious diseases account for 50% of the deaths; about 80% of population from developing countries use traditional medicine [8], emphasizing such plant species to be investigated for a better understanding of their safety and efficacy. A quick overview of the traditional uses of Melia azedarach plant is given in Table 2. A synopsis of pharmacological activities of M. azadarch is given below (Table 2).

Table 2. Ethnomedicinal uses of M. azedarach L.

<table>
<thead>
<tr>
<th>Plant part</th>
<th>Ethnomedicinal use(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaves</td>
<td>Diuretic, Anthelmintic, Resolvent. Effective in skin diseases, hysteria, toothache, fever, rheumatic pain. Extract from fresh leaves is applied for burns externally. Five ml extract from leaves is orally administered three times a day for piles. Five – Ten ml leaf extract is orally taken two times a day for seven days in pyrexia. Extract from leaves is used to cure the eruption on the scalp and also for headache [28,42-45]</td>
</tr>
<tr>
<td>Stem</td>
<td>Administered in asthma [46-48]</td>
</tr>
<tr>
<td>Gum</td>
<td>Effective in enlargement of spleen [48]</td>
</tr>
<tr>
<td>Bark</td>
<td>Prescribed in fever to relieve thirst, nausea, vomiting and loss of appetite. Thirty-</td>
</tr>
<tr>
<td>Plant part</td>
<td>Ethnomedicinal use(s)</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>Stem bark</strong></td>
<td>Fifty ml infusion from stern bark is used orally two times a day for gonorrhea [28,47]</td>
</tr>
<tr>
<td><strong>Roots</strong></td>
<td>Deobstruent and resolvent [49,50]</td>
</tr>
<tr>
<td><strong>Flowers</strong></td>
<td>Astringent, diuretic, anodyne, resolvent, deobstruent. Refrigerant and alexipharmic, vermicidal, stomachic, valuable in killing lice and eruptive skin diseases [51]</td>
</tr>
<tr>
<td><strong>Fruits</strong></td>
<td>Anthelmintic, purgative and emollient [52,53]</td>
</tr>
<tr>
<td><strong>Seeds</strong></td>
<td>Bitter, aphrodisiac, expectorant, anthelmintic, used in typhoid fever, scrofula, helminthiasis and in pelvic region pain [52]</td>
</tr>
<tr>
<td><strong>Seed oil</strong></td>
<td>Antiseptic for sores and ulcers, skin diseases, e.g., ringworm, scabies and rheumatism. The oil is used internally in malaria fever and leprosy [54]</td>
</tr>
</tbody>
</table>

**Hepatoprotective Activity**
The liver is vital organ, injury susceptible to various drugs and chemicals. Ethanol extract from leaves of *Melia azedarach* has reported to decrease the serum enzymes including Serum glutamic pyruvate transaminase (SGPT) and Serum glutamic oxaloacetic transaminase (SGOT) intoxicated by carbon tetrachloride (CCl4) in rats thus shown significant hepatoprotective activity [9]. Liver transaminases viz. Glutamic Pyruvic Transaminase (SGPT), Serum glutamic oxaloacetic transaminase (SGOT), Liver biliary duct enzyme alkaline phosphatase (ALP) and serum bilirubin are widely taken as useful biomarkers for liver injury. In a study liver protective activity of the plant against CCl4 chemical induced liver injury was conducted against the mentioned parameters. All the four biochemical parameters were significantly improved while histological changes (steatosis and fibrosis); pragmatic in CCl4 intoxicated group, were reduced to normal levels after treatment [10]. There are few other reports available compiling data on hepatoprotective activity of *M. azedarach* [11-15].

**Wound healing Activity**
While suffering from diabetes mellitus, impaired immune defenses, increased blood sugar impairing the blood flow and oxygen release, and microbial infections are the possible reasons of interruption in the wound healing process. Topical application of methanol extract from leaves of *M. azedarach* has shown noteworthy wound healing activity in alloxan induced diabetic rats analogous with povidone iodine standard [16]. There are other reports dealing with wound healing activity of *M. azedarach* [17-20].

**Antipyretic Activity**
Hydro-methanolic extract from leaves of *M. azedarach* exhibited significant reduction in elevated temperature in comparison to that of paracetamol standard drug in yeast induced pyrexia in experimental animals ascribable to the flavonoide components and/or alkaloides in the plant extract [21]. Other investigators also commented on antipyretic action of this plant [22-24].

**Antimicrobial Activity**
Isolated from leaves of *M. azedarach*, ‘Meliacine’ was found to restrain the growth of foot and mouth disease virus [25]. Another compound purified from leaves of *M. azedarach* ‘Meliacarpin’ inhibit in vitro the Vesicular stomatitis and Herpes simplex virus mushrooming without any cytotoxic effects [26]. Significant inhibition of different bacterial strains including the gram negative as well as gram positive bacteria was shown by the aqueous and ethyl acetate
extracts of *M. azedarach* [27]. Extracts of different polarity from *M. azedarach* seeds showed inhibitory action against eighteen different human pathogenic bacteria. Methanol, benzene, ethyl acetate and aqueous extracts from seeds of the plant showed significant antibacterial activity against experimental pathogens. The ethyl acetate extract exhibited the highest inhibition rates among all the others [28]. There are more studies related to antimicrobial activity of the plant [29-34].

**Antioxidant Activity**

The total flavonoid contents (TFC) and total phenolic contents (TPC) in ambient dried plant parts were found to be in the range of 10.67-23.45 mg CE/g DW (Catechin equivalents per gram dry weight) and 66.89-103.34 mg GAE/g DW (Galllic acid equivalents per gram dry weight), while sun dried parts in the range of 13.32-28.11 mg CE/g DW and 74.43-112.10 mg GAE/g DW respectively. The diphenyl-picrylhydrazyl (DPPH) scavenging activity and linoleic inhibition capability of the sun dried material was found to be in the range of 35.57-52.11% and 55.43-63.86% while for the ambient dried plant parts it was in the range of 33.87-50.33% and 48.54-61.00% respectively. The reducing potential of sun dried and ambient dried plant parts at 10mg mL⁻¹ concentration was in the range of 0.727-1.211and 0.601-0.890, showing the higher antioxidant activity for sun dried samples. Among different plant parts, the stem bark showed better antioxidant activity than those of others [35]. Antioxidant activity of plant by biological assays has been assessed by various researchers [36-38].

**Antimalarial Activity**

Antimalarial activity of methanol extract from leaves, bark and fruits of *M. azedarach* was studied against *Plasmodium berghei*, the malaria parasite, in experimental mice. Fruit and bark extracts showed a significant growth inhibitory effect on the parasite. Although less significant than chloroquine standard, *M. azedarach* showed significant anti-malarial effect [39].

**Anthelmintic Activity**

The ethanol extract of *M. azedarach* is reported to be active against *Pheretima postthuma* (earthworm) and *Taenia solium* (tapeworm) with Piperazine phosphate control. The inhibitory result was better against *Taenia solium* than Piperazine phosphate standard [40]. Ethanol extracts from fruits of *Melia azedarach* checked the growth of hookworms (*Bunostomum trigonocephalum*), earthworms (*Pheretima posthuma*), tapeworms (*Taenia solium*), nodular worms (*Oesophagostomum columbianum*) better than piperazine phosphate and hexylresorcinol the standards against tapeworms and hookworms, respectively [41].

**Conclusions**

The renewed focus in plant based remedies is because of a few numbers of side effects. *M. azedarach* known for its cytotoxic value possesses potential medicinal attributes. For medicinal bioactivities, antimicrobial, antioxidant, antihelminthic, antimalarial and wound healing are more focused ones. Phytochemical studies reveal typical constituents of *M. azedarach* as alkaloids, terpenoids, flavonoids and anthraquinones. For better understanding of the molecular mechanism of interaction in the human body further investigations should be conducted at *M. azedarach* purified compounds in different diseases.

**Authors’ contributions**


**References**

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