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Melia azedarach: A phytopharmacological review

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ABSTRACT

Ayurveda is a traditional Indian medicinal system being practiced for thousands of years. Considerable research on pharmacognosy, chemistry, pharmacology and clinical therapeutics has been carried out on ayurvedic medicinal plants. Natural products, including plants, animals and minerals have been the basis of treatment of human diseases. The current accepted modern medicine or allopathy has gradually developed over the years by scientific and observational efforts of scientists. However, the basis of its development remains rooted in traditional medicine and therapies. .

Melia azedarach Linn, commonly known as mahanimba belongs to family Meliaceae. It is large evergreen tree found throughout India and very similar to neem. Traditionally it is used as anthelmintic, antilithic diuretic, emmenagouge, astringent and stomachic. Varios scientific studies reported the analgesic, anticancer, antiviral, antimalarial, antibacterial, antifeedent and antifertility avtivity of this plant. So the objective of the present review is to highlight the phytochemical and pharmacological information of this plant.

KEY WORDS: Ayurveda, *Melia azedarac* ,emmengogue, anticancer, antifeedant activity

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, Sri Lanka and other countries 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. A scholarly description of the legacy of Charaka in contemporary idiom, best attempted with a commentary from modern medicine and science viewpoint, gives some glimpses of ancient wisdom. Indian healthcare consists of medical pluralism and ayurveda still remains dominant compared to modern medicine, particularly for treatment of a variety of chronic disease conditions. India has about 45,000 plant species; medicinal properties have been assigned to several thousands. About 2000 are found in the literature; indigenous systems commonly employ about 500–700.

Melia azedarach, commonly known as bead tree, distributed through out India. Different parts of plant are useful in leprosy, leucoderma, ulcer, helminthiasis, diabetes. Meliacin is principle constituient present in plant.

source and botanical description

Botanical source: *Melia azedarach*
Family: Meliaceae
Synonyms: *Melia composita*
Sanskrit synonyms: Mahanimba, Himadruma, Paratanimba vraksha
Regional names:
English: Persian lilac, Pride of China, Pride of India, common bead tree.
Hindi: Bakayan, Bakain, Mahanimb.
Gujrati: Bakan, limbodo.
Kannada: Bevu.
Malyalam: Mullay vaempu.
Panjabi: Drek.
Bengali: Ghora neem.
Tamil: Malai veppam,
Telgu: Taraka vepa

Plant is a moderate sized deciduous tree, 9-12 m in height with a cylindrical bole and a dark gray bark having shallow longitudinal furrows. Leaves are bi or tripinnate opposite or alternate. Flowers are lilac, fruits are ellipsod-globose 4-seeded drupes, yellow when ripe (1).

Distribution: It is found wild in the forest of hottest parts of India, in sub-Himalayan tracts up to 914 m; also cultivated through out India (2).

PHYTOCHEMISTRY

Stem: stem has been shown to contain surinol, melianin b, sendanolactone, **3-**α-hydroxy-4, 4,14alpha-trimethyl-5-α-preg-8-en-20-one and ochinin acetate. Methnolic extract at 7.5% concentration gave better larval mortality and its 10% concentration showed better ovicidal activity against *Helicoverpa armigera, Earias vittella and Plutella xylostella* (3)

2-beta-carboline alkaloids, 4-methoxy-1-vinyl-beta-carboline and 4,8-dimethoxy-1-vinyl-beta-carboline, were isolated from the cortex of *M. azedarach* (4).

Stem Bark: It contain 4', 5'-dihydroxyflavone-7-0-α-L-rhamnopyranosyl(1→4)-β-D-glucopyranoside, 1,8-dihydroxy-2-methylanthraquinone-3-0-β-D-galactopyranoside, 1,5-dihydroxy-8-methoxy-2-methylanthraside,1,5- dihydroxy-8-methoxy-2-methylanthraquinone-3-0-α-L-rhamnopyranoside,

7α-acetoxy-14β-15β-epxygedunan-1-en-3-0-β-D-glucopyranoside, kuline, kulactone, kulolactone, kulinone (5).
Methanolic extract of stem **bark** of *Melia azedarach* var. japonica has led to a new limonoid, 12-hydroxyamoorastatone along with two known limonoids 12-hydroxyamoorastatin and 12-acetoxyamoorastatin. All the three compounds exhibited significant cytotoxicities against five human tumour cell lines of A- 549 (human lung adenocarcinoma), SK-OV-3 (human lovarian adenocarcinoma), SK-MEL-2 (human malignant melanoma), XF-498 (human CNS carcinoma) and HCT-15 (Human Colon Adenocarcinoma) using antimycin A (6).
Heart Wood: It contains bakayanin, bakalactone, tannin (7).
Bark: It contains nimbinene, azaridine, paraisine, isochuanliansu, 6 H-β-hydroxy-4-stigmasten-3-one, 6β-hydroxy-4-campesten-3-one (7).
Leaves: Leaves has been shown to contain nimbinene, meliacin, quercetrin, quercetin-3-0-β-rutinoside, kaempferol-3-0-β rutinoside, rutin and kaempferol-3-L-rhamno-D-glucoside (7,8). Hot methanolic etract of *Melia azedarach* leaves contain dipentadecyl ketone, glycerol 1,3-bis-undec-9-enoate 2-dodec-9-enoate and glycerol tris-tridec-9-enoate. (9).
Ethyl acetate extract of leaves of *M. azedarach* led to the isolation of the limonoid 1-cinnamoyl-3,11-dihydroxymeliacarpin, which showed IC50 values of 6μM and 20μM for vesicular somatitis (VSV) and herpes simplex (HSV-1) viruses respectively (10).
Fruits: azaridine, bakayanin, bakalactone(8), margosine, azadirone, azadiradione, epoxyazadiradione, ohchinol, ohchinin, ohchinolal,ohchinolides A and B, nimbolinin B, 1-desacetylnimboline B, nimbolidins A and B, triterpene B, meliacins A_1,A_2, B_1, B_2, sendanin, sendenal, 1-cinnamoylmelianolone, meliantriol, melianone, melianol, lupeol, β-sitosterol and its 3-glucoside catechin, vanillin and cinnamic acid (7).
Three new C-Seco limonoids and one new tetracyclic limonoid were isolated from a methanol extract of the ripe fruits of *Melia azedarach* collected in Curitiba, Brazil. Among the limonoids isolated, 15-O-deacetylnimbolidine, B, and 12-O-deacetyltricilin H exhibited significant anticancer activity against HeLa S3 cancer cells, whereas 15-o-deacetyl-15-O-methylnimbolidine A, 15-o-deacetyl-15-O- methylnimbolidine B showed weak cytotoxicity (11).
Seeds: cystine, serine, arginine, glycin, glutamic acid, threonine, methionine, leucine, lycine and proline, limonoid glycosides, 6-acetoxy-11-hydroxy-7-oxo-14β,15β-epoxy meliacin-1,5-dien-3-0-α-L-rhamnopyranoside, nimbinene, salannin and meldenin (7).
Azo alkyd dyes were isolated from *Melia composita (M. azedarach)* seed oil (12).
The hydroxy coumarin scopoletin was isolated from seed kernels of *Melia azedarach* L. from which three other compounds, vanillin , 4-hydroxy-3-methoxycinnamaldehyde , and (±) pinoresinol have also been isolated. This shows synergistic antifungal activity with Mancozeb and Carboxin (toxic synthetic antifungals, used in conventional agricultural) (13). The seeds contain icosane, tingenone, methyl heptanoate, methyl heptaicosanoate, methyl 3, 12-dihydroxyhexadecanoate, octanoic nonanoic anhydride, hexadecanoic pentadecanoic anhydride and cabraleolactone (14).
Root: It contain Salanin, a limonoid (6-acetoxy-3β-hydroxy-7-oxo-14β-epoxymeliac-1,5-dien-3-0-β-D-glucuronopyranoside) and apigenin-5-0-β-D-galactopyranoside (7).
Two new azadirachtin type limonoids, 1-methaacrylyl-3-acetyl-11-methoxymeliacarpinin (fig.1) and 1-(2-methylpropanoyl)-3-acetyl-11- methoxymeliacarpinin (fig.2), together with the known compounds, meliacarpinin D (fig.3), melianin B (fig.4) and 2β,3β-dihydroxy-5α-pregn-17(20)-(Z)-en-16-one (fig.5), were isolated from the methanolic extract of **roots** of *Melia azedarach* (15).

A new limonoid, two new anthraquinones and a new glycosyl derivative of ellagic acid were isolated and identified from the roots of *Melia azedarach* (16). Three new degraded limonoids teracrylmelazolide A, melazolide A and teracrylmelazolide B were isolated from the roots *Melia azedarach* (17). Two new terpinoids, bakayanolide and 2 alpha-hydroxy-3beta-methoxy-6-oxo-13alpha, 14beta, 17alpha-lanosta-7,24-dien-21,16beta-olide, together with the known compounds 6beta-hydroxy-3-oxo-13alpha,14beta,17alpha-linosta-7,24-dien-21,16beta-olide, sendanolactone, kulactone, and beta-sitosterol have ben isolated from the etanolic root extract of *Melia azedarach* (18).

Root bark: It contains azedarachol, a steroid ester (7). Monosaccharide, water-soluble polysaccharides, pectin substances and hemocellulose were isolated from the root **bark** of *M. azedarach* (19). Two new degraded limonoids, azedaralide (fig.6-1) and 12α- acetoxy fraxinellone (fig. 7-2), were isolated along with four known dregraded limonoids fraxinellone (fig.7-3), fraxinellonone (fig.7-4), pyroangolensolide (fig.6-5), and 9alpha-acetoxyfraxinellone (fig.7-6) from the **root bark** of *Melia azedarach*. Biological activity of the isolated degraded limonoids was tested on incect antifeedant and ichthyotoxic activities using the third – instar larvae of spodoptera littoralis and a Japanese killifish oryzias latipes. fraxinellonone, showed no antifedant activity but azedaralide, 12α- acetoxyfraxinellone and fraxinellone were active at 500 ppm, corresponding to the concentration of 10 μg cm-2, against the insect by leaf disk method. On the other hand all the compounds showed the ichthyotoxic activity at the following concentrations, azedaralide 50 ppm, 12α- acetoxyfraxinellone 50 ppm, fraxinellone 10 ppm and fraxinellonone 50 ppm. (20). A new limonoid, azedarachin C, was isolated from the diethyl ether extract of **root bark** of Chinese *Melia azedarach* and an insect antifeedant against the larvae of voracious pest insect *spodoptera exigua* Hubner. azedarachin C has no oxygen-function at C-12 and thus is different from known azedarachins (21). Four new limonoids, 1-tigloyl-3, 20-diacetyl-11-methoxymeliacarpinin, 3-tigloyl-1,20-diacetyl-11-methoxymeliacarpinin, 1-cinnamoyl-3-hydroxy-11- methoxymeliacarpinin, and 1-deoxy-3-methacrylyl-11-methoxy-meliacarpinin, together wih a known

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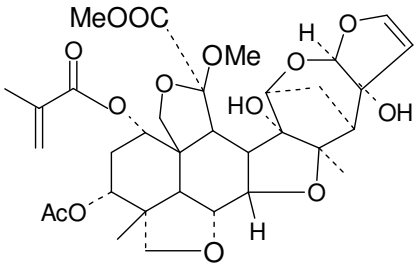
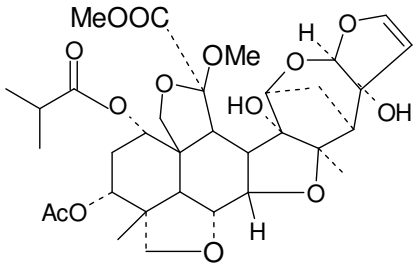


1



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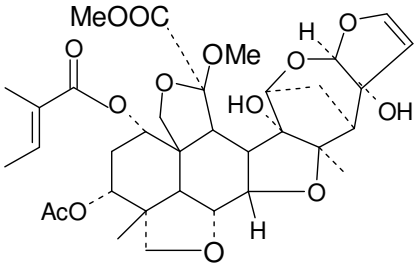

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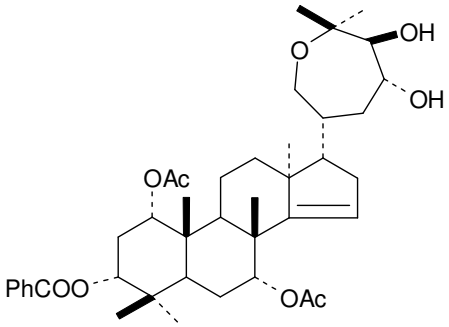

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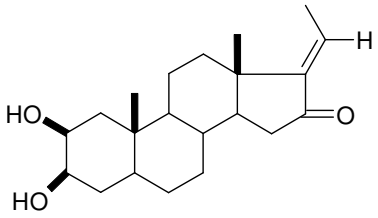

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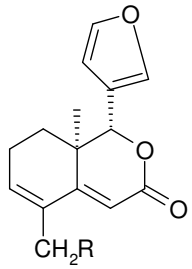
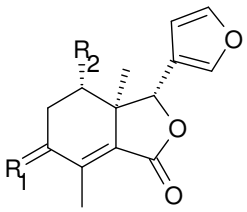


1: R= OH
5: R= H



2: R_1= H, R_2= OAc

3: R_1= H, R_2= H

4: R_1= O, R_2=H

6: R_1= alpha-OAc and beta-H, R_2= H

limonoid 1-cinnamoyl-3-acetyl-11- methoxymeliacarpinin, were isolated from the ethanolic extract of the **root bark** of *Melia azedarach* (22). A biogenetically intresting ring C-seco limonoid, salannal, and a potent insect antifeedant, meliacarpinin E, were isolated from the diethyl ether extract of **root bark** of Chinese *Melia azedarach*, along with four known seco limonoids, salannin, deacetylsalannin, nimbolinin B, nimbolidin B (23). The ethanolic extract of the **root bark** of *Melia azedarach* exhibited cytotoxic activity against lymphocytic leukemia P388 cell lines in vitro. Systemic

fractionation of the extract monitoried by cytotoxic bioassay led to the isolation of two new azadirachtin-type limonoids, 1-tigloyl-3-acetyl-11-methoxymeliacarpinnin and 1-acetyl-3-tigloyl-11-methoxy meliacarpinnin, together with three highly cytotoxic sendanin type limonoids, 29-iso-butylsendanin, 12-hydroxyamoorastin and 29-deacetylsendanin (24).

PHARMACOLOGY AND TRADITIONAL USES

Stem: The exuded gum obtained from its trunk is considered useful in spleen enlargement, its wood extract is prescribed internally in asthma (2) decoction of bark is used in paroxysmal fever to relieve thirst, nausea, vomiting and general debility, loss of appetite and skin diseases (7).

Leaves: leaves are applied in the form of poultice to relievbe nerous headach and to cure the eruption on the scalp. Leaf juice is anthelmintic, diuretic and emmenagouge, expectorant, vermifuge and their decoction is astringent, stomachic (1,2,7), employed in hysteria, they are used internally and externally in leprosy, scrofula and other skin diseases (25).

Flowers: They are astringent, refrigerent, anodyne, diuretic, emmenagouge, resolvent, deobstruent and alexipharmic (1,7). They are applied as a poultice to relieve nervous headache (2). They are stomachic(11), vermicide and valuable in eruptive skin diseases (8,25) and for killing lice (8).

Fruits: Fruits are purgative, emmolient and anthelmintic (3). Fruits are considered tonic. Sushruta prescribed mahanimb fruits internally in indigestion, colic and intestinal catarrh (8).

Seeds: seeds are bitter, expectorent, anthelmintic and aphrodiasic, and are useful in helminthiasis, typhoid fever, pain in the pelvic region, uropathy, vitiated conditions of vata and scrofula (1). They are prescribed in rheumatism; oil obtained from seeds is applied locally in skin diseases (2). They are taken with adjuvants like rice water and clarified butter; ramyak Ghrita of sushurta was a specific remedy for gout. Sharangadhara prescribed seeds for urinary disorders. Ashroghna vati, a classical compound of 16th centuary, was prescribed for piles (8).

Roots: roots are bitter, astringent, mildly thermogenic, anodyne, depurative, vulnerary, antiseptic, anthelmintic, constipating, expectorant, febrifuge, antiperiodic, urinary astringent, emmenagogue and bitter tonic in low doses. They are useful in sciatica, lumbago, headache, leprosy, leucoderma, skin diseases, wounds, ulcers, piles, worm infestation, cough, asthma, ammenorrhoea, dysmenorrhoea, diabetes, abnormal urethral discharge, chronic and intermittent fevers, vomiting, post labour pain in uterus (1,7). Sharangadhara prescribed a paste of the roots for alleviating sciatica (8).

Root bark: It is deobstruent, resolvent, alexipharmic (2), astrigent, tonic and antiperiodic(11), also emetic, anthelmintic, in large doses narcotic (25).

SCIENTIFICALLY VALIDATED USES

Analgesic activity: *Melia azedarach*, showed promising narcotic analgesic activity (mediated through opioidergic receptors) (26).

Haematological activity: The role of *Melia azedarach* in haematological parameters was studied in mice. An aqueous extract of leaves exhibited a transient increase in packed red blood cell volume and haemoglobin concentration, an increase in neutrophil number and a decrease in lymphocyte number (27).

Immunomodulatory activity: An extract of leaves of *M. azedarach* inhibited phagocytosis and the respitaory burst triggered by the post-receptor stimulus, phorbol 12-myristate 13-acetate in human monocytes (28).

Antifeedant activity: The effect of powdered fruits of *Melia azedarach* and extracts in petroleum ether and acetone on , reduction in F1 progeny and repellency to adults of Sitophilus oryzae at different concentration were studied. The results showed that mortalities recorded following exposure to the powder were very low during the Ist week of treatment, and then gradually increased to reach a moderate percentage (29).

Water extract of leaves and fruits of chinaberry produced significant reduction of live larve of B. fusca 72 h after treatment (30). Systematic fractionation of a fruit extract of Argetine *Melia azedarach*, which was monitored by insect antifeedant bioassay, led to the isolation of meliartenin, a limonoid antifeedant, which existed as a mixture of two interchangeable isomers. At 4 $\mu g/cm^2$ and 1 $\mu g /cm^2$, the isomeric mixture was as active as azadirachtin in strongly inhibiting the larval feeding of *Epilachna paenulata* and the polyphagous pest, *Spodoptera eridania*, respectively (31).

In laboratory choice and no-choice bioassays, treatment of elm leaves with extracts obtained from unripe fruits and green or senescent leaves of *Melia azedarach* at 1-10 percent concentration significantly deterred feeding by adults of the elm leaf beetle, Xanthogaleruca luteola. Extracts from the different plant structures were similarly active, and starvation as a consequence of their strong antifeedant activity could play a significant role in the high mortality values observed (32). Three new limonoid antifeedants, meliacarpinins 1-3, were isolated along with fourteen known limonoids from the root bark of Chinese *Melia azedarach* Linn (Meliaceae).Their structures and antifeedant activity were elucidated. The antifeedant activities of the isolated limonoids, 1-17, were tested by the conventional leaf disk method against the larvae of S. exigua Hubner and S. eridania (Boisduval). The most potent was the meliacarpinins.1-4. which active at 50 pw corresponding to the concentration of 1 pg/cm' which may be less than those of the azadirachtins from the Indian neem tree *M. azadirachta indica* but belongs to the first class in the limonoids (33).

Insecticidal activity: The methanolic extract of the stems and its acetone, benzene and hexane extracts have been evaluated for their insecticidal activity against Helicoverpa armigera, Earias vittella and Plutella xylostella. Methanolic extract at 7.5% concentration gave better larval mortality and its 10% concentration showed better ovicidal activity (3)

Different concentratons (2.5, 5.0, 7.5 and 10 percent) of the methanolic extract of *Melia azedarach* roots and its acetone, benzene and hexane fractions (0.5 and1.0 percent) were tested for their insecticidal activity against Earias vittella larve. Methanolic extract at 10 percent concentration,

afforded the best result regarding larval and pupil period, percent pupation and adult emergence (reduction), adult longevity (reduced) and minimum hatching of the eggs. Amongst the fractions, acetone (1 percent) showed the best result (34).

The epitome of sum and substance of biotoxicity screening of aqueous extract of different parts of *Melia azedarach* against mosquito (Anopheles stephensi Liston) larvae in general and seed in particular. The toxicity assessment has been done by scoring larval mortality percentage at different concentractions (35). Methanolic extracts of dried and crushed neem and bakainseeds were exmined for theie effect on the biology and food consumption-utilization indices of Earias vittella, in comparison to nimbecidine (300 ppm azadirachtin) revealed that neem, bakain and nimbecidine (0.5 percent) adversely affected different biological processes of the pest. Larvae fed on fruits treated with progressively higher concentrations of the extracts had correspondingly lower weight, prolonged duration and decreased percent population, adult emergence and fecundity than those fed on untreated food (36).

Extracts from fruits and leaves of *Melia azedarach* were tested for repellent and insecticidal properties against eggs and nymphs of *Triatoma infestans*, the vector of Chagas disease. Unripe fruit extract was highly repellent for first and fourth instar nymphs. Ripe fruit had a weaker effect while leaves were ineffective. No effects on egg hatching, nymph survival or development time were detected, but first instar nymphs reared in contact with extracttreated refuges were significantly smaller than controls after moulting (37).

Fazal investigated the nontoxic and eco-friendly repellents of plant origin, he reported the use of *Bambusa arundinacea*, *Coriander sativum*, *Melia azedarach*, *Mentha spicata*, *Ocicum basilicum*, *Ricinus communis*, *Urtica dioica*, *Vitex nigundo*, *Withania somnifera* and *Xanthium strumarium* in controlling insects (38).

Antiviral activity: Meliacine(MA), a peptide isolated from leaves of *M. azedarach* inhibited the multiplication of foot and mouth disease virus (FMDV) in BHK-21 cells (39). Meliacin(MA), an antiviral principle isolated from leaves of *Melia azedarach*, exhibits potent antiviral activity against herpes simplex virus type(HSV-1) by inhibiting specific infected cell polypeptides(ICPs) produce late in infection. MA diminished the synthesis of viral DNA and inhibited the spread of infectious viral particles when HSV-1 that expresses β-galctosidase activity was used. An antiviral principle present in a purified fraction from *Melia azedarach* L. leaf aqueous extract restrains Herpes simplex virus type-1 propagation (40). Meliacin, an antiviral compound isolated from leaves of *M. azedarach* that inhibits HSV-1 replication in vitro and also prevents the development of herpetic stromal keratitis in mice (41).

Ocular herpes siplex virus type-1 (HSV-1) infections remain an important cause of corneal disease which may result in a loss of vision. Meliacine (MA), an antiviral activity present in crude leaf extract of Melia azedarach L. that inhibits HSV-1 multiplication in vitro, was studied in a murine herpetic stromal keratitis experimental model. Adult Balb/c mice were inoculated with HSV-1 at their corneas after abrasion. MA was administered topically three times a day for 3 consecutive days, beginning at 24 and 96 hr. after infection. MA significantly reduced the incidenc and the severity of blepharitis, neovascularization and stromal keratitis with respect to untreated infected mice, regardless the shedule of treatment assayed. Histological examination of corneas from MA treated animals revealed no tissue damage, whereas corneal samples from untreated infected mice showed inflammation, vascularization and necrosis. Treatment with MA at 24 hours post-infection (h.p.i.) reduced viral multiplication in the eye by 1-1.5 orders of magnitide. Thus, MA provides to exert an antiviral action on the development of herpetic stromal keratitis when supplied by post-treatment. Unexpectedly, treatment with MA after 96 h.p.i. prevented ocular disease, suggesting an in vivo immunomodulating activity of MA (42).

Antifungal activity: The ethanol extract of ripe fruits of *Melia azedarach* showed fungistatic (MIC values of 50-300 mg/ml) and fungicidal activies against aspergillus flavus, Fusariummoniliforme, Microsporum canis and candida albicans (43).

Antibacterial activity: The methanolic extract of *Melia azedarach* flowers showed potent antibacterial action in rabbit suffering from a skin infection produced by S. aureus (44).

The methanol extracts of leaves, root and stem barks of *Horsfieldia helwigii* and *Melia azedarach* showed a broad spectrum of antibacterial activity. The activity was increased on fractionation (petrol, dichloromethane, ethyl acetate) , particularly in the petrol fraction ofthe leaves of *H. helwigii* and dichlorometane fraction of the stem bark of *M. azedarach*. No activity was shown against tested moulds (45).

Cytotoxic activity: several workers reported the cyotoxic activity of *Melia azedarach*. In one study, the ethanolic extract of the root bark, exhibited cytotoxic activity against lymphocytic leukaemia P388 cell lines in vitro (24).

In another study it was found that ethanolic extract of *M. azedarach* showed a strong potential of cytotoxic activity against cultured human lung (A549) and colon (Col2) cancer cells (46). The effect of meliacine (MAS) and two fractions Mab 1 and MAB 2 obtained from it on the in vitro production of TNF-alpha of murine macrophages induced by bacterial lipopoly-saccharide (LPS) (from E. coli) was tested. Simultaneous administration of the above fractions to a macrophage culture significantly increased the amount of TNF-alpha released at 24 h of induction in a dose-dependent manner. Meliacine alone, at a concentration of 56 microg/ml, is a weak inducer of TNF-alpha production (47). A methanolic extract of ripe fruits of *Melia azedarach* afforded seven new ring C-Seco limonoids, exhibited inhibitory activity against HeLa S3 cancer cells (48).

Antimalarial activity: The antimalarial activities of extracts of *M. azedarach* leaves against laboratory-adapted isolates of P. falciparum were evaluated using an in vitro radioisotopic uptake technique. Chloroquine was used as a reference antimalarial drug (49).

Anthelmintic activity: The anthelmintic efficacy of *Melia azedarach* seeds was evaluated against gastrointestinal nematodes in sheep by measuring the number of eggs/g faeces (EPG) before and after treatment. It is concluded that *Melia azedarach* has no anthelmintic effect against trichostrongyloid infections in sheep (50).

Antilithic activity: Lithiasis was induced in rats by administering 0.75% ethylene glycol in drinking water for 28 days. Simultaneous administration of aqueous extract of *Melia azedarach*, (250 mg/kg) orally for 28 days along with ethylene glycol reduced urinary calcium, oxalate, phosphate and elevated urinary magnesium level, so it has antilithiatic effect on ethylene glycol induced nephrolithiasis in rats (51).

Antifertility activity: Ethanolic leaf extract of *Melia azedarach* were investigated for antifertility activity on male rats in oral dose of 100mg/kg daily for 21 days. There was abolition of libido in 100% males (52). Ethanolic extract of root of *Melia azedarach* intercepted pregnancy in 60% and 75% adult female rats when administeres at 250 and 500mg/kg daily doses, respectively on days 1-10 post coitum by the oral route. On fractionation, the activity was localized in the chloroform fraction of the ethanolic extract, which showed 80-100% activity at 250mg/kg daily dose in repeat test (53).

Oral administration of polar and nonpolar fractions, of *Melia azedarach* Linn. Seed extract at 24mg/kg for 18 days, significantly decrease the number normal follicles in ovaries of rat (54) the possible role of energy metabolism in the antifertility action was investigated by measuring changes in activities of the key enzyme of carbohydrate metabolism in uterus on 7^{th} day of pregnancy. It was observed that on 7^{th} day of pregnancy, one key enzyme of glycolitic pathway (phosphofructokinase) was significantly reduced in the uteri of treatd rats as compared to control. Hexosemonophosphate pathway also appeared to be sensitive to tretment with the plant extract and showed an inhibitory effect on the enzyme activities of glucose-6-phosphate dehydrogenase (55) the motility of rat and mice spermatozoa was inhibited with various concentrations of petroleum ether fractions of *Melia azedarach* seed at different time intervals ranging from 20 seconds to 240 seconds as compared to control. The effect was dose dependent and complete spermatozoan immobilization was seen with 10 and 25 mg concentrations tested for 240-20 seconds, respectively (56).

CONCLUSION

Over the past decade, herbal medicine has become an item of global importance with both medicinal and economic implications. The history of medicine includes many ludicrous therapies, never the less, ancient wisdom has been the basis of modern medicine and will remain as one important source of future medicine and therapeutics.

In present review we have made an attempt to congregate the botanical, phytochemical, pharmacological and ethno pharmacological information on *Melia azedarach*. Survey of literature reveals the presence of limonoids (12-hydroxyamoorastatone, 12-hydroxyamoorastatin and 12-acetoxyamoorastatin), dipentadecyl ketone, glycerol 1,3-bis-undec-9-enoate 2-dodec-9-enoate and glycerol tris-tridec-9-enoate, surinol, melianin b, sendanolactone, **3**-α-hydroxy-4, 4,14-trimethyl-5-α-preg-8-en-20-one and ochinin acetate. In folk medicine, it is used as a astringent, stomachic; emmenagogue, cathartic, emetic, expectorant and anthelmintic, for killing lice, in ascariasis; and eruptive skin diseases. Scientific research on this plant reported the antifertility, antibacterial, insecticidal, antifeedant, antiviral, cytotoxic, immunomodulatory, anthelmintic and antilithic activity of various parts of this plant.

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