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MELIA AZEDARACH: A REVIEW

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ABSTRACT

Medicinal plants are a major source of raw material for the traditional system like Ayurveda, Siddha & Unani. Even the modern system of medicine has more than 25 percent of drugs in use, which are either plant based or plant derived. Although several tree possess various medicinal properties, it has been ignored by indigenous & modern system of medicine *Melia azedarach* L. (Family: Meliaceae) is a deciduous tree that is native to north eastern India. It has several common names such as, White cedar, Persian lilac, Tulip cedar and Chinaberry. The plant has been introduced into several countries in Asia, North America and Latin America. In Jordan it has been planted as an ornamental plant for unrecorded number of years. For the Indian natives it has been known for quite long time, that the tree members of family Meliaceae are good source of folk medications. Extracts of fruits, seeds, leaves of *M. azedarach* have shown many characteristics of medicinal and pesticidal activities against several pathogenic and pest organisms respectively. In medical and veterinary entomological investigations, extracts of *M. azedarach* showed efficacy against the tick *Boophilus micropus*, the malarial vector *Anopheles stephensi*, the dengue vector, *Aedes aegypti* and the human lice *Pediculus humanus capitis*. Insecticidal, acaricidal, fungicidal and rodenticidal potentials of extracts made from various parts of the plant have been proven by many workers in several countries. The effect of *M. azedarach* extracts on the activity of NADPH-cytochrome reductase and the cholinesterase in insects was also investigated. Antiviral, antibacterial and antifungal potentials of the plant extracts have been reported by many investigators, working on human and animal diseases. Among these diseases are skin Cellulitis and herpes simplex.

Keywords: Antiviral, Antibacterial, Antifungal.

INTRODUCTION

India has a wealth of medicinal plants most of which have been traditionally used in Ayurveda, Unani systems of medicine and by tribal healers for generation. In ancient Indian literature, it is mentioned that every plant on this earth is useful for human beings, animals and other plants. Medicinal plants constitute the major constituents of most indigenous medicines and a large number of Western medical preparations contain one or more ingredients of plant origin. Medicines that are used today are not definitely the same as those that were used in ancient times or even in the recent past. Several modifications, improvement, sophistication and newer discoveries contribute continuously to the type, quality, presentation and concept of medicinal preparation. The therapeutic use of development of human knowledge, scientists endeavoured to isolate different chemical

constituents from plant, put them to biological and pharmacological tests and thus have been used to prepare modern medicines.

Each and every part of the plant have traditional medicinal uses like stem is prescribed internally in asthma, bark is used in fever to relieve thirst, nausea, vomiting and general debility, loss of appetite and skin diseases. Leaves also relieve from headache and cure the eruption on the scalp. Leaf juice is anthelmintic, diuretic, vermifuge and their decoction is astringent and stomachic. Flowers are astringent, refrigerant, anodyne, diuretic, resolvent, deobstruent and alexipharmic. Fruits are used for the preparation of tonic which is purgative, emollient and anthelmintic. Seeds are bitter, expectorant, anthelmintic and aphrodisiac and are useful in helminthiasis, typhoid fever, pain in the pelvic region and scrofula. Roots are

bitter, astringent, anodyne, depurative, vulnerary, antiseptic, anthelmintic, constipating, expectorant, febrifuge, antiperiodic, and bitter tonic in low doses. The tree yields valuable timber, is very useful for making furniture, plywood, toys, fuel wood and also as insect repellent. Recent works have highlighted the role of polyphenolic compounds of the higher plants [1] such as flavonols [2], anthaquinones [3], Xanthanins that contribute to their anticarcinogen or cardioprotective effects.

Scientific synonyms: *Melia japonica*, *Melia australis*, *Melia sempervivens*.

Biological activity of *Melia azedarach*

Insecticidal, Acaricidal and Rodenticidal Activities

The Meliaceae plant family is known to contain a variety of compounds, which show insecticidal, antifeedant, growth regulator and development modifying properties [4]. Effects of *M.azedarach* extracts of various parts of the plant on many pests have been already reported [5].

An extensive work conducted by Wondscheer, j. and coworkers (2004) on larvicidal action of *M. azedarach* against the dengue mosquito *A. aegypti* in Brazil. Results showed the Potentiality of (MA) in controlling this insect via its larval stage. Many triterpenoids present in plants of the Meliaceae family are described as showing insecticidal activity. Bohnenstengel *et al.* (1999) reported the isolation of three meliacarpin (fig. 1) derivatives from *M. azedarach* leaves.

The activity of meliacarpin derivatives were tested on larvae of the polyphagous pest insect *Spodoptera littoralis* by incorporating it into artificial diet to larvae in a chronic feeding bioassay. Results indicated a comparable insecticidal activity to the well known lipopesticide azadarachtin found in neem tree. The crude ethanolic seed extract of Brazilian *M. azedarach* showed both phagoinhibitory and anti molting activities to the hemophagous insect *Rhodnius prolixus*, one of the vectors of chagas disease [6]. In the phytochemistry analysis of *M. azedarach* ethanol extracts, it revealed the presence of triterpenoids and steroids, respectively, and both seeds and leaves also presented alkaloids and condensed tannins. These compounds are able to inhibit development or insect feeding and also they display ovicidal activity in insects [7]. More recent report on utilizing leaf extract of *M. azedarach* showed that it is inactive as a pregnancy interceptive [8] On the other hand it was found that chloroform extract of *Melia azedarach* roots showed a significant contraceptive activity.

The antifertility extract from (MA) and ferula asafoetida was investigated by measuring changes in activities of key enzymes of carbohydrate metabolism in rat uterus on day 7 of pregnancy [9]. It was observed that on the day 7 of pregnancy one key enzyme of glycolytic

pathway (Phosphofructokinase) was significantly reduced in the uteri of treated rats as compared to controls. Hexosemonophosphate pathway also appeared to be sensitive to treatment with the plant extract and showed an inhibitory effect on the enzyme activities of glucose-6-phosphate dehydrogenase.

Fungicidal Potential

The activity of ethanolic leaf, seed and fruit extracts from (MA) in controlling plant and human pathogenic fungi such as *Aspergillus flavus*, *Fusarium moniliform*, *Microsporium canis* and *Candida albicans* has been reported [10].

Three compounds were isolated from crude extracts and identified as, vanillin (fig.2), hydroxyl-3-methoxycinnamaldehyde and (+-) pinoselinol (fig.3). In a subsequent research effort, the seeds of ripe fruits from *M.azedarach* L. were utilized to isolate the active compound Scopoletin, a hydroxyl coumarin, and the subsequent testing of its antifungal synergistic effect. Results revealed a good antifungal activity of the isolated compounds when tested against *F. verticilloides* as well as its synergistic effect when it was combined with two conventional fungicides mancozeb or carboxin.

Antibacterial potential

The antibacterial potential of *M. azedarach* L. was tested using crude leaf extracts against human pathogenic bacterial strains. Various bacterial pathogenic were subjected to extracts (using Petrol, Benzene, Ethyl acetate, Methanol, Aqueous, Chloramphenicol). The bacterial strains were *Bacillus subtilis*, *Proteus mirabilis*, *Shigella flexneri*, *Sh. dysenteriae*, *Plesiomonas shigellides*, and *Staphylococcus aureus*. Ethyl acetate was the most effective extract followed by methanolic fraction that inhibits the growth of all tested pathogens.

Melia azedarach flower extracts was prepared and used to treat bacterial skin disease in children. The methanolic extract of flowers was used to make a cream preparation. An activity comparison of the prepared cream and the skin drug, neomycin was made. The diameter of infected area (mm²) before and after the two weeks treatment. The results showed that (MA) cream was a significantly potent cure in several cases. (MA) flowers extract showed its potential in curing rabbits suffering from a skin infection produced by *Staphylococcus aureus*. The healing effects were found comparable to the known drug neomycin.

Antiviral potential

Meliacine, a peptide isolated from leaves of *M. azedarach* inhibited the multiplication of foot and mouth disease virus. It also exhibited an antiviral activity against herpes simplex virus when aqueous extract of chinaberry was made and examined on *Vesicular stomatitis (VSV)*, polio and herpes simplex (HSV) viruses in cell culture.

The purified extracts from leaves of (MA) which contains meliacaprin inhibited VSV and HSVI multiplication in vitro when added after infection with no cytotoxic effect.

In the field of veterinary medicine, the larvicidal and ovicidal activity of (MA) extracts on the helminthus *Haemonchus contortus* was reported. Both leaves and seed

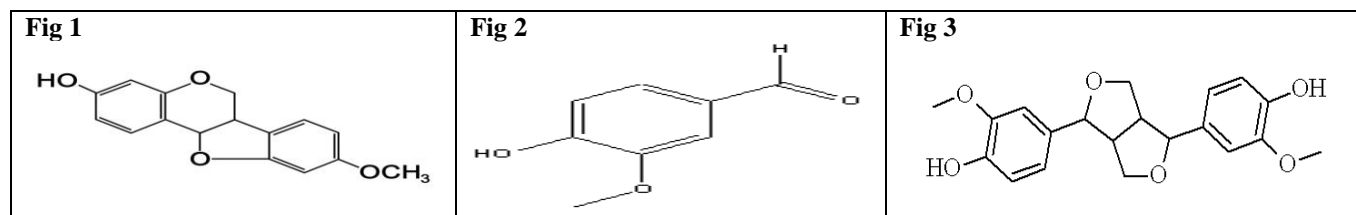
extracts revealed the presence of triterpenoids and steroids, and both also presented alkaloids and condensed tannins. Compounds present in leaves are different from these in seeds, since the former inhibit mainly egg hatching and the later, larval development.

Table 1. Pesticidal, Fungicidal & Antibacterial Potentiality of *M. Azedarach* L

Medicinal activity	Targeted pests	Extracts	Basic Reference
Larvicidal & anti-oviposition	<i>Aedes aegypti</i>	Leaf & Fruit	Carolina <i>et al.</i> , 2008, , Carolina <i>et al.</i> 2004, Cori a <i>et al</i> 2008, Correges 1994, Omena 2007 Wondscheer, <i>et a.l.</i> , 2004
Pediculicidal & Ovicidal	<i>Pediculus humanus capitis</i>	Fruit	Caprinella <i>et al.</i> , 2003-2007
Antifeedant	<i>Pseudaletia unipunctata</i> <i>Trachiaplusia ni</i> <i>Spodoptera eridania</i>	Seed Seed Fruit	Akhtar <i>et al</i> 2008 Carpinella <i>et al.</i> , 2002
Rodenticidal	Albino rat	Seed Leaves	Roop <i>et al</i> 2005, Keshri <i>et al</i> 2003, Keshri <i>et al.</i> , 2004
Anti oviposition, Anti hatchability	<i>Erias vitella</i>	Seed	Gajmer <i>et al.</i> , 2001

Medicinal activity	Targeted pests	Extracts	References
Fungicidal	<i>Aspergillus flavus</i> <i>Diaporthe phseolorum</i> <i>Schlertina sclertiorum</i>	Seed	Carpinella <i>et al.</i> , 1999-2003-2005

Medicinal activity	Organism or Disease	Extracts	References
Antibacterial	<i>Proteus mirabilis</i> <i>Shigella flexeneri</i> <i>Staphylococcus aureus</i> <i>Bacillus subtilis</i>	Leaf	Abdul Viqar <i>et al.</i> , 2008
Antiviral	Foot and mouth Disease <i>Herpes simplex</i> ,(VSV) , (HSV)(VSV), (HSV1) <i>Ocular Herpes simplex</i>	Leaf Leaf Leaf Leaf	Wachsman <i>et al.</i> , 2008 Wachsman <i>et al.</i> , 1982 Alche, L. <i>et al.</i> 2002 Pifarri, <i>et al.</i> 2002
Antiprotozoal	<i>Trichomonas vaginalis</i>	Seed, Leaf	Lee <i>et al.</i> , 2007
Anti helminthal	<i>Haemonchus contortus</i>	Seed, Leaf	Maciel, <i>et al.</i> , 2006



CONCLUSION

In this review we made an effort to compile information on pesticidal and medicinal activities of the chinaberry *Melia azedarach*. Survey of literature revealed the presence of many lemonoids compounds such as meliacaprin, scopoletin, meliartenin in addition to other groups of compounds. Extracts of seeds, leaves, fruits are most parts of the plant which they were used in most

investigations. Various literatures indicated successful attempts of scientists to prove the potentiality of this plant in combating pests such as a malarial mosquito, dengue mosquito, lice and ticks under laboratory conditions. Activities of various extracts were proved to be effective against many economical pests including insects, mites, fungi and rodents.

A drug-development programme should be undertaken to develop modern drugs with the compounds isolated from *Melia azedarach*. Although crude extracts from various parts of neem have medicinal applications from time immemorial, modern drugs can be developed after extensive investigation of its bioactivity, mechanism of action, pharmacotherapeutics, toxicity and after proper standardization and clinical trials. As the global scenario is now changing towards the use of nontoxic plant products having traditional medicinal use, development of modern

drugs from melia should be emphasized for the control of various diseases.

Several therapeutically and industrially useful preparations and compounds have also been marketed, which generates enough encouragement among the scientists in exploring more information about this medicinal plant. An extensive research and development work should be undertaken on neem and its products for their better economic and therapeutic utilization.

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