

Review

Phyto-morphological overview of medicinal plant: *Melia Azedarach* Linn

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Melia azedarach Linn. (Family: Meliaceae) is a shrub or small evergreen, medium-sized deciduous tree. It grows in temperate and tropical countries like India, China, and Japan. The plant requires a wide range of soil, acid to alkaline and it needs moderate moisture level. It is also known as pride of India and Persian lilac having a wide spectrum of pharmacological activities. It is one kind of medicine in the Ayurvedic system. This plant is considered as a multipurpose tree because of its multidirectional and widespread uses in medicine, therapeutics and other economic implications. This paper describes the plant's medicinal aspects and chemical constituents in its different parts. This paper also provides brief information of plant bioprospecting and its launched market products.

Keywords: *Melia azedarach* Linn., pharmacological activity, medicinal plant, ayurveda, phyto-morphological.

INTRODUCTION

Ayurveda- an ancient medical science is even more recognized for its worth and efficacy. Indian cultured heritage is also amply enriched with the presence of Unani and Siddha systems of medicine. In the present time when allopathy has become so advance, the world has been attracted towards traditional Indian systems of medicine. India has several traditional medical systems, such as Ayurveda and Unani, which has survived through more than 3000 years, mainly using medicinal plant-based drugs. Medicinal plants are plants containing inherent active ingredients used to cure disease or relieve pain (Okigbo et al., 2008). The use of traditional medicines and medicinal plants in most developing countries as therapeutic agents for the maintenance of good health has been widely observed (UNESCO, 1996). The medicinal use of plants is very old. Properties and therapeutic uses of medicinal plants were studied in detail and recorded empirically by the ancient physicians in Ayurveda (an indigenous system of medicine) which is

a basic foundation of ancient medical science in India (Sirkar, 1989).

In Ayurveda *Melia azedarach* Linn. has been well documented for its therapeutic potentials. It has been used in Ayurvedic medicine for more than 4000 years due to its medicinal and a wide range of economic properties. This plant has long been recognized as an insecticidal and medicinal plant all over the world (Awadh Ali et al., 2001; Kahn et al., 2001; Chistokhodova et al., 2002; D'Ambrosio and Guerriero, 2002; Lev, 2002; Szweczuk, 2003). *Melia azedarach* L., a close relative of neem, from the family Meliaceae which occurs in India and other tropical and subtropical countries. It contains a chemical constituent which makes it a candidate in pest control. It has been reported to possess antimicrobial, insecticidal and nematicidal properties. It is also known for its antioxidant, antiviral, antiparasitic, anti lithiasis, analgesic, hematological, antimalarial, anti-inflammatory and anti-fertility activity.

***Melia azedarach* L. - An important medicinal plant**

Botanical Name: *Melia azedarach* Linn.

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Common names

Hindi	: Bakan
Sanskrit	: Mahanimba,
English	:Pride of China, Pride of India, China berry
Guajarati	: Bakamlimbodo,
Punjabi	: Drek, Chein, Kachen, Bakain, Dhek, Jek.
Bengali	: Mahanim, Ghoranim
Malayalam	: Malaveppu, Valiyaveppu,
Karinnvembu,	<u>Hutchubevu.</u>
Talgu	:Kondavepa, Turakvepa
Tamil	: Malaivempu, Malaivembu,
	Malaiveppam.

Taxonomical Classification: - (Kirtikar *et al.*, 1980; Evans *et al.*1996):

Kingdom	: Plantae
Division	: Magnoliophyta
Class	: Magnoliopsida
Subclass	: Rosidae
Order	: Sapindales
Family	: Meliaceae
Genus	: <i>Melia</i>
Species	: <i>azedarach</i>

Botanical Description

Melia azedarach L. is a deciduous tree up to 45 m tall; bole fluted below when old, up to 30-60 (max. 120) cm in diameter, with a spreading crown and sparsely branched limbs (Fig. A). The Bark smooth, greenish-brown when young, turning grey and fissured with age. The leaves are alternate or opposite, pinnate or unifoliate or ternate or bifoliate or bipinnate compound or simple and 12-24 mm in long (Fig. C). The flower minute to large, white or greenish white or purple, calyptrate, regular, cyclic, tetra cyclic to polycyclic and 0.25-0.3mm long, fragrant, in long-peduncle auxiliary panicles 3-9mm long, querulous at first. Petals lilac, stamina tube, 0.2-0.3mm long, very conspicuous, purple, slightly ribbed outside (Fig. B and D). The fruits 5 seeded and generally fleshy or non-fleshy. A capsule or a berry without fleshy investment. Capsules septical or loculicidal. It is ellipsoid-globose 4-seeded drupes 0.5-0.6mm long, 3-6 celled, yellow and plump when ripe, become wrinkled and remaining on the tree long after ripening (Fig. E).

Economic importance

Plants provide a variety of resources that contribute to the fundamental needs of food, clothing and shelter. *Melia azedarach* L. has high economic value, because of its high wood quality.

Fodder: Leaves are lopped for fodder and are highly nutritious.

Fuel: Fuel wood is a major use of *M. azedarach*. It has a calorific value is 5100 kcal/kg.

Timber: *M. azedarach* wood (the 'white cedar' of commerce), which resembles mahogany, is used to manufacture agricultural implements, furniture, plywood, boxes, poles, tool handles; it is used in cabinet making and in construction because of its resistance to termites. The density is 510-660 kg/cubic m.

Lipids: Oil suitable for illumination has been extracted experimentally from berries.

Poison: Aqueous and alcoholic extracts of leaves and seed reportedly control many insect, mite and nematode pests. However, because they contain toxic components, care is needed in their use. The fruit of *M. azedarach* is highly toxic to warm-blooded animals; the consumption of 6-8 fruit can cause nausea, spasms, and in children, even death.

Medicine: *M. azedarach* is well known for its medicinal uses. Its various parts have anti-helmintic, antimalarial, cathartic, emetic and emmenagogic properties and are also used to treat skin diseases. Dried ripe fruit is used as an external parasiticide; some toxic components are found in the seed oil, the oral intake of which may cause severe reactions and even death.

Otherproducts: Fruit stones make ideal beads and are used in making necklaces and rosaries.

Chemical constituents

Plant grown at stable growth rates and provided with a balanced and proportionally increasing nutrient supply would exhibit different chemical properties. *Melia azedarach* L. has active ingredients like triterpenoids, limonoids, steroids, flavonoids and carboxylic acid and other chemical ingredients. Different Parts of *Melia azedarach* L. contain different types of phytochemicals which contributed in different biological activities (Table - 1).

Medicinal importance

Most of the medicinal plants, even today, are collected from wild. The continued commercial exploitation of these plants has resulted in receding the population of many species in their natural habitat. *Melia azedarach* L. is medicinal plant. This plant is over-exploited for its medicinal value. Plant has long been recognized as an insecticidal and medicinal plant all over the world (Awadh Ali *et al.*, 2001; Kahn *et al.*, 2001; Chistokhodova *et al.*, 2002; D'Ambrosio and Guerriero, 2002).

Leaves

Various parts of *M. azedarach* are reported to possess therapeutic values. *M. azedarach* alleviates kapha and pitta, antidotes poison, purifies the blood, is constipative and is useful in worms, sciatica, vomiting, nausea, skin diseases, burning pains, ulcers, intermittent fevers,

Figure

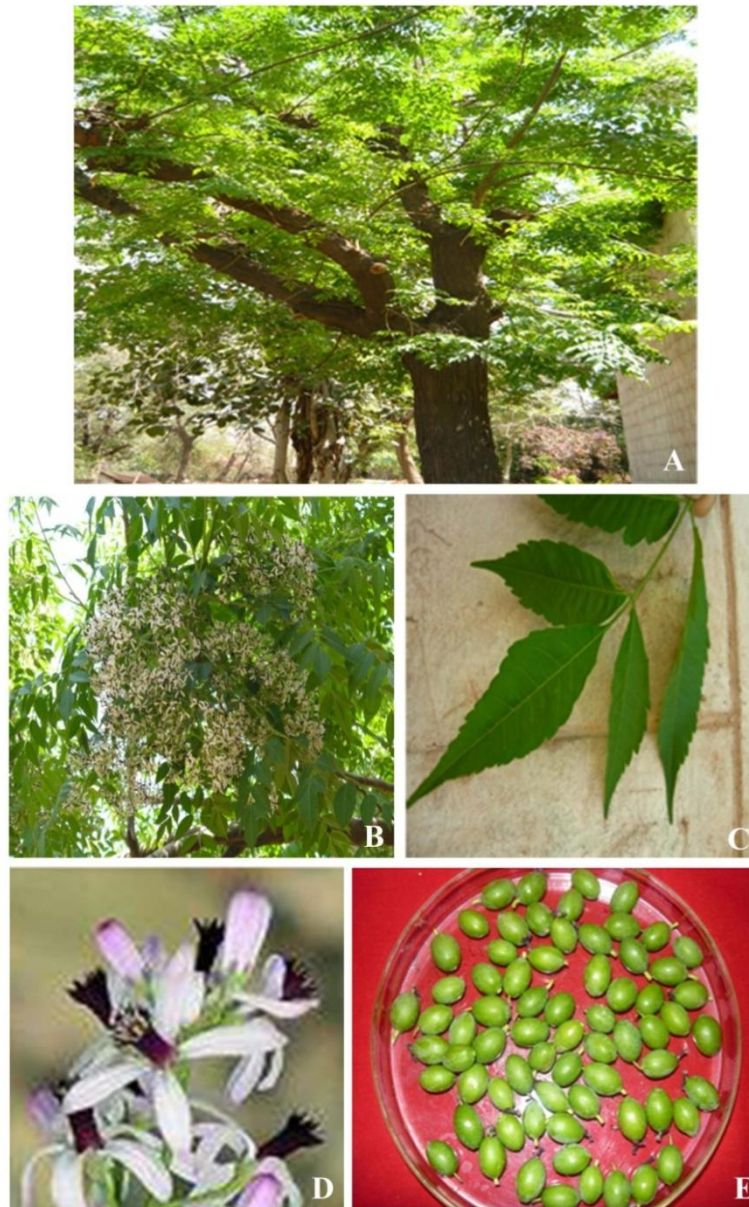


Fig. A: *Melia azedarach* Linn. Tree
Fig. B: Inflorescence of *Melia azedarach* Linn.
Fig. C: Closeup view of Leaf
Fig. D: Closeup view of Flower
Fig. E: Immature Fruits

urinary disorders (Pandey, 1995; Sudarshan, 2005; Sharma, 2001).

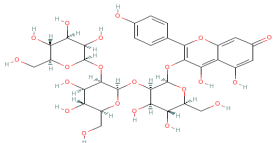
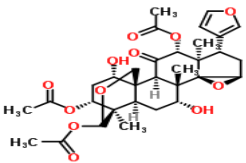
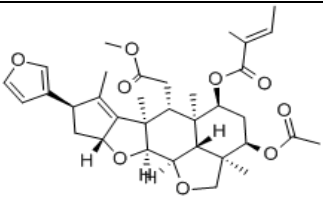
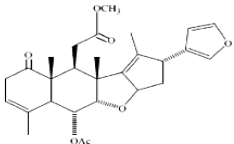
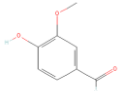
The leaves of *M. azedarach*, unlike those of neem, are only slightly bitter; they are occasionally eaten after boiling with vegetables. The leaves are bitter, astringent, expectorant, vermifugal, antilithic, diuretic, emmenagogue and stomachic. They are useful in hysteria, leprosy, scrofula; cough (Vaidyaratnam, 1994). The juice of the

leaves is given internally as an anthelmintic, antilithic, diuretic, and emmenagogue (Pandey, 1995).

Root

The root are bitter, astringent, mildly heating, anodyne, depurative, vulnerary, antiseptic, anthelmintic, antiperiodic, urinary astringent and tonic. They are useful

Table 1. Chemical constituents of different plant tissues of *Melia azedarach* Linn.

Plant Part	Chemical Name	Chemical Structure
Leaves	Kaempferol	 <p>Kaempferol is a polyphenolic flavonoid. Kaempferol is a natural plant product. It reduces cancer, arteriosclerosis, cardiovascular disorder, and serve as antioxidant and anti-inflammatory.</p>
Fruits	Sendanin	 <p>The limonoid compound (28-deacetyl sendanin) isolated from the fruit of <i>Meliatoosendan</i> SIEB. et ZUCC. was evaluated on anticancer activity.</p>
Root	Salannin	 <p>The salannin is a limonoids type of compounds, which are characterized by the two oxygen bridges C-6/28 and C-7/14. Salannin compound shows antifeedant properties against various insects.</p>
Seed	Nimbinene	 <p>Nimbinene are new pentanortriterpenoids in which the double bond and carbonyl group are not conjugated, and C-4 methyls have been last along with four carbons of the side chain. Nimbinene shows activeantifeedant activity.</p>
Cortex	Vanillin acid	 <p>Vanillic acid is a dihydroxybenzoic acid derivative used as a flavoring agent. It is an oxidized form of vanillin. It is also an intermediate in the production of vanillin from ferulic acid. Vanillic acid shows stronger antioxidant activity.</p>

in vitiated conditions of sciatica, leprosy, leucoderma, skin diseases, wounds, ulcers, haemorrhoids, helminthiasis especially tapeworm, cough, asthma, diabetes, urethrorrhea, chronic and intermittent fevers, vomiting, uteralgia after delivery, burning sensation and general debility. In excessive dose, it is emetic and purgative (Vaidyaratnam, 1994).

Root bark

The root bark is used as a therapeutic. The root bark is a vermifuge and effective for broken fevers and dysentery. The root-bark is bitter and anthelmintic in large doses

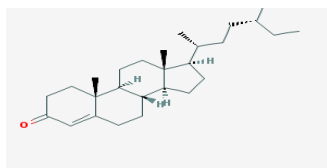
narcotic. Decoction of the root-bark (1 in 10) is used as a bitter tonic, astringent and antiperiodic and use in treatment of malaria before the introduction of quinine. The bark as a mixture is a good febrifuge and is especially useful in periodic fevers also in thirst and nausea. A decoction is used in fevers in combination with other medicines. Poultices of the bark are used in leprosy and scrofulous ulcers (Nadkarni *et al.*, 1976).

Flowers

The flowers are astringent, refrigerant, anodyne, stomachic, vermifuge, diuretic, deobstruant and

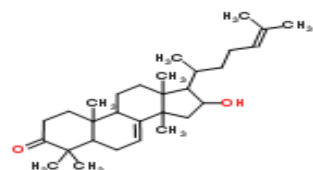
Table 1. Continued.

Bark Stigmasten-3-one



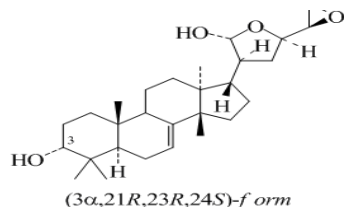
The Stigmasten-3-one is a Steroid compound 6b-hydroxy-4-stigmasten-3-one and 6b-hydroxy-4-campesten-3-one was isolated from bark and their structures confirmed by partial synthesis and shows antimicrobial, antioxidant and anti-inflammatory.

Stem bark Kulinone



The kulinone is a tetra cyclic triterpenoids of the eophane (20β -H) ¹ series, for which the name "kulinone" is proposed. This compound shows antimicrobial and antifeedant activity.

Root bark Melianol



The structure of melianol a new tetracyclic triterpenes of the tirucallane type. The side-chain is characterised by the presence of a hemiacetal and of an oxiran ring. This compound shows insecticidal activity and antifeedant activity.

alexrpharmic. They are useful in cephalalgia, gastropathy, verminosis, strangury, dysmenorrhoea and fever. A paste of the flowers is used to destroy lice and for eruptions of the scalp. It is used also for smooth heat. The flowers and leaves are applied as a poultice to relieve nervous headaches (Nadkarni *et al.*, 1976; Vaidyaratnam, 1994)

Fruit

The fruit is described as purgative, emollient and useful in intestinal worms, urinary diseases, piles, etc. The fruit is tonic and poisonous, but is however approved in leprosy and scrofula. Dried berries absorbed in whisky have been use against ascarides, tapeworm etc. and pulp of berries stewed in fat is useful in scald head (Kapoor, 2005).

Seeds

The seeds are emetic, laxative and are used in rheumatism (Chatterjee and Pakrashi, 1994). The seed oil is laxative, anthelmintic, depurative, maturant, tonic and is useful in helminthiasis, hepatopathy, inflammation, leprosy and dermatopathy. Externally, it has stimulant,

antiseptic and alterative properties and is useful in chronic syphilitic sores and indolent ulcers (Nadkarni, 1976; Chatterjee and Pakrashi, 1994). Gums are a remedy for splenic enlargement (Agarwal, 1997).

Biological Activities

Antibacterial

Methanol extract of *Melia azedarach* Linn. flowers showed potent antibacterial action in rabbits with *S. aureus* skin infection. (Sallem *et al.*, 2003)




Contraceptive

Ethanol extract of *Melia azedarach* Linn. roots prevented pregnancy in 60-75% of female rats with decreased rate of implantation.

Antioxidant

Study showed the leaves of *Melia azedarach* Linn. to possess an erythrocyte protective activity against drug-induced oxidative stress. (Samudram *et al.*, 2009).

Table 2. Some product lunched in market, containing *Melia azedarach* Linn.

Name of the product	Company	Applications
 <p>Talekt</p>	Maaz international company (India)	Talekt has antimicrobial, anti-allergic, wound-healing, anti-inflammatory, antioxidant, hepatoprotective and immunostimulatory actions, which synergistically complement the renormalization of disturbed physiological metabolic processes.
 <p>DivyaArshkalpVati.</p>	Health by Ayurveda company(India)	It helps to relieve complications like pain, burning sensation and Itching while passing the stool.
 <p>Parasitin</p>	Renewed Health Company	Parasitin is a unique formula designed to help the body detoxify and rid itself others product may help to alleviate: lack of appetite, poor vision, (especially if it seems to come and go),intestinal malfunction, bloating, yellow skin, sleep problems, poor memory, unexplained weight gain, skin problems, drooling on your pillow's harmful parasites.

Antifungal

Extracts from different parts of *Melia azedarach* Linn. exhibited fungistatic activity against *Aspergillus flavus*, *Diaporthe phaseolorum* var. *meridionales*, *Fusarium oxysporum*, *Fusarium solani*, *Fusarium verticillioides*, and *Sclerotinia sclerotiorum* (Carpinella et al., 2003)

Antiparasitic

Drupe extracts of *Melia azedarach* Linn. in Argentina showed better activity against tapeworm than standard piperazine phosphate used for Cestodal infections (Szewczuk et al., 2003).

Antiviral

Extract of leaves of *Melia azedarach* Linn. isolated a Meliacarpin which showed antiviral activity against vesicular stomatitis and herpes simplex virus. (Alche et al., 2003).

Anti-lithiasis

Study of the alcoholic and lipid, extract of *Melia azedarach* Linn. Fruit showed the antiulcer effect on some administered to male rats. (Moursi and Khatib, 1984).

Table 2. Continued.

<p>Minyak But But HPA</p> 	SukaSehat Herbal Center (Indonesia)	For broken bones. This oil is heated first and swept the broken section, and wrapped with the cloth. Abdominal bloating (Little boys).
<p>Antifungal Cream</p> 	Alibaba company (India).	Anti-inflammatory, Inhalant, These guggals were used for arthritis, pulmonary disorders.
<p>Diquat</p> 	Shanghai Agro China international company (China).	Used as seed treatment for control smuts and bunts.
<p>Cortex Meliae P E</p> 	Shaanxi Undersun Biomedtech Co., Ltd. (China).	Cortex meliae is one of the herbs used in oriental medicine for the treatment of various types of vaginitis.
<p>Attend Strategy Pac.</p> 	Earth Turns company (Made in America).	<ul style="list-style-type: none"> • Support focus and concentration. • Maintain healthy brain and cognitive function. • Promote mental alertness. • Promote a balanced mood. • Aid periodic bouts of distress, nervousness, and hyperactivity. • Maintain proper information processing, understanding, and retrieval.

Analgesic activity

Melia azedarach, showed promising narcotic analgesic activity (mediated through opioidergic receptors) (Vohra and Dandia, 1992).

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 (Benencia et al., 1992).

Antifeedant activity

M. azedarach Extract could affect feeding and colonization on bean plants by *B. tabaci*. (Nardo et al. 1997).

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 (Ofulla et al., 1995).

Commercial value of *Melia Azedarach* Linn.

Many of the pharmaceuticals currently available to physicians have a long history of use herbal medicines opium, aspirin, digitalis, and quinine. The World Health Organization (WHO) estimates that 80 percent of the populations presently use herbal medicine for some aspect of primary health care. Pharmaceuticals are prohibitively expensive for most of the world's population. Herbal medicines made from leaves, root, flower and seeds are gathered from nature, with little or no cost. In view of the ethno-botanical uses and medicinal properties of *Melia azedarach* L. [Meliaceae], decided that this plant herbal product have been use for the treatment of various disease in different parts of the world. Some herbal products available in the market are shown in (Table - 2).

CONCLUSION

Ayurvēda is the Indian traditional system of medicine, which also deals with pharmaceutical science. Different type of plant parts used for the Ayurvedic formulation; overall outline of those herbal scenario and its future prospects for the scientific evaluation of medicinal plants used by traditional healers are also discussed in this review. In conclusion, of the present investigation *Melia azedarach*, one of the most famous plants found throughout India has strong health alleviating activity. It can be used in the form of powder and liquid extract. Its usage in Ayurvedic medicine for thousands of years has proved its detoxifying properties. It has shown most beneficial effects for the circulatory, digestive, respiratory and urinary systems. The plants contain potential use for the development of pharmaceutical industries as a therapy against various diseases. *M. azedarach* is an invader of disturbed habitats, and is highly resistant to insects and other pathogens. The plant is often planted

as an ornamental shade tree. Several compounds from Chinaberry have been isolated for medical purposes.

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REFERENCE

- Agarwal VS (1997). Drug Plant of India. Vol. I. New Delhi: Kalyani Publishers.
- Alche, L.E., G.A. Ferek, M. Meo, C.E. Coto, M.S. Maier (2003). An antiviral meliacarpin from leaves of *Melia azedarach* L. Verlag der Zeitschrift für Naturforschung, 58: 215 - 219.
- Awadh Ali, N.A.A., Jülich, W., Kusnick, C., Lindequist, U. (2001). Screening of Yemeni medicinal plants for antibacterial and cytotoxic activities. J. Ethnopharmacol. 74, 173-179.
- Carpinella, M.C., G.G. Herrero, R.A. Alonso, S.M. Palacios. 1999. Antifungal activity of *Melia azedarach* fruit extract. *Fitoterapia*, 70: 296-298.
- Carpinella, M.C., L.M. Giorda, C.G. Ferrayoli, S.M. Palacios. (2003). Antifungal effects of different organic extracts from *Melia azedarach* L. on phytopathogenic fungi and their isolated active components. J. Agric. Food Chem., 51: 2506-2511.
- Charturvedi, P.; Raseroka, B. H.; Ntshebe, O. (2006). Evaluation of antimalarial activity of *Melia azedarach*. J. Appl. Zoological Res. 17 (1):109-113.
- Chatterjee A, Pakrashi SC. 1994. The treatise on Indian Medicinal Plant. Vol. III, New Delhi: Publications and Information Directorate, CSIR.
- Chistokhodova, N., Nguyen, C., Calvino, T., Kachirskaia, I., Cunningham, G., Howard Miles, D. (2002). Antithrombin activity of medicinal plants from central Florida. J. Ethnopharmacol. 81, 277-280.
- D'Ambrosio, M., Guerriero, A. (2002). Degraded limonoids from *Melia azedarach* and biogenetic implications. *Phytochemistry*. 60, 419-424.
- Duke JA. (1992). Handbook of phytochemical constituents of GRAS herbs and other economic plants. Boca Raton, FL.: CRC Press.
- Evans WC (1996). Trease and Evans Pharmacognosy. XIVth ed. England: W.B. Saunders Publications.
- F. Benencia, M.C. Courreges, F.C. Coulombie and E.J. Massouh. (1992). Effects of *Melia azedarach* fresh leaf aqueous extract on mice hematological parameters. *Fitoterapia*. 63(5): 411-413.
- Kapoor LD. (2005). Handbook of Ayurvedic Medicinal Plants. 1st ed.: CRC Press LLC.

- Khan, M., Kihara, M., Omolosa, A.D. (2001). Antimicrobial activity of *Horsfieldiahelwigii* and *Melia azedarach*. *Fitoterapia* 72: 423-427.
- Kirtikar KR, Basu BD.(1980). plants. IInd ed. Vol. I. Dehradun: Bishen Singh Mahendra Pal Singh Indian medicinal.
- Lev, E., 2002. Reconstructed materiamedica of the Medieval and Ottoman al-Sham. *J.Ethnopharmacol.*80:167-179.
- Moursi, S.A.H., I.M.H. AL-Khatib, (1984). Effect of *Melia azedarach* fruits on Gipsing - restraint stress induced Ulcers in rats. *Japan. J. Pharmacol.*, 36: 527 - 533.
- Nadkarni AK, Nadkarni KR. Dr.K.R.Nadkarni's. (1976).Indian MateriaMedica. Vol. I. Bombay: Popular Prakashan.
- Nardo, E.A.B.; Costa A.S. & Lourenção, A.L. (1997), *Melia azedarach* extracts as naanantifeedant to *Bemisiatabaci* (Homoptera: Aleyrodidae). *Fla. Entomol.*, 80: 92-94.
- Ofulla, A.V.O., Chege, G.M.K., Rukunga. (1995). "In vitro antimalarial activity of the extracts of *Albizia gummifera*, *Aspilia mossambicensis*, *Melia azedarach* and *Azadirachta indica* against *plasmodium falciparum*". *Afr. J.Health Sci.* 2(2):309-311.
- Pandey G.1995. Medicinal Plants of Himalaya.Isted. New Delhi: Sri Satguru Publications.
- S.B. Vohra and P.C. (1992). Dandia.Herbal analgesic drugs.*Fitoterapia.* 63(3):195-207.
- Salleem, R., S.I. Ahmed, S. Faizi, B.S. Siddiqui, (2002). Antibacterial effect of *Melia azedarach* on rabbits. *Phytother Res.*, 16(8): 762-764.
- Samudram P, Vasuki R, Rajeshwari H, Geetha A, Sathiyamoorthi P.(2009). Antioxidant and antihepatotoxic activities of ethanolic crude extract of *Melia azedarach* and *Piper longum*. *J. Med. Plants Res.*, 3(12): 1078-1083,
- Sharma PC, Yelna MB, Dennis TJ.(2001). Database on Medicinal Plants used in Ayurveda. Vol. II. New Delhi: CCRAS.
- Sharma PC, Yelna MB, Dennis TJ.(2001). Database on Medicinal Plants used in Ayurveda. Vol. II. New Delhi: CCRAS.
- Sudarshan SR. (2005). Encyclopedia of Indian Medicine, Meteria Medica-Herbal Drugs. Vol. IV. Mumbai: Popular Prakashan Pvt. Ltd.
- Szewczuk, V.D. (2003). Estudio de estructuras, reactividad y persistencia, de pesticidassintéticos y naturales. PhD Thesis, director: Prof. A.B. Pomilio. Facultad de Ciencias Exactas, Universidad Nacional de La Plata, La Plata, Argentina.
- UNESCO, (1996). Culture and Health, Orientation texts- World Decade
- Vaidyaratnam PSV. (1994). Indian medicinal plants - a compendium of 500 species.Vol. IV. Orient Longman Ltd.