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Bakayan (*Melia azedarach*) pharmacological actions, therapeutic uses and phytochemistry: A review

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Abstract
Bakayan (*Melia azedarach*), a popular Unani plant belonging to family Meliaceae is also known as Drek (Hindi), Persian lilac or China tree (English), and fleurslilas (French). In South America it is commonly known as "Paraiso" or paradise, and in the US as Indian lilac or white cedar. The whole plant or its specific parts (leaves, stem, and roots) are known to have medicinal properties and have a long history of use by indigenous and tribal people in India. Every part of the plant has been used in Unani system of medicine from medicinal point of view, leaves, bark, root bark, wood, young fruits, nut or seeds, gum etc. *Melia azedarach* is native to tropical Asia. It is widely distributed in Pakistan, India, Indonesia, Southeast Asia and Australia. It has musakkin (analgesic), musaffi-*e*-khoon (Blood purifier), mohali -e-waram (Anti-inflammatory), qatil-e-qiram (Insecticidal), anti-diarrhoeal, mufatt-e-sudda (Deobstruent), mudir-e-baul (Diuretic), dafa-e-ziabetes (Antidiabetic), muqi (emetic) and dafa-e-hudar (anti-rheumatic) etc. properties. It is used in Baras (Leucoderma), Juzam (Leprosy), Jarb (Scabies), Kharish (Itching), Khanazeer (Scrofula), Jiryan (Spermatorrhoea), Bawaseer (Piles) and *Huma* (Fever) etc. It showed Antibacterial, Antioxidant, Antihelmintic and Antipyretic etc. activities.

Keywords: *Melia azedarach*, bakayan, anti-inflammatory herb, paraiso

Introduction
Bakayan (*Melia azedarach*), a popular Unani plant belonging to family Miliaceum is also known as drek (Hindi), Persian lilac or China tree (English), and fleurslilas (French). In South America is commonly known as "paraiso" or paradise, and in the US as Indian lilac or white cedar. The whole plant or its specific parts (leaves, stem, and roots) are known to have medicinal properties and have a long history of use by indigenous and tribal people in India. *Melia azedarach* is used as, musakkin (analgesic), musaffi-e-khoon blood purifier), daf-e-waram (anti-inflammatory), qatil-e-qiram (insecticidal), anti-diarrheal, mufatt-e-sudda (Deobstruent), mudir-e-baul (diuretic), dafa-e-ziabetes (antidiabetic), muqi (emetic), dafa-e-*hudar* (Anti-rheumatic), amraz-e-jild (skin disease), Mohallil (Resolvent) and bawaseer (piles) etc. (Khan, 1313; Asadujjaman *et al.*,2013; Azam *et al.*,2013; Sharma *et al.*, 2005; Hakeem, 2002; Ghani, ynm) [16, 5, 6, 28, 13].

Vernacular Names
Annam : Cay sau dau, Cay xaon, Cay xaondau, Chao maulein, Sandan, Xun lien, Yu mou
Arabic : Habulban, Ban
Assamese : Thamaga
Baluchi : Bakain, Bakaur
Bengali : Ghoranim, Mahanim
Bombayese : Bakayan, Drek, Mahalimbo, Nimb, Vilayatinim
Burmese : Kamaka, Tamaka
Canarese : m Arebevu, Bevu, Garudabevu, Huchubevu, Sikkabevu, Vishabevu
Chinese : Lien, Lien Chou
Deccan : Giuliani, Gourami
Dutch : On evaderboom, Paternoster boom
English : Barbados lilac, Bead tree, Indian lilac, Persian lilac, Pride of china, Pride of India
French : Agemlilasazedarach, Bipinneazedarachcommun, Arbeachapelete, Jasmine de parse, Laurier grec, Lilasde chin e lilas des indes.

Garhwali	:	Denkana
German	:	Peternosterbaum, Zedrach
Gujrati	:	Bakanlim, Bodo
Hindi	:	Bakain, Balkarja, Bakayan, Betain, Deikna, Drek, Mahanimb
Japanese	:	Senndan, Senyoosi, Shen lien
Konkani	:	Vilayatinimb
Kumani	:	Dain kan
Malayalam	:	Malaveppu
Marathi	:	Bakananimb, Limbara, Vilayatinimb
Maxicon	:	Arbo lparaiso lila paraiso morado
Nepalese	:	Bakain, Bakaina, Bakainu
Persian	:	Bakaen
Philippines	:	Paraiso
Portuguese	:	Bomboloni n puto
Punjabi	:	Bakain, Chein, Dhek, Drake Kitchen
Pushtu	:	Bakayana
Sanskrit	:	Akshadaru, Brihannimba, Dreka, Gairika, mahanimba Mahatikta, Nimbaka,
Sindhi	:	Bakayun, Drek
Sinhalese	:	Lunumidella, Mahanimba
Spanish	:	Acedaraque, Cinamomo
Tahiti	:	Tira
Tamil	:	Malaivembu, Malaveppu, Pisidam, Sigarinimbam
Telugu	:	Turakavepa, Vettiveppa
Urdu	:	Bakayan
Venezuela	:	Alcli

(Khan, 1313; Sharma *et al.,* 2005; Hakeem, 2002; Anonymous, 2005; Kabiruddin, 2000; Asadujjaman *et al.,* 2013; Azam *et al.,*2013; Sharma *et al.,* 2005; Rubae, 2009) [16, 5, 6, 28, 13, 15, 25].

Fig 1: Leaf of Bakayan

Description according to unani classical literature

Bakayan is very popular herbal origin Unani drug. The flower, leaves and fruits of *Bakayan*are similar as *Neem.* (Kabiruddin, 2000; Kritikar and Basu, 2005; Nadkarni, 2007; Anonymous, 2005) [15, 3, 18, 22].

Parts Used

Every part of the plant has been used in Unani system of medicine from medicinal point of view. Leaves, bark, root bark, wood, young fruits, nut or seeds, gum etc. (Khan,1313; Sharma *et al.,*2005; Azam *et al.,* 2013; Kritikar and Basu, 2005; Nadkarni, 2007; Anonymous, 2005; Kabiruddin, 2000) [16, 6, 28, 18, 22]

Mizaj

Hot 3^0 and Dry 3^0 (Ghulam,2007) [12]

Hot 2^0 and Dry 2^0 (Hakeem, 2002; Anonymous, 2005; Kabiruddin, 2000) [13]

Dose

4-7 grams	(Hakeem, 2002) [13]
10 grams	(Ghulam, 2007) [12]
Leaves: 1-2 grams	(Anonymous, 2005) [3]
Stem bark: 5-10 grams	(Anonymous, 2005) [3]
7-10grams	(Kabiruddin, 2000) [15]

Actions

Table I: Actions of *Bakayan*

Action	Reference
Dafe-e-Humma (Antipyretic)	Anonymous, 2005; Kirtikar and Basu, 2005; Kabiruddin, 2000 [15, 18]
Daf-e-Bawaseer (Anti-Heamorrhoids)	Anonymous, 2005; Khan, 1313; Hakeem, 2002; Ghani, ynm; Ghulam, 2007; Nadkarni, 2007; Kirtikar and Basu, 2005 [16, 13, 12, 18, 22]
Kasir-e-Riyah (Carminative)	Khan,1313; Anonymous, 2005; Kirtikar and Basu,2005; Ghani, ynm [16, 18]
Mufarreh **(**Exhilarant**)**	Khan, 1313 [16]
Muqawwi-e-Dimag (Brain Tonic)	Khan, 1313; Ghani, ynm; Nadkarni, 2007; Kirtikar and Basu,2005[16, 18]
Muqawwi-e-Qalab (Heart Tonic)	Khan,1313; Ghani, ynm [16, 22]
Muqawwi-e-Dandan	Ghulam, 2007; Kabiruddin, 2000; Hakeem, 2002; Anonymous, 2005; Nadkarni,2007; Kirtikar and Basu, 2005 [13, 15, 12, 18, 22]
Mohallil (Resolvent)	Khan, 1313; Anonymous, 2005; Khan, 1313; Hakeem, 2002; Ghani, ynm; Ghulam, 2007; Anonymous, 2005; Kirtikar and Basu, 2005; Nadkarni, 2007; Sharma *et al.,* 2005 [16, 28, 13, 12, 3, 18, 22]
Mufatteh Sudda (Deobstruent)	Kirtikar and Basu, 2005; Nadkarni, 2007; Hakeem, 2002 [13, 18, 22]

Munaqqi (Expallent)	Anonymous,2005; Kabiruddin,2000[15, 3]
Musaffi-e-Dam (Blood Purifier)	Kirtikar and Basu, 2005; Anonymous, 2005; Ghulam, 2007; Kabiruddin, 2000; Ghani, ynm; Nadkarni,2007; Hakeem, 2002; Anonymous, 2006 [13, 15, 12, 3, 18, 22]
Mushil-e-Balgham	Kabiruddin,2000; Hakeem,2002; Ghani, ynm; Kirtikar And Basu, 2005; Nadkarni,2007[13, 18]
Mujaffif (Desicant)	Kabiruddin, 2000; Hakeem, 2002; Ghani, ynm [13, 15]
Muqi (Emetic)	Kirtikar And Basu,2005; Nadkarni,2007; Hakeem, 2002 [13, 18, 22]
Mudir-e-Baul (Diuretic)	Anonymous,2005; Ghani, ynm; Kirtikar and Basu,2005; Nadkarni,2007[3, 18, 22]
Mudir-e-Haiz (Emmenogogue)	Ghani,ynm; Nadkarni,2007; Ghani, ynm; Kirtikar and Basu, 2005; Anonymous, 2006 [3, 18, 22]
Musakkin-e-Aam (Analgesic)	Anonymous,2006; Sharma *et al.*,2005; Anonymous,2005; Khan,1313; Hakeem, 2002; Kirtikar and Basu,2005; Kabiruddin,2000; Ghani, ynm [16, 28, 13, 15, 3, 18]
Mufattit-e-Hisat (Lithotriptic)	Nadkarni, 2007; Kirtikar and Basu, 2005 [18, 22]
Qatil-e-Deedan (Anthelmentic)	Ghani, ynm; Ghulam, 2007; Kirtikar and Basu,2005; Anonymous, 2005; Kabiruddin,2000; Nadkarni, 2007; Ghani, ynm; Anonymous,2006[15, 12, 3, 22]
Qabiz (Astringent)	Nadkarni,2007; Kirtikar and Basu,2005; Ghani, ynm; Sharma *et al.*,2005[28, 18, 22]

Therapeutic Uses

Table II: Therapeutic Uses of *Bakayan*

Clinical Indication	Reference
Amraz-e-Tihal (Splenic diseases)	Nadkarni,2007; Kirtikar and Basu,2005[18, 22]
Amraz-e-Jild (Skin disease)	Hakeem, 2002; Ghulam, 2007; Kabiruddin, 2000; Kirtikar and Basu,2005; Anonymous,2005; Anonymous, 2006; Ghani, ynm; Nadkarni, 2007 [13, 15, 12, 3, 18, 22]
Amraz-e-Kabid (Liver diseases)	Ghani, ynm; Nadkarni, 2007; Kirtikar and Basu, 2005 [22]
Amaraz-e-Rea (Respiratory diseases)	Kritikar and Basu, 2005; Kabiruddin, 2000; Hakeem, 2002; Ghani, ynm [13, 15, [18]]
Amraz-e-Qalb (Heartdiseases)	Kritikar and Basu, 2005; Khan, 1313; Ghani, ynm [16, 18]
Badhazmi (Indigestion)	Ghani, ynm
Azm-e-Tihal (Splenomegaly)	Nadkarni, 2007[22]
Bars (Leucoderma)	Ghulam, 2007; Anonymous, 2005; Anonymous, 2006; Ghani, ynm; Kabiruddin, 2000; Kirtikarand Basu, 2005; Ghani, ynm; Nadkarni, 2007 [12, 3, 18, 22]
Bawaseer (Haemorrhoids)	Hakeem, 2002; Ghulam, 2007; Anonymous, 2005; Kabiruddin, 2000; Kirtikar and Basu, 2005; Nadkarni, 2007 [13, 12, 3, 22]
Dard-e-Sar (Headache)	Hakeem, 2002; Ghulam, 2007; Anonymous, 2005; Kabiruddin, 2000; Kirtikar and Basu, 2005; Nadkarni, 2007 [13, 15, 12, 3, 18, 22]
Huma (Fever)	Hakeem, 2002; Anonymous, 2005; Kabiruddin, 2000; Kirtikar and Basu, 2005 [13, 15]
Hudar (Rheumatism)	Kritikar and Basu, 2005; Anonymous, 2006 [18]
Hisat-e-Masana (Bladder stone)	Ghani, ynm; Nadkarni, 2007; Kirtikar and Basu, 2005 [3, 22]
Juzam (Leprosy)	Gahni, ynm; Hakeem, 2000; Khan,1313; Ghulam, 2007; Anonymous, 2005; Kabiruddin, 2000; Kirtikar and Basu, 2005 [16, 13, 12, 18, 22]
Jarb (Scabies)	Kritikar and Basu, 2005; Ghani, ynm
Jiryan (Spermatorrheoea)	Ghani, ynm; Anonymous,2005
Kharish(Itching)	Hakeem, 2002; Ghulam, 2007; Anonymous, 2005; Anonymous, 2006; Kabiruddin, 2000; Kirtikar and Basu, 2005; Nadkarni, 2007; Khan, 1313 [16, 13, 15, 12, 3, 18, 22]
Khanazeer(Scrofula)	Ghulam, 2007; Kritikar and Basu, 2005; Nadkarni, 2007 [12, 18, 22]
Nakseer(Epistaxis)	Kritikar and Basu, 2005; Hakeem, 2002 [13]
Niqrus(Gout)	Anonymous, 2005 [3]
Deedan-e-am'a(Intestinal worms)	Anonymous, 2005; Nadkarni, 2007; Hakeem, 2002; Khan, 1313; Ghulam, 2007; Kabiruddin, 2000; Kirtikar and Basu, 2005; Gahni, ynm; [16, 13, 15, 12, 3, 18, 22]
Qulai-e-Dahan(Stomatitis)	Kabiruddin, 2000; Ghani, ynm [15]
Qarah-e-Medi (Gastric Ulcer)	Kabiruddin, 2000 [15]
Qarah-e-Isnasri (Duodenal ulcer)	Kabiruddin, 2000 [15]
Suda (Nervous Headache)	Kritikar and Basu, 2005; Nadkarni, 2007; Anonymous, 2005 [3, 18, 22]
Tashannuj (Convulsions)	Hakeem, 2002; Ghulam, 2007; Kabiruddin, 2000 [13, 15, 12, 3]
Taqteer-ul-Baul (Drilibling of Urine)	Kritikar and Basu, 2005 [18]
Waja-ul-Asnan (Toothache)	Kabiruddin, 2000; Ghani, ynm; Hakeem, 2002; Kritikar and Basu, 2005; Nadkarni, 2007; Ghulam, 2007 [13, 15, 12, 18, 22]
Waja-ul-Meda (Stomachic)	Nadkarni, 2007; Kritikar and Basu, 2005; Ghani, ynm[18, 22]
Waja-ul-Mufasil (Arthralgia)	Anonymous, 2005 [5]
Waja-ul-Qalab (Angina)	Kritikar and Basu, 2005; Ghani, ynm [18]
Waja-ul-Uzn (Earache)	Kritikar and Basu, 2005; Hakeem, 2002; Ghani, ynm [13, 18]

Botanical description

Habit and habitat

Scientific Classification

Kingdom	:	Plantae
Order	:	Sapindales
Family	:	Meliaceae
Genus	:	Melia

Melia azedarach is native to tropical Asia. It is widely distributed in Pakistan, India, Indonesia, Southeast Asia and Australia. It has become naturalized in Philippines, United States of America, Brazil, Argentine and many African and Arab countries. (Anonymous,2005; Asadujjaman *et al.*, 2013; Azam *et al.*, 2013; Sharma *et al.*, 2005; Rubae, 2009) [5, 6, 28, 25, 3].

Plant description

Melia azedarach is a small to medium deciduous treeattaining a height 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. The plant regenerates freely from seeds during rain under natural condition. It can also be

artificially propagated by direct sowing, transplanting seedlings from nursery or by cutting and root suckers. Barksare 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 pungent odor when crushed. Inflorescence a long, axillary panicle up to 20 cm long. Flowers are purple and fragrant, numerous on slender stalks, white to lilac; 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 are oblong goid, 3.5 mm x 1.6 mm, smooth, brown and surrounded by pulp. (Sharma and Paul,2013; Kritikar and Basu, 2005; Sharma *et al.,*2005; Asadujjaman *et al.,*2013) [5, 28, 18, 27].

Microscopic examination

Leaves

Rachis: Transverse section of epidermis of the rachis shows unicellular trichomes& multicellular trichomes & multicellular glandular trichomes on unicellular stalk, a wide cortex, some cell containing rosette crystal of calcium oxalate, vascular tissue nearly circular in the middle region.

Midrib: Shows a ridge above and below, single layered epidermis, covered with cuticle on both surfaces, cortex consists of 2 to 3 layers of collenchymatous cells on both sides followed by thin walled parenchymatous cells, vascular region shows arc of xylem after with three subsidiary bundles, crystals distributed in cortical region.

Lamina: Isobilateral, thick cuticle present, single layer of epidermal cells, multicellular glandular and unicellular long trichomes present.

Mature bark shows outer zone of rhytidoma, formed of alternating strips of dark brown cork cells and dead secondary phloem; cork cells compressed, almost rectangular and many layered; secondary phloem multilayered and compressed; cork cambium and secondary cortex almost absent; beneath rhytidome wide zone of secondary phloem present, with sieve tubes and compound sieve plates, and with groups of fibers; phloem parenchyma oval to irregular, thin-walled, colorless with intercellular spaces; phloem rays 2 to 5 cells wide; rosette and prismatic crystals of calcium oxalate present in phloem parenchyma and ray cells; a few very small, simple, round to oval, starch grains measuring 5 to 11 µ in diameter, having 2 or 3components (Anonymous,2005; Asadujjaman *et al.,* 2013; Sharma *et al.,*2005) [5, 28, 3].

Phytochemical Studies

Preliminary phytochemical screening of *Melia azedarach*, showed the presence of number of organic moleculesi. e. terpenoids, flavonoids, steroids, acids, anthraquinones, alkaloids, saponins, tannins (Rishi *et al.,*2003; Bahuguna *et al.,*2009; Suresh *et al.,*2008; Bibi *et al,*. 2016) [24, 7, 8].

Roots: of the plant showed the presence of terpenoids and limonoids like 6-Acetoxy-7a-hydroxy-3-oxo-14β, 15β-epoxymeliac-l.5-diene, 6-Acetoxy-3β-hydroxy-7-oxo-14β, 15 β-epoxymeliac-l,5-diene-3-0-β-D-glucopyranoside, Azecin-l, Azecin-2, Azecin-3, Azecin-4. Roots also contain flavonoids like Apigenin-5-O-β-D-galactopyranoside; Steroids like24-Methylenecydoartanol,24-Methylenecydoartanone, 4-Stigmastanen-3-one, 4-Campestene-3-one β-Sitosterol, β-Sitosterol-B-D-glucoside; Acids like Trans-cinnamic acid, Vanillicacid (4-Hydroxy-3-methoxy benzoic acid).

Root bark: Contain terpenoids and limuloids like 12-O-Acetyl azadirachtin-A, 12-OAcetylazedarachin-B,l-Acetyl-3-tigloyl-11-methoxymeliacarpinin,12-O-Acetyl trichilin-B, 2α-Acetyl-29-deacetyl-29-isobutyrylsendanin, Azedarachin-A, Azedarachin-C, l-Cinnamoyl-3-acety l-11-methoxy Meliacarpinln, l-Cinnamoyl-3-hydroxy-11-methoxymeliacarpinin, 1-Deoxy-3-methacrylyl-11 methoxymeliacarpinin, 1 –Deacetylnimbolinin-B, 1, 12-Diacetyltrichilin-B, 7, 12-Diacetyltrichilin-B, 29-lsobutyl sendanin, Meliacarpinln, E, Nimbolidin-B, Salannal, Salannin, 1 -Tigloyl-3-acetyl-11-methoxy meliacarpinin,1-Tigloyl-3,20-diacdyl-11-methoxyrneliacarpinin,3-Tigloyl-1, 20-diacetyl-11-methoxyme- lia carpinin, Trichilin-B, Trichilin-D, Trichilin-H. The yalso contain steroids like 6-β-Hydroxy-4-canpesten-3-one, 6-β-Hydroxy-4-Stigmasten-3-one, Azeclarachol.

Fruits: contain terpenoids and limonoids like 6-Acetoxy-14,15-epoxy-3,11-dihydroxymeliaca-l,5-diene-7-one,Amoorastatin,Amorastatone,Azedirachtin-A,l Cinnamoyl-3, 11-dihydroxy-meliacarpinin, Cinnamoylmelianolone, l-Cinnamoylmelianone, Composition, Compositol ide,1-O-Deacetylohchinolide-B,29-Deacetylsendanin, 1-Deacetylnimbolinin-A, 3-Deoxy mmelian one, 21, 23:24, 25-Diepoxy-tirucall-7-ene-21-ol, 3-Epimelianol, 3-Epimeliantriol,Gedunin,12-a-Hydroxyamoorastatin, Meliandiol, Melianol, Melianolone, Melianone, Melianoninol, Meliantriol, Meliatoxin-A1, Meliatoxin-A2, Meliatoxin-B1, Meliatoxin-B2, Nimbolidin-A, Nimbolinin-A, Nimbolinin-B, Ohchinal, Ohchinin, Ohchinin acetate, Ohchinolal, Ohchinolide-A, Ohchinolide-B, Sendanal, Sendandal, Sendanin, 3-O-Tigloylohchinin, Vilasinin. 21-β-Acetoxymelianone, Methylkulonate,3-α-Tigloylmelianol. They also contain acids like Stearic acid (octadecanoic acid), Trans-cinnamic acid.

Leaves: contain terpenoids and limonoids like l-Cinnamoyl-3-acetyl-11-hydroxy Meliacarpin, l-Cinnamoyl- 3-methacrylyl-l1-hydroxy Meliacarpin, Deacetylsalannin, 1,3-Dicinnamoyl-l1-hydroxy-rneliacarpin, α-Pinene, β-Pinene, α-Terpinene, α-Terpineol,Kaempferol-3-O-β-rutinoside, Kaempferol-3-L-rhamno-D-glucoside, Rutin. They also contain acids like Palmitic acid (Hexadecanoic acid).

Stem bark: contain terpenoids and limonoids like 7a-Acetoxy-14β, 15β- epoxygedunanl-ene-3-O-β-D-Glucopyranoside, 12-Acetoxyamoorastatin,Amoorastatin, Fraxinellone, 12-Hydroxyamoorastatone, 3: Hydroxy eupha-7,24-diene-21,16-olide, Kula tone, Kulinone, Kulolactone, Methylmalonate, a-Pinene, β-Pinene, a-Terpinene, a-A Terpineol. They also contain flavonoids like 4', 5-Dihydroxy flavone-7-O-u-L-rhamnopyranosyl-(1-4)-β-D-Glucopyranoside, Anthraquinone like 1,3,5,8-Tetrahydroxy-2-methyl anthraquinone; 8-Me ether, 3-O-α-L-rhamnopyranoside, 1,5-dihydroxy-8-methoxy-2-methl-anthraquinone- 3-O-α-L-rhamnopyranoside, 1,8- dihydroxy-2-methyl anthraquinone-3-O-β-D, Galactopyranosidase. Stem wood contain terpenoids and limonoids like Melianin-A,

Melianin-B. Seeds contain terpenoids and limonoids like 3 β, 7aDihydroxy-21, 23-epoxy-apotirucalla-14, 24-diene-21-one, Meldenin. They also contain steroids like Campesterol, Cholesterol, Stigmasterol and acids like Linoleic acid, Linolenic Acid, Oleic acid (9-octadecenoic acid).
(Sharma & paul, 2013; Asadujjaman *et al.*,2013; Azam *et al.*,2013; Sharma *et al.*,2005; Rupa *et al.*,2014; Bahuguna *et al.*,2009; Suresh *et al.*,2008) [5, 6, 27, 28, 7].

Physicochemical studies

Physical constants	Values
Foreign matter	not more than 1 %
Total Ash	Not more than11 %
Acid-insoluble ash	not more than 1 %
Alcohol-soluble extractive	not less than 6 %
Water-soluble extractive	not less than 7 %

(Anonymous,2005; Sharma& Paul, 2013) [27, 3]

Pharmacological Studies

Antibacterial study

Rhaymah *et al.,* (2006) [23] studied the antibacterial activity of the crude leaf extract of (methanol, ethanol, dichloromethane, ethyl acetate and aqueous) of *Melia azedarach* against Gram negative and Gram positive bacterial strains using disk diffusion method. Significant inhibition showed ethyl acetate and aqueous extracts of *Melia azedarach* against bacteria tested.

Khan *et al.,* (2011) [17] studied *Melia azedarach* against eighteen hospital isolated human pathogenic bacterial strains. Petroleum ether, benzene, ethyl acetate, methanol, and aqueous extracts at five different concentrations (1, 2, 5, 10 and 15 mg/ml) were evaluated using disk diffusion method. All extracts of the seeds showed significant antibacterial activity against tested pathogens. However, ethyl acetate extract revealed the highest inhibition comparatively among all other extracts.

In a studied carried by Saleem *et al.,* (2008) [26] cream was prepared by methanol flower extract of *Melia azedarach*. Neomycin was used as a standard drug. The result showed that, extract of *Melia azedarach* flower showed potential in curing rabbits suffering from skin infection produced by Staphylococcu saureus. The effect was compare with standard drug neomycin.

Fungicidal study

Carpinella *et al.,* (2005) [9] were studied that the ethanolic extract of leaf, seed and fruit of *Melia azedarach* showed significant antifungal activity against Aspergillus flavus, Fusarium moniliforme, Microsporum Canis and Candida albicans had been reported.

Antiulcer study

In a study showed that some active constituents present in the lipid fraction of *Melia azedarach* extracts were experimented on rats under Gipsing-restrainstress to induce ulcers by Moursi in 1984 [20]. The result demonstrated that lipid component of *Melia azedarach* which is mainly phytosterol fraction was capable to reduce the free and total HCl combined with reduction of total acidity, and significant increases the volume of gastric juice thus showing its antiulcer potential.

Antipyretic study

Sultana *et al.,* (2014) [29] studied trial in which hydro-methanolic extract of *Melia azedarach* leaves exhibited significant antipyretic effects at 500 mg/kg dose. The extract showed significant reduction in yeast induced elevated temperature as compared with that of standard drug paracetamol.

Antiviral study

In a study carried by Wachsman *et al.* (1998) [35], a peptidei. e. "Meliacine" isolated from *Melia azedarach* leaves was found to inhibit the multiplication of foot and mouth disease viruses was reported.

Alche and his colleagues in 2001 reported that another compound "Meliacarpin" found in the purified extract of *Melia azedarach* leaves inhibits the Vesicular stomatitis and Herpes simplex virus multiplication *in vitro* when added after infection with no cytotoxic effects.

Antihelmintic study

Szewezuk *et al.,* (2003) [31] were reported that the ethanol extract of *Melia azedarach* was tested for its anthelminthic activity against the Tapeworm Taenia solium and the earthworm Pheretima posthuma using Piperine phosphate as the standard drug in a study, it was showed by the result that the extract was found active against both the tapeworm and the earthworm, also the result was better against Tapeworm than Piperazine phosphate.

Antiprotozoal study

Lee *et al.,* (2007) [19] were reported that *Melia azedarach* extract possesses the antiprotozoal effect on Trichomonas vaginalis cells through the inhibition of cell multiplication as well as the impairment of protein synthesis.

Wound healing study

Vidya *et al.,* (2012) [33] studied that wound healing potential of *Melia azedarach* leaves in alloxan induced diabetic rats was carried out, result showed that the topical application of methanol leaf extract of *Melia Azedarach* possesses significant wound healing activity in alloxan induced diabetic rats. In this study it has been shown that the topical application of *Melia azedarach* leaf extract encourages wound healing in diabetic rats and its effect was analogous with standard poid one iodine. *Melia azedarach* leaf extract enhanced the wound healing in diabetic rats which may be due to its antimicrobial activity.

Ant nephrolithiasis study

In vivo study was conducted by Christina *et al.,* (2006) [10] on rats to determine the effect of aqueous extract of *Melia Azedarach* one thylene glycol-induced nephrolithiasis. The result of the study showed that *Melia azedarach* extract reduced the urinary calcium oxalate and phosphate levels. Thus *Melia azedarach* possesses inhibitory potential on induced nephrolithiasis judged by serum and urine levels of creatinine.

Anticancer us study

Jafari *et al.* (2013) [14] conducted a study to evaluate the anticancer activity of *Melia azedarach* oncancer cell lines and also to evaluate their safety in humans by testing them on normal cell line. In this study, the cytotoxic activity of crude extracts from *Melia azedarach* leaves, pulps and seeds as well as three main fractions of their leaf extracts were determined against HT-29, A-549, MCF-7 and HepG-2 and MDBK cell

lines. Results of the present study showed that seed kernel extract of *Melia azedarach* exhibited the highest cytotoxic activity and selectivity to cancer cell lines (IC50 range of 8.18- 60.10µg mL-1). Methanol leaf fraction of *Melia azedarach* seems to be safer in terms of cytotoxicity. Flavonols are abundant in the leaves of *Melia azedarach* and these compounds seem to be responsible for many of medicinal effects exploited in the traditional uses.

Antioxidant study

Ahmed *et al.* (2012) [1] conducted a research study and concluded that phenols are responsible for the variation in the antioxidant activity of the plant. The high DPPH scavenging activity of *Melia azedarach* may be due to hydroxyl groups present in the phenolic compounds. They possess antioxidant effect by inactivating lipid free radicals or preventing decomposition of hydro-peroxides into free radicals. One of the major plant compounds with antioxidant activity is polyphenols. The -OH groups in phenolic compounds are considered have a significant role in antioxidant activity.

Munir *et al.,* (2012) [21] to demonstrate the antioxidant activity of *Melia azedarach*. The TPC (Total Phenolic Contents) and TFC (Total Flavonoid Contents) contents in different parts of sun dried extracts of *Melia azedarach* were found to be in the range of 74.43-112.10 mg and 13.32-28.11 mg, while in ambient dried TPC and TFC found to be in the range of 66.89-103.34 mg and 10.67- 23.45 mg respectively. 2,2-diphenyl-2-picrylhydrazyl (DPPH) scavenging activity and linoleic inhibition capability of sun dried was found to be in the range of 55.43-63.86% and 35.57-52.11%, respectively while for ambient dried was in the range of 48.54-61.00% and 33.87-50.33%, correspondingly. The reducing potential of sun dried and ambient dried at concentration of 10.0 mg/mL was in the range of 0.727-1.211 and 0.601-0.890, respectively. The result of the study, therefore, showed the sun dried extracts of *Melia azedarach* had higher antioxidant activity whereas, among the plant parts, the stem bark was found to be proved better antioxidant activity.

Hepatoprotective study

In the study conducting by Ahmed *et al.,* (2012) [1] revealed the hepatoprotective activity against CCl4 induced liver injury. Parameters like SGOT, SGPT, ALP and serum bilirubin were measured and histopathological evaluation was conducted. Biochemical parameters have improved after treatment and histological changes such as statuses (fatty changes in hepatocytes) and fibrosis which were observed in CCl4 intoxicated group were totally reduced to normal levels. Further investigations are in progress to determine the exact phyto-constituents responsible for hepatoprotective effect.

Antifertility study

Vishnukanta and Rana (2009) studied hydro-alcoholic extract of *Melia azedarach* roots for anti-implantation, estrogenic/anti-estrogenic and progestational/ anti-progestational activities. It was found that the extract exhibited significant anti-implantation and anti-progestational activity and devoid of estrogenic/anti-estrogenic activity. It is therefore assumed that a certain substance was present in the extract which impairs the synthesis, secretion and functions of ovarian steroids and also blocks the implantation process by hindering the development of oocycte and graffian follicle as well as the endometrial epithelium.

Antimalarial study

Szewezuk *et al*., (2003) [32] studied 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 but less significant than chloroquine.

Pesticidal study

Szewczuk *et al.,* (2003) [32] studied that the anti-parasitic activity of the drupe extracts of *Melia azedarach* growing in Argentina was tested against a tapeworm and an earthworm, showing to be better against tapeworms than the standard piperazine phosphate, which is used in the treatment of Cestoda infections. Result showed that the *Melia azedarach* had potent action against tapeworm. An extensive work conducted by Wondscheer and coworkers (2004) on larvicidal action of *Melia azedarach* against the dengue mosquito A. aegypti in Brazil. Results showed the potentiality of *Melia azedarach* in controlling this insect via its larval stage. The efficacy of leaves and seeds methanolic extracts against the malarial vector Anopheles Stephen sunder laboratory conditions.

References

1. Ahmed MF, Rao AS, Ahemad SR, Ibrahim M. Phytochemical Studies and Hepatoprotective activity of *Melia azedarach* Linn, against CCl4 induced Hepatotoxicity in rats. J Pharm Res. 2012; 5:2664-2667.
2. Alche LEGA, Ferek M, Meo CE, Coto MS, Maier: An antiviral meliacarpin from leaves of *Melia azedarach* L. Verlag der Zeitschrift fur Natur for schung Tubingen. 2001; 58:215-219.
3. Anonymous. Qarabadeen Jadeed, Central Council for Research in Unani Medicine. 2005, 90-105.
4. Anonymous. The Wealth of India, Volume 3, National Institute of Science Communication and Information Resources, New Delhi, 2005, 6-7.
5. Asadujjaman M, Saed A, Hossain MA, Karmakar UK Assessment of bioactivities of ethanolic extract of *Melia azedarach* (Meliaceae)leaves. Journal of Coastal Life Medicine. 2013; 1(2):118-122.
6. Azam MM, Mamun-Or-Rashid ANM, Towfique NM, Sen MK, Nasrin S. Pharmacological potentials of *Melia azedarach* L. - A review. American Journal of BioScience. 2013; 1(2):44-49.
7. Bahuguna Y, Patil K, Rawat MSM, Jalalpure S, Uniyal S. Antiulcer activity of *Melia azedarach* Linn in aspirin induced and pylorus ligated rats. Journal of Pharmacy Research. 2009; 2:1456–1459.
8. Bibi S, Jabeen R, Hayee AA. Phytochemical Screening and Allelopathic Effects of *Melia azedarch* L. on Seed Germination and Seed lind Growth of Penisitum Americanum L. International Journal of Development Research. 2016; 6(8):8813-8817**.**
9. Carpinella MC, Ferrayolic CG, Palacios SM. Antifungal synergistic effect of scopoletin, a hydroxyl coumarinisolated from Msynergistic effect of scopoletin, a hydroxyl coumarin isolated from *Melia azedarach* L. fruits. J Agric Food Chem. 2005; 53:2922-2927.
10. Christina AJM, Najumadeen NAH, Kumar SV, Mainikandan N, Tobin GC, Venkataraman S, *et al.* Antilithiatic effect of on *Melia azedarach* ethylene glycol

induced nephrolithiasis in rats. Pharma Biol; 2006; 44:480-485.
11. Ghani N, (YNM). *Khazain-ul-Advia, Idara KitabulShifa*. New Delhi; 2006, 218-220.
12. Ghulam NM. *Makhzan-e-Mufradat WA Murakkabat*. Central Council for Research in Unani Medicine MHFW GOI. New Delhi,2007, 66.
13. Hakeem A *Bustan-ul-Mufredat, IdaraKitab-ul-Shifa.* DariyaGhanj, Delhi 110002, 2002,131.
14. Jafari S, Saeidnia S, Hajimehdipoor H, Ardekani SMR, Faramarzi MA, Hadjiakhoond A, *et al*. Cytotoxicevaluation of *Melia azedarach* in comparison with, Azadirachtaindica and its phytochemical investigation. DARU JPharma Sci.2013; 1:21-37.
15. Kabiruddin H. Makzanul Mufradat. Aijaz Publishing House, Delhi. 2000, 131-132.
16. Khan A. *Muheet-e-azam, Mataba Nizamia*. Kanpur. 1313, 106-107.
17. Khan AV, Ahmed QU, Mir MR, Shukla I, Khan AA. Antibacterial efficacy of the seed extracts of *Melia azedarach* against some hospital isolated human pathogenic bacterial strains. Asian Pacific J Trop Biomed. 2011; 1:452-455.
18. Kirtikar, Basu, *Indian Medicinal Plants*, 2nd edition. International Book Distributors, Dehradun, 2005; 1:542-547.
19. Lee YS, ChungIB, Choi WH, Cho YJ, Chu JP, Min BI, Shin EH. Inhibitory effects of *Melia azedarach* L. extracts on the growth of Trichomonas vaginalis Ultrastructural changes of Trichomonas vaginalis by *Melia azedarach* L. J Protozool. Res. 2007; 17:16-24.
20. Moursi SAH, Al-KhatibIMH. Effect of *Melia azedarach* fruits on Gipsing restraint stress induced ulcers in rats. Japan J Pharmacol. 1984; 36:527-533.
21. Munir A, Sultana B, Babar T, Bashir A, Amjad M, Hassan Q. Investigation on the Antioxidant Activity of Leaves, Fruit and Stem Bark of Dhraik (*Melia azedarach*). European J Appl Sci. 2012; 4:47-51.
22. Nadkarni KM. The Indian Materia Medica. 3rd Edition. Popular Prakashan Pvt. Ltd. Mumbai. 2007; 2:776-785.
23. Rhaymah MSH. Anticomplementary activities of aqueous extract of the fruit of *Melia azedarach* and *Cotoneaster prostrata* in rats. J Animal Vet Adv. 2006; 5:197-199.
24. Rishi K, Singh R. Chemical components and insecticidal properties of Bakain (*Melia azedarach* L.) - A Review. Agri. Rev. 2003; 24(2):101-115.
25. Rubae AYAL. The Potential Uses of *Melia azedarach* L. as Pesticidal and Medicinal Plant, Review. American-Eurasian J. Sustain. c Agri. 2009; 3(2):185-194.
26. Saleem R, Rani R, Ahmed M, Sadaf F, Ahmad SI, Zafar N, *et al*. Effect of a cream containing *Melia azedarach* flowers on skin diseases in children. Phyto med. 2008; 15:231-236.
27. Sharma D, Paul Y. Preliminary and Pharmacological Profile of *Melia azedarach* L: An Overview. Journal of Applied Pharmaceutical Science. 2013; 3(12):133-138.
28. Sharma PC, Yelne MB, Dennis. Database on medicinal plants used in ayurveda. 2005; 2:389-395.
29. Sultana S, Asif HM, Akhtar N, Waqas M, Rehman SU. Comprehensive Review on Ethano botanical Uses, Phytochemistry and Pharmacological Properties of *Melia azedarach* Asian J pharmaceut res health care. 2014; 6(1):26-32.
30. Suresh K, Deepa P, Harisaranraj R, Vaira AV. Antimicrobial and Phytochemical investigation of the leaves of *Caricapapaya*, *Cynodondactylon Euphorbia Hirta*, *Melia azedarach* and *Psidium guajava.* Ethnobotanical Leaflets. 2008; 12:1184-91.
31. Szewezuk VD, Mongelli ER, Pomilio AB. Antiparasitic activity of *Melia azedarach* growing in Argentina. Mol Med chem. 2003; 1:5457.
32. Szewezuk VD, Mongelli ER, Pomilio AB: Antiparasitic activity of *Melia azedarach* growing in Argentina. Mol Med chem. 2003; 1:5457.
33. Vidya V, Srinivasan, Sengottuvelu Wound healing potential of *Melia azedarach* leaves in alloxan induced diabetic rats. Global J Res Med Plants & Indi Med. 2012; 1:265-271.
34. Vishnukanta AC, Rana AC. Antifertility activity of *Melia azedarach* linn. (Meliaceae) in female Wistar rats. Pharmacology online. 2009; 2:117-132.
35. Wachsman MBV, Castilla, Coto C. Inhibition of foot and mouth disease virus (FMDV) uncoating by plant – derivedpeptide isolated from *Melia azedarach* L. Leaves. Arch. Virod. 1998; 143:581-590.