



ISSN (E): 2320-3862
ISSN (P): 2394-0530
NAAS Rating: 3.53
www.plantsjournal.com
JMPS 2020; 8(2): 54-60
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Received: 24-01-2020
Accepted: 28-02-2020

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A review on: phytochemical screening and pharmacological activity on *Madhuca longifolia*

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Abstract

Herbal medicines obtained from plant source are one the healthy and having less side effects. *Madhuca longifolia* commonly called as mahua, mahuwa, mohula. Now a day such kind of tree involved in most activities of tribal people. The present investigation manages the macroscopical and microscopical investigation on leaves, petioles, stems and the wound healing activity of ethanolic extracts of leaves and bark of Madhuca. It is quickly developing tree that develops to around 20 meters in tallness and has a place with the family Sapotaceae. Mahua having Ethnomedical uses, for example, antitumour, antipyretic, hepatoprotective, calming, pain relieving, antiprogestational, antiestrogenic and furthermore having wound recuperating property. Customarily M. longifolia bark is utilized in tonsillitis, ulcers, bleedings and ailment. The present survey contains the different ethnomedical and customary employments of bark and leaves of *Madhuca longifolia*.

Keywords: *Madhuca longifolia*, mahua, herbal plant, medicinal plant, ethanolic extract

Introduction

Plants are considered as awesome in cause and were loved as Mother (Goddess). They have assumed a critical job in keeping up human wellbeing and improving the nature of human life for a great many years [1]. Over the most recent couple of years there has been an exponential development in the field of natural medication and these medications are picking up fame both in creating and created nations due to their root and less symptoms [1]. *Madhuca longifolia* is profoundly viewed as an all-inclusive panacea in the ayurvedic medication. Madhuca normally known as mahua or butternut tree. It has a place with the family Sapotaceae [1]. It has a critical spot in innate culture. The bark is yellowish dim to dim darker red in shading and smooth inside. The bark is prescribed for mucus and in stiffness bark chips are somewhat warmed and tied on joints. The bark is a decent solution for tingle, growing, breaks and snake-nibble harming. Preliminary phytochemical investigations of stem bark with ethanol, water and chloroform remove demonstrated the nearness of starch, terpenoids, proteins, adhesive, anthraquinone glycosides, heart glycosides, saponins and tannins [1]. Madhuca or the Butter nut tree is a medium to enormous estimated deciduous tree conveyed in Nepal, India and Sri Lanka [2]. *Madhuca longifolia* is an enormous tree, about 17m high with a huge top [3]. Mahua is an enormous, obscure, deciduous tree hovering a great part of the focal Indian scene, both wild and developed. Mahua seeds are of monetary significance as they are acceptable wellspring of eatable fats [4]. The blossoms have been generally utilized as cooling operator, tonic, sexual enhancer, astringent, demulcent and for the treatment of helminthes, intense and ceaseless tonsillitis, pharyngitis just as bronchitis [5]. *Madhuca longifolia* leaves are expectorant and furthermore utilized for interminable bronchitis and Cushing's malady [6]. The refined juice of the blossom is viewed as a tonic, both dietary and cooling and furthermore in treatment of helminthes, intense and incessant tonsillitis, just as bronchitis. The leaves are applied as a poultice to calm skin inflammation. The ethereal parts are utilized for treatment of aggravation [7].

Leaves: Clustered at end of the branches; leathery in texture, elliptic, shortly acuminate, and narrowly triangular with the acute angle.

Flower: numerous, near the ends of branches, drooping on pedicels.

Calyx: coriaceous, densely clothed rusty to mentum.

Corolla: yellowish-white, tube fleshy.

Stamens: 20-30, usually 24 or 26, anthers hispid at the back with stiff hairs.



Fig 1: *Madhuca longifolia*

Fruits: berries, ovoid, fleshy and green (8).

Scientific classification (8)

Kingdom: Plantae

Unranked: Angiosperms

Unranked: Eudicots

Unranked: Asterids

Order: Ericales

Family: Sapotaceae

Genus: *Madhuca*

Species: *M. longifolia*

Vernacular names: (8)

Bengali: Mohua

Oriya: Mahula

English: Honey tree, butter tree

French: Illipe, arbre à beurre, bassie, madhuca

India: Moha, mohua, madhuca, illuppai

Tamil: kuligam, madurgam, mavagam, nattiluppai, tittinam

Sanskrit: Madhuka

Kerla: Ponnam

Distribution

The species is disseminated in northern, focal and southern piece of India, Srilanka. Of the two assortments, var. *longifolia* is dispersed in Sri Lanka, Southern India stretching out northwards to Maharashtra and Gujarat; var. *latifolia* is found in certain pieces of focal and north India and Burma. It is normal in dry blended deciduous woods, dry salwood and dry teak timberlands. The tree develops on a wide assortment of soils yet flourishes best on sandy soil. It likewise develops on shallow, bouldery, clayey and calcareous soils. It is found up to a height of 1200m, mean yearly most extreme temperature 28-50 °C, least 2-12 °C; yearly precipitation from 550-1500mm. The species is dry spell safe, solid light demander and promptly smothered under shade [8].

Botanical description and identification features

A medium estimated to huge deciduous tree, as a rule with a short, opening and enormous adjusted crown found all through the green timberland part of India up to an elevation of 1,200 meter and of 12 to 15 meter stature, bark thick dim shaded broke, inward bark dim red, milk, trunk short, branches various [9].

Leaves are 10-30 centimeter long, are thick and weathered a large portion of leaves pointed at the tip, clustrescent glabred close to end of branches, elliptic or elliptic oval 7.5 to 23 cm into 3.8 to 11.5 cm. coriaceous pube and when youthful nearly.

Blossoms are little and meaty, dull or pale white in shading and in characterize fascicles close to end of branches. Corolla

cylindrical, newly pale, yellow fragrant and caduceus.

Fruits are 2-6 cm long, fleshy and greenish with dark color bark [9].

Morphology

Leaves: Leaves are clustered at the ends of the branches; young branches, leaves and petiole pubescent or tomentose. Leaves are coriaceous, elliptic or oblong-elliptic, shortly acuminate, base cuneate. Petiole is short and easily fractured [10]. Shown in table no.1.

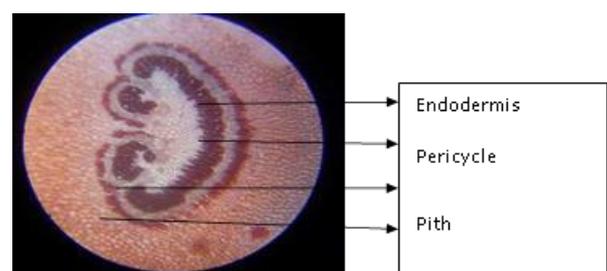
Table 1: Petiole is short and easily fractured

Morphology of leaves	Observation
Colour	Green
Odour	Characteristics
Taste	Bitter
Size	11-15 cm long, 5-8cm wide
Shape	Lanceolate to ovate
Texture	Short
Apex	Acute
Arrangement	Opposite
Appearance	Smooth



Microscopical characters

Petiole: Petiole consist vascular bundle, xylem, phloem, endodermis, pericycle and pith [10].



Leaf T.S: leaf T.S. consist scork, upper and lower epidermis, xylem, phloem and pith [10].

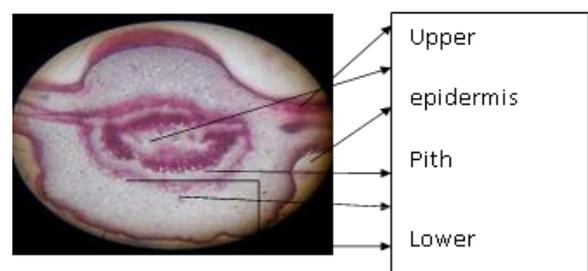


Fig 7: Transverse section of leaf of *Madhuca longifolia*.

Stem: The stems of *Madhuca longifolia* consists thin layered cell cork, cortex, epidermis, xylem, phloem, pith [10].

Trichomes: Leaves consists uniseriate type of trichomes and covering trichomes.

Stomata: Both lower and upper surface consist paracytic stomata [10].

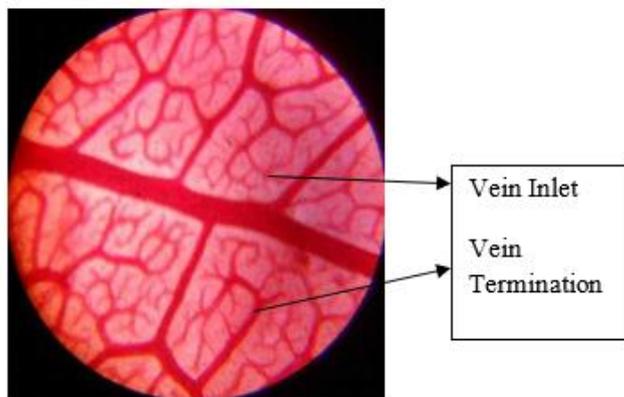


Fig 2: Venation pattern in leaf of *Madhuca longifolia*

Chemical constituents

Numerous therapeutic plants establish a rich wellspring of bioactive synthetics that are to a great extent liberated from antagonistic impacts and have brilliant pharmacological activities; they could prompt the improvement of new classes of potentially more secure medications [1]. Phytochemistry studies of leaves revealed the presence of β -carotene and xanthophylls; arthrodiol, palmitic acid, myricetin and its 3-arabinoside and 3-O-L-rhamnoside, quercetin and its 3-galactoside; 3 β -caproxy and 3 β -palmitoxy olean-12-en-28-ol, oleanolic acid, β -sitosterol and its D-glucoside, stigmasterol, β -sitosterol- β -Dglucoside, n-hexacosanol, 3 β -caproxyolcan-12-en-28-ol, β -carotene, n-octacosanol, sitosterol and quercetin [1]. The remedial estimation of the plant relies upon the dynamic constituents present inside the distinctive piece of the plant, which might be available in the little or enormous amount. The auxiliary metabolites are the significant substance liable for the primary therapeutic properties in the rough medications. The leaves of Mahua tree contain saponin, an alkaloid, and glucoside. Sapogenin and other fundamental corrosive are found in the seeds. Different Photochemical examinations on Mahua incorporate portrayal of Sapogenin, triterpenoids, steroids, saponin, flavonoids and glycosides. In perspective on the associates and credited restorative properties new parts including madhucic corrosive (penta cyclic triterpenoids), madhushazone, four new oleanane type triterpene glycosides and madhucosides A and B. The new blossom of Mahua contains 2-acetyl 1 pyrroline, the fragrance atom. They additionally contain polysacheride which on hydrolysis give D-galactose, D-glucose, L-araninose, L-rhamose, D-xylose and D-glucuronic corrosive. To establish the pharmacological action of specific unrefined medication is known as the pharmacological screening, and it is significant for forecast of action [1].

Phytochemistry [4]

Flower: Vitamins A and C.

Bark: ethyl cinnamate, sesquiterene alcohol, α -terpeneol, 3 β -

monocaprylic ester of Eythrodiol and 3- β -capryloxy oleanolic acid. α - and β - amyryn acetates.

Nut-shell: n-hexacosanol quercetin and dihydroquercetin, β -sitosterol and its 3 β -Dglucoside.

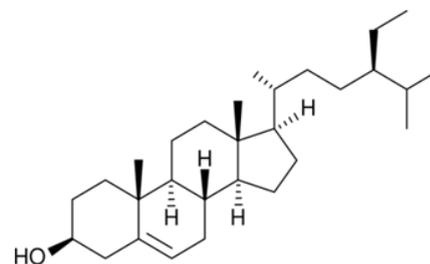
Seeds: arachidic, linoleic, oleic, myricic, palmitic and stearic acids, α -alanine, aspartic acid, cystine, glycine, isoleucine and leucine, lysine, methionine, proline, serine, threonine, myricetin, quercetin, saponin A & B.

Leaves: β -carotene and xanthophylls; erthrodiol, palmitic acid, myricetin and its 3-O- arabinoside and 3-O-L-rhamnoside, quercetin and its 3-galactoside; 3 β -caproxy and 3 β -palmitoxy- olean-12-en-28-ol, oleanolic acid, β -sitosterol and its 3-O- β -Dglucoside, stigmasterol, β -sitosterol- β -Dglucoside, n-octacosanol, n-hexacosanol, 3 β -caproxyolcan-12-en-28-ol, sitosterol, β -carotene, n-octacosanol, Quercetin.

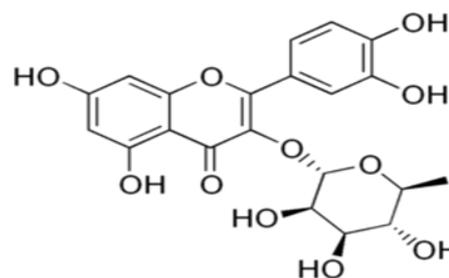
Table 2: Chemical constituents present in different parts of *Madhuca longifolia*.

Bark	Flavonoids, Triterpene, Sterol
Latex	Soluble Resin, Insoluble Resin
Leaf	Moisture, Minerals, Organic Matter, Potas (K ₂ O) Phosphoric Acid (P ₂ O ₅) Silica, Flavonoids, Protobasic Acid, Alkaloids.
Flower	Ascorbic Acid, Carotene, Ascorbic Acid, Folic Acid, Thiamine, Riboflavine, Niacine, Biotine, Inositol.
Ripe Fruit	Moisture, Fat, Protein, Carbohydrates, Minerals, Calcium, Carotene, Phosphorus, iron, Ascorbic

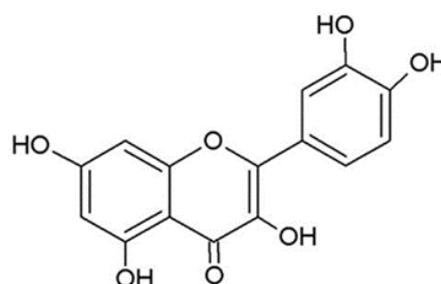
Name and structure of the derived chemical compound:



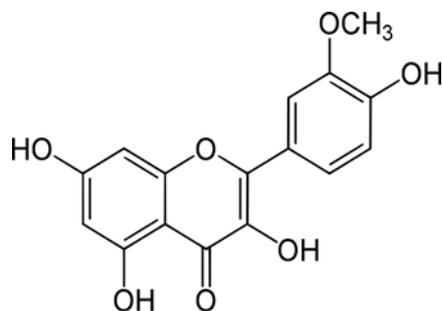
Structure No.1: β -sitosterol- β -D glucoside



Structure No.2: 3-arabinoside



Structure No.3: Quercetin



Structure No.4: 3-O-L-rhamnoside

Pharmacological activities

Anti-Inflammatory activity

The reason of the age of the expanding or aggravation is arrival of the different concoction middle people from the harmed cell like histamine and serotonin ^[11] Aggravation is a cautious system of the body ^[12]. The most significant instrument of mitigating drugs is viewed as hindrance of PG amalgamation at the site of damage. The calming strength of medications is compares with their intensity with to hinder the COX ^[13]. As more restraint of COX implies the mitigating action of that specific plant is more. The *Madhuca longifolia* is seen as a decent solution for treatment of the irritation, its flying parts is used for the treatment of aggravation. The plant material (50 g) was extricated with 100 ml of methanol for 24 hrs. utilizing soxhlet contraption. Along these lines, remove were separated and thought under vacuum sounding mechanical assembly for 30 min. at the point when this arrangement was given to the male vistar rodent which was at that point having irritation demonstrated an acceptable outcome. Calming impact can be estimated as the percent hindrance of irritation and determined concerning negative control ^[14]

Analgesic activity

Analgesics are the specialists that diminish the impression of agony without upsetting cognizance or changing other afferent sources of info (Remington). Pain relieving action was assessed on the acidic corrosive initiated squirming. The methanolic concentrate of *Madhuca longifolia* was offered orally to the gathering of 6 creatures. The quantity of squirming during the accompanying 30 min. period was seen after acidic corrosive infusion. Against absence of pain is communicated as the decrease of the quantity of stomach choking between control creature and mice pretreated with the concentrate. At the end of the day if the pain relieving drug works the stomach compression will be the less in numbers. The pain relieving action of the *Madhuca longifolia* can likewise be assessed by the utilizing other strategy for assessment like hot plate technique in rodents ^[16]

Antipyretic activity

Mahua is utilized to treat the fever in individual, as it is tested in creatures. Around 5 gatherings of 6 rodents each were infused subcutaneously with 10 ml kg⁻¹ body weight. Right off the bat the creature are compelled to fever by infusing the suspension of the yeast suspension, this will expand the internal heat level of the exploratory creature. In the wake of estimating the basal rectal temperature of every creature by an assistance of thermometer, around 19 Hr. after yeast infusion, the rectal temperature was recorded again and creature indicating an ascent temperature of rodent, which shows the antipyretic impact of Mahua ^[16].

Anti-hyperglycemic activity

The critical hypo-glycemic impacts of Mahua bark in diabetic rats show that this impact can be interceded by incitement of glucose usage by fringe tissues. The consequences of the present investigation obviously showed the ethanolic concentrate of Mahua bark to hypoglycemic ally affect STZ instigated diabetic rats. In all gatherings with the exception of glibenclamide, at 30 min of starting glucose resilience test, blood glucose focus was higher than at zero time yet diminished essentially from 30 to 120 min. Methanolic removes were improving glucose usage, in this manner the blood glucose level was fundamentally diminished in glucose stacked rats. Methanolic concentrate of Madhuca have fundamentally diminished the serum glucose level in streptozotocin and STZ-NIC prompted diabetic rats. The rough methanolic concentrate of Mahua leaves showed portion subordinate decreases in serum glucose level after organization in glucose-stacked mice. The reductions in serum glucose levels were seen as fundamentally diminished at portions of 100, 250, and 500 mg remove for each kg body weight. At these portions, the concentrate decreased serum glucose levels ^[17].

Anti-Ulcer activity

Gastro intestinal ulcer is a typical issue of gastrointestinal tract. It is currently viewed as that gastrointestinal ulcer is a sickness of multi factorial inception however its definite etiology is as yet not clear ^[18]. Ulcer is an aftereffect of the awkwardness between the protective and assaulting factors in the GIT. An ulcer is a neighborhood imperfection or exhuming of the upper part that is called surface of an organ or the tissue ^[19]. Anti-ulcer movement has been demonstrated in Madhuca plant while it is tried in the male vistar rat ^[14]. To assess the counter ulcer action of the Mahua tree, right off the bat the creature is compelled to deliver the ulcer by any of appropriate technique like pressure instigated ulcer or carrageen-initiated ulcer, and afterward the equivalent is treated with the concentrate of the tried plant materials.

Antioxidant activity

Oxidative pressure is delivered during ordinary metabolic procedure in the body just as incited by a Variety of natural and compound factor, which cause an age of a different receptive free radical and resulting change in DNA and lipids ^[19, 18]. The decreasing property of ethanolic bark concentrate of Madhuca suggests that it is equipped for giving hydrogen particle in a portion subordinate way. The high substance of phenolic mixes in the concentrate might be a contributing variable towards cell reinforcement action on the grounds that the phenol mixes are known to have direct cancer prevention agent property because of the nearness of hydroxyl gatherings, which can work as hydrogen contributor. The diminishing limit of a compound may fill in as a critical pointer of its potential cancer prevention agent action ^[17]. The anti-oxidant power of any medication relies on the two component, first to forestall the oxidation by oxidizing itself or second by making a layer of security over the material.

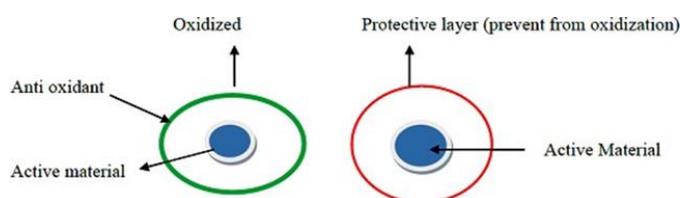


Fig 3: Possible mode of action of Antioxidant ^[9]

Anti-Fertility activity

The level of prolific male mice and the quantity of pregnancies were altogether decreased in atropine initiated mice from control mice in present case there was finished decrease of fruitfulness in male rat, number of pregnant females and number of litters in plant separate treated gathering. Among the plant based contraceptives, restraint of male richness after organization of characteristic substances has been identified with decline spermatozoa thickness. Likewise for male contraception, it isn't important to stop spermatogenesis, but instead to wipe out the treating capacity of the spermatozoa by causing changes in the morphology or in the capacity of the sperm. The diminishing in spermtally and the high no of morphologic anomalous sperms demonstrate obstruction with testicular spermatogenesis^[20]

Dermatological activity

Due to the present climatic condition and contamination skin related issue are rising step by step, and there are hardly any engineered salve and cream are accessible for it, yet they cause a few opposite reaction like rashes and tingling as well. That is the reason the utilization of therapeutic or common plant is a lot more secure and advantageous. The decoction of the bark is helpful in tingling and ulceration, the oil is acquired from the seed, which is valuable in the few unfavorably susceptible issue. It is additionally utilized as diuretic^[21].

Hepatoprotective activity

The methanol concentrates of *Madhuca longifolia* bark is read for hepato defensive movement against pale skinned person rodents with liver harm actuated via carbon tetrachloride (CCl₄). It was discovered that the methanol concentrate of *Madhuca longifolia* bark at a portion of 300 mg/kg body weight showed moderate defensive impact by bringing down the serum levels of Glutamate Pyruvate Transaminase (SGPT), Serum Glutamate Oxaloacetate Transaminase (SGOT), Serum bilirubin and Serum antacid phosphate (SALP) to a huge degree. Present discovering exhibited the methanolic bark concentrate of Madhuca could bear the cost of huge portion subordinate security against CCl₄ instigated hepato cell damage^[22].

Antibacterial activity

The blossom has an antibacterial movement against the *Escherichia coli* and oppose against rice bug illness^[22].

Antiepileptic activity

The anticonvulsant movement of the methanol concentrate of heart wood of *Madhuca longifolia* was surveyed in pentyl enetetrazole (PTZ)-initiated spasm in mice with benzodiazepine as standard medication. Unthinking investigations were directed utilizing flumazenil, a GABA-benzo-diazepine receptor complex site adversary, and naloxone a vague narcotic receptor opponent. *Madhuca longifolia* at the portion of 400 mg/kg delayed the beginning time seizure and diminished span of seizures contrasted with saline gathering^[34].

Anticancer activity

In Ayurvedic system of medicine it is stated that the bark of *Madhuca longifolia* is useful in treatment of cancer at the local application^[24].

Neuropharmacological activity

The neuropharmacological action has been contemplated from the methanolic remove and a triterpene, compound segregated from the leaves of *Madhuca longifolia* utilizing phenobarbitone as a standard. Dozing time was expanded just as there is a huge decrease in engine movement and marble covering action which affirm its calming nature^[12].

Wound healing activity

The ethanolic concentrates of leaves and bark of *M. longifolia* indicated powerful twisted mending action when contrasted and the standard medication betadine and control treatment. In extraction wound model, *Madhuca* remove treated creatures demonstrated a huge decrease in wound zone and time of epithelization^[13].

Toxicity

Like all word sees, it isn't completely without establishment the danger of home grown medication is by and large brings down than a large portion of the cutting edge sedate^[25]. A blend of saponin disengaged from *Madhuca longifolia* seed didn't uncover any cholinergic movement, in spite of the fact that it created at a higher focus. The saponin is amazingly harmful when directed parentally^[26]. L.D. 50 by IP course was one of indistinguishable requests from that by the IV course, being 50 to multiple times higher than oral course^[21]. In the base of *Madhuca longifolia*, most extreme measure of phenol was watched for example 46.0 mg/gdw. These mixes assume a significant job in the antecedent of harmful substance and job in the development guideline and improvement of plants^[16]. It is moreover answered to have dangerous substance aflatoxine in *Madhuca longifolia* seed oil^[26]. The quality control of home grown drug ought to be carefully followed to stay away from any destructive impact^[28].

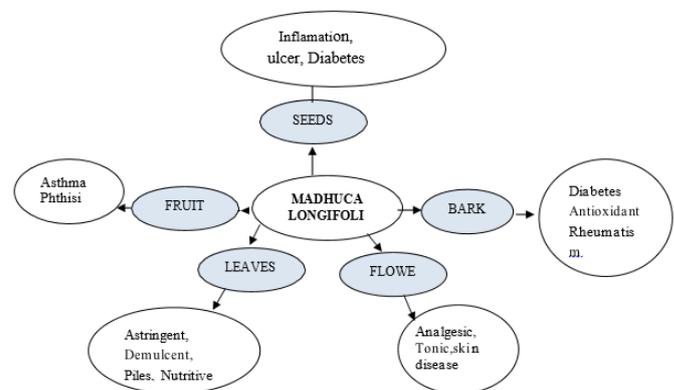


Fig 4: Biological Activity of Mahua

Nutritional and medicinal use

The Mahua tree is having lots of dietary advantage in it. It produces characteristic item which is regarded for its seed which yield high measure of fat mechanically known as Mahua spread or mowrah margarine, various consumable and remedial applications and it is also used as a biodiesel^[29]. Its fat has been used an option for cocoa spread and ghee. It is one of the single greatest wellsprings of normal hard fat^[30]. The fat which is in like manner gotten from Mahua regular item oil is used in cooking, singing and collecting chocolates. The seed fat has emulsion property so it generally used as an emulsifying administrators in scarcely any pharmaceutical endeavors. It is generally applied as back focus on oil various bit of the country, as it is magnificent to soak skin^[9].

Other than tasteful and restorative uses, Mahua has present day application as it will in general be utilized in the creation of apparel chemicals and oils [31]. Additionally, the seed cake is represented to have insecticidal and pesticide property and used as characteristic stool in crops like rice, sugarcane, etc. The helpful properties which are found in this plant are energizer, demulcent, emollient, warming. Skin ailment, sickness, headache, laxative, stores, and from time to time as galactagogue astringent and some more (The wealth of India,). Review of composing subject to manufactured structure of mahua blossom reveals its high solid advantage. Besides being a rich source of protein and sugar, the blooms also contain essential minerals like K, Fe, P, and Ca. Calcium is a noteworthy section of the bone and helps teeth improvement [34] phosphorus is next in importance to calcium as utilization of Ca is solidly related to it. A huge segment of the Calcium in the body is kept as the calcium Phosphate [33].

Traditional use

Although Mahua tree is effectively found in the few piece of India, it isn't utilized as a nourishment material. Mahua bloom involve a significant situation in the life of the ancestral in numerous pieces of India [35]. Just a little amount of blossoms is devoured in a crude, cooked or singed framed in various pieces of India. Significant amount of blossoms is utilized in the readiness of the refined alcohols. The crisply arranged alcohol has a solid, smoky foul scent, which vanish on maturing. It is likewise observed that the nuisance of the Mahua tree husk is utilized to fix the break of bone. The most intrigued thing about the Mahua tree is that it has two organic products in various seasons; the seed oil is removed from it and utilized in the few distinct purposes. The wood of mahua tree is additionally utilized in the house hold utility like entryway and window making [9].

Table 3: Ethano medical uses of *Madhuca longifolia*

Place, country	Parts used	Ethnomedical uses	Preparation(s)
India	Seeds cake	Anti-inflammatory, anti-ulcer and hypoglycaemic activity.	Ethanollic & crude alkaloid extract
India	Bark	Antidiabetic activity	Methanol, water & petroleum ether
India	Bark	Antihyperglycemic and Antioxidant	Ethanollic extract
India	Flower	Analgesic activity	Aqueous extract

There are a few reports on planning of sugar syrup from dry Mahua blossoms, as its sweet property is used in the maturation procedure. The water concentrate of dried blossom is decolorized with various decolorizing operator like loosened lime and initiated charcoal before concentrating it to the ideal fixation. Enacted charcoal at a centralization of 3.5-5% was seen as the best specialist for the readiness of the Mahua sugar syrup. The syrup in this way got from the blossom of Mahua is utilized in the distinctive reason, either in the assembling of chocolate or as an improving operator (The wealth of India).

Industrial use

Recently, biodiesel has been getting expanding consideration because of its less contaminating nature and in light of the fact that it is a sustainable power source asset as against the ordinary diesel, which is a petroleum derivative prompting a potential weariness. For the most part, biodiesel is set up from oils like soybean, rapeseed, sunflower, safflower, zetropa and

so on all through the world [36].

Conclusion

Therapeutic plants to fill in as a substitute wellspring of battling contaminations in individuals which may likewise be of lower cost and lesser poisonous quality. The blossoms, seeds and seed oil of Madhuca have extraordinary therapeutic worth. Remotely, the seed oil rub is successful to ease torment. In skin maladies, the juice of blossoms is scoured for oleation. It is additionally helpful as a nasya (nasal drops) in maladies of the head because of pitta, similar to sinusitis. The seed oil is utilized in assembling of cleansers and is utilized as an eatable too. Inside, Madhuca is utilized in immense scope of illnesses. The decoction of the blossoms is an important solution for pitta illnesses. As a general tonic, the powder of blossoms functions admirably with ghee and nectar. The decoction of blossoms extinguishes the thirst successfully. As a result of its astringent property, madhucarista is healthy in looseness of the bowels and colitis. In rakta pitta, the new squeeze of blossoms is utilized with incredible advantage to capture the dying. The blossoms assume a significant job in augmentation the bosom milk in lactating moms and in boosting the amount of original liquids moreover. Madhuca is advantageous in urinary sicknesses like consuming micturition, lack of hydration, fever and tuberculosis. Madhuca exceptionally viewed as a general panacea in the ayurvedic medication.

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