

# MADHUCA LONGIFOLIA A REVIEW OF ITS PHYTOCHEMICAL AND PHARMACOLOGICAL PROFILE

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**Abstract :** Herbal Medicine Is Still The Mainstay Of About 75 – 80% Of The World's Population In The Developing Countries For Primary Health Care. Madhuca Longifolia (M. Longifolia) Is Also Known As Mahua Belonging To The Family Sapotaceae Family. M. Mahua Is A Large Tree, About 17m High With A Large Top, Shady, Deciduous Tree. An Important Economic Tree Growing Throughout India And Used In Various Type Of Disease Condition Such As Antioxidant Activity, anti-Inflammatory Activity, analgesic Activity antipyretic Activity, neuro pharmacological Activity, anti-Hyperglycaemic Activity, immunosuppression ,anti-Ulcer Activity. madhuca As Anti-Neoplastic Hepatoprotective And Nephroprotective Activity Wound Healing Anti-Fertility Activity The Present Review Contains The Various Ethnomedical And Traditional Uses Of Bark And Leaves Of M. Longifolia.

**Keywords:** Herbal Medicines, Mahua, Sapotaceae, anticancer activity, Pharmacological profile.

## Introduction

From ayurvedic era, herbal medicines are considered as the backbone of the traditional system of medicine, as they have a potent pharmacological effect, and hence are considered to be a potential source of new drug development [1] More than 75% of the population in developing countries still depends on traditional medicines. It has been found from a scientific intervention that plant-derived compounds show a broad spectrum of efficacy and safety with comparatively lesser side effect as compared to synthetic molecules. Thus there is a need to increase screening of plants having medicinal value[2,3]. Madhuca longifolia (M. longifolia) also termed as mahua or butter nut tree (Mahva, Mohva, Mohua, Erappe, Ippa, Iluppai, Madhukah, Irippa), belong to family sapotaceae[4]. These are a medium evergreen deciduous tree, distributed widely across India, Nepal, and Sri Lanka. Various parts of M. longifolia is used in traditional and folklore system of medicine, due to its various pharmacological properties[5,6]. Therefore it is also termed as the panacea of ayurvedic medicine[7]. Different parts of M. longifolia has shown efficacy in the treatment of epilepsy diabetes, inflammation, bronchitis, ulcer and other diseases[8-10]. diabetes, inflammation, bronchitis, ulcer and other diseases[8-10]. Madhuca oil extracted from the seed is used as biofuel, edible fats and has shown good antioxidant and antimicrobial properties[10- 12]. The flowers are well known for its reducing sugar content and have been used as a cooling agent, astringent, demulcent and clinical study proves its activity in increasing the sperm count[13,14]. Leaves of M. longifolia are used in Cushing's disease and bronchitis and have antioxidant properties[14,15]. The barks have shown remedy for itching, swelling, snake poisoning and diabetes[16,17]. These are not only used for primary healthcare in rural areas in developing countries but also in developed countries as well where modern medicines are predominantly available. The use of plants as a source of medicine has been inherited and is an important component of the health care system in India and abroad even in the present era. The ayurvedic treatments of several ailments have focused on the need for investigating newer but potent and safer herbal medicines for use in various afflictions of the public in general. Madhuca longifolia which belongs to family Sapotaceae. M. longifolia is commonly known as Mahua, Butter nut tree. Mahua is a medium to large-sized deciduous tree distributed in Nepal, India and Sri Lanka.[18] Madhuca longifolia is a large tree about 17 M height with a large top.[19] Madhuca longifolia is a large, shady, deciduous tree dotting much of the central Indian Landscape, both wild and cultivated. Madhuca longifolia seeds are of economic importance as they are a good source of edible fats.[20]

## 2. Taxonomy

Botanical Name: Madhuca longifolia

Family: Sapotaceae

Subfamily : Caesalpinioideae

Tribes: Caesalpinieae

Genus : Madhuca

Species : longifolia

Order : Ericaleae [21]

**SYNONYM(S)**

*Madhuca latifolia* Macb., *Bassia latifolia* Roxb., *Mahuaindica* J.F. Gmel. VARIETIES2: *Madhuca longifolia*(Koenig) J.F. Macb. var. *longifolia*, and *Madhucalongifolia* (Koenig) J.F. Macb. var. *latifolia* (Roxb.)Cheval. [62]

**VERNACULAR/COMMON NAME**

Honey tree, butter tree (English), mohua (India), mi, Illuppai (Sri Lanka), Illuppai (Tamil), Mahua (Hindi & Bengali), Madhukah (Sanskrit), Errape (Kannada), Ippi(Telugu), Irippa (Malayalam), Mahuda (Gujarat).[62]

**Different Species of Madhuca**

The genus *Madhuca* belongs to the family Sapotaceae. This genus has various species (The Plant List, 2013); some of it are listed below:

1. *Madhuca alpinia*
2. *Madhuca aristulata*
3. *Madhuca aspera*
4. *Madhuca barbata*
5. *Madhuca bejaudii*
6. *Madhuca betis*
7. *Madhuca burckiana*
8. *Madhuca calcicola*
9. *Madhuca cheogiana*
10. *Madhuca clavata*
11. *Madhuca coriacea*
12. *Madhuca costulata*
13. *Madhuca crassipes*
14. *Madhuca cuneata*
15. *Madhuca cuprea*
16. *Madhuca curtisii*
17. *Madhuca daemonica*
18. *Madhuca decipiens*
19. *Madhuca diplostemon*
20. *Madhuca dongnaiensis*
21. *Madhuca dubardii*
22. *Madhuca elliptica*
23. *Madhuca elmeri*
24. *Madhuca endertii*
25. *Madhuca engleri*
26. *Madhuca erythrophylla*
27. *Madhuca esculenta*
28. *Madhuca firma*
29. *Madhuca floribunda*
30. *Madhuca fulva*
31. *Madhuca fusca*
32. *Madhuca glabascens*
33. *Madhuca hainanensis*
34. *Madhuca heynei*
35. *Madhuca hirtiflora*
36. *Madhuca insignis*
37. *Madhuca kingiana*
38. *Madhuca klackenbergi*
39. *Madhuca korthalsii*
40. *Madhuca krabiensis*
41. *Madhuca kuchingensis*
42. *Madhuca kunstleri*
43. *Madhuca lanceolata*
44. *Madhuca lancifolia*
45. *Madhuca lanuginose*
46. *Madhuca laurifolia*
47. *Madhuca lecomtei*
48. *Madhuca leucodermis*
49. *Madhuca ligulata*
50. *Madhuca lobbii*
51. *Madhuca longifolia*
52. *Madhuca longistyla*
53. *Madhuca macrophylla*
54. *Madhuca magnifolia*
55. *Madhuca malaccensis*
56. *Madhuca microphylla*



57. *Madhuca mindanaiensis*
58. *Madhuca mirandae*
59. *Madhuca montana*
60. *Madhuca monticola*
61. *Madhuca moonii*
62. *Madhuca motleyana*
63. *Madhuca multiflora*
64. *Madhuca multinervia*
65. *Madhuca neriifolia*
66. *Madhuca oblongifolia*
67. *Madhuca obovatifolia*
68. *Madhuca obtusifolia*
69. *Madhuca ochracea*
70. *Madhuca orientalis*
71. *Madhuca ovate*
72. *Madhuca pachyphylla*
73. *Madhuca palembanica*
74. *Madhuca pallida*
75. *Madhuca pasqueiri*
76. *Madhuca penangiana*
77. *Madhuca penicillata*
78. *Madhuca pierrei*
79. *Madhuca platyphylla*
80. *Madhuca primoplagensis*
81. *Madhuca proluxa*
82. *Madhuca pubicalyx*
83. *Madhuca punctata*
84. *Madhuca ridieyi*
85. *Madhuca rufa*
86. *Madhuca sandakanensis*
87. *Madhuca sarawakensis*
88. *Madhuca sepilokensis*
89. *Madhuca stipulacea*
90. *Madhuca stylosa*
91. *Madhuca sessiliiflora*
92. *Madhuca sessilis*
93. *Madhuca silamensis*
94. *Madhuca spectabilis*
95. *Madhuca stipulaceae*
96. *Madhuca takensis*
97. *Madhuca thorelii*
98. *Madhuca tomentosa*
99. *Madhuca tubulosa*
100. *Madhuca utilis*
101. *Madhuca vulcania*
102. *Madhuca vulpina*
103. *Madhuca woodii* .[63]



### Historical background

Since long ago, mahua tree has been a source for various edible products and also in medicinal purposes. Mahua has been worshipped by tribals because it's all parts are used for the well-being of humans. The flower of *Madhuca longifolia* is used as a flavouring agent in dishes and rice. Pickles are also made from mahua flower. It is also used as feed for the cattle. Mahua is used by lactating mothers as it increases milk production [64].

Tribals believe in conserving mahua as it is sacred for them and the mahua drink comes in the culture of tribals[65].

### Cultivation and collection

In India, 0.12 million tones Mahua seeds are produced which are used for extraction of the oil. Mahua flowers production in India is about 1 million tons. The state government of India motivates mahua seeds and flowers collection as it is a source of employment for many people. Mahua can be planted or it can be self-sown. Flowering occurs in March to April[66].

The collection of mahua seeds is generally performed in May, June and July. In this period the flowering is more than the seed production. The fruits are collected in the morning by the villagers by hand-picking method or bamboo sticks. In the peak time, about 15 kg of tori could be collected in one day. From 1 kg of seed, approximately 250 ml of oil can be extracted which is mostly used in household purposes. The seeds are parted out from the fruits; from which the pulp obtained is consumed as food. For oil expelling, the indigenous methods could be used. The gully oil obtained could be sold after vacuum purification to the soap industries. The gully oil can be preserved from not being destroyed by fungus by storing in airtight earthen pot/basket [67].

**Microscopic characteristics**

Corolla: There is a single layer of epidermis in the petal. Beneath the epidermis lies irregularly shaped and thin-walled parenchyma cells. In the parenchymatous tissues lie the scattered vascular bundles. Androecium: 4 pollen chambers are present inside the anther and in the centre of these pollen chambers lie cells of connective tissue. The epidermis of androecium is single-layered and has a thin cuticle. Endothecium: It has oval, radially elongated lignified cells. Tapetum is not distinct. Pollen grains: These are single or found in groups, spherical in shape, with clear exine and intine walls scattered in the pollen sac, a few cells of the vascular bundles are observed inside the connective tissues. Powder: The powder is dark brown. Fragments of epidermal cells and unicellular hairs are observed. Roundshaped, brown pollen grains are observed with clear exine and intine walls.

**Distribution and Habitat**

*Madhuca longifolia* is widely distributed in Burma and India (North and central parts). *Mahua* is found in dry teak forests, mixed deciduous and dry forests. *Mahua* grows well on sandy soil. It can grow on a variety of soils like clayey, shallow, calcareous soils. The favorable conditions for the growth of *Madhuca longifolia* are as follows:

- Temperature: 28-50°C (max); 2-12°C (min)
- Altitude: 1200 m
- Annual rainfall: 550-1500 mm

It needs strong light and is resistant to drought conditions.[68]

table no 1: phytochemistry

Sr. N.	Part Of Plant	Chemical Constituent	Ref. N.
1	Leaves	Dglucoside, stigmaterol, $\beta$ - carotene, xanthophylls, erthrodiol, palmitic acid, myricetin, 3- O- arabinoside, 3-O-L- rhamnoside, quercetin, 3- galactoside; 3 $\beta$ -caproxy and 3 $\beta$ -palmitoxy- olean- 12-en- 28-ol, oleanolic acid, $\beta$ - sitosterol, 3-O- $\beta$ - Dglucoside, 3 $\beta$ - caproxyolcan- 12-en-28- ol, $\beta$ -carotene, n- octacosanol, sitosterol, quercetin, $\beta$ - sitosterol- $\beta$ - Dglucoside, n- hexacosanol.	22,,23,24,25,26,27,28,29
2	Bark	Ethylcinnamate, sesquiterene alcohol, $\alpha$ - terpeneol, 3 $\beta$ - monocaprylic ester of eythrodiol and 3 $\beta$ - capryloxy oleanolic acid. $\alpha$ - and $\beta$ - amyryn acetates.	30,31,32,33
3	Seeds	Myrisic, palmitic and stearic acids, $\alpha$ -alanine, aspartic acid, cystine, glycine, isoleucine and leucine, lysine, methionine, proline, serine, threonine, myricetin, quercetin, Mi- saponin A, saponin B, arachidic, linolelic, oleic.	34,35,36,37
4	Fruits	n-hexacosanol quercetin and dihydroquercetin, $\beta$ - sitosterol and its 3 $\beta$ - Dglucoside, $\alpha$ - and $\beta$ - amyryn acetates.	38,39,40,41
5	Flower	Vitamins A & Vitamins C	42

table no 2: experimental data on uses of madhuca species

Plant parts	Pharmacological activity	Extract	Dose	Experimental models	References
Bark	Anti-ulcer]	Ethanollic	extract 400 mg/kg	in vivo	43
	Anti-diabetic	Ethanollic extract; Methanollic extract	100–200 mg/kg; 75 mg/kg	in vivo	44,45
	Wound healing	Ethanollic extract	5% w/w	in vivo	46
	Hepatoprotective	Methanollic extract	200–400 mg/kg	in vivo	47,48
	Antioxidant	Ethanollic extract	100–300 mg/kg	in vitro	49,50
	Anti-inflammatory	Ethanollic extract	Data not available	in vivo	51
	Antimicrobial	Acetone, chloroform, ethanollic extracts	50–100 µg/mL	Bacteria (Staphylococcus aureus, Bacillus subtilis, Escherichia coli), fungi (Aspergillus oryzae)	52,53
Flower	Analgesic	Alcoholic extract	64 mg/kg	in vivo	54
	Hepatoprotective	Methanollic extract	100–200 mg/kg	in vivo	11
	Anti-ulcer	Ethanollic extracts	100–300 mg/kg	in vivo	36
Leaves	Wound healing	Ethanollic extract	5% w/w	in vivo	31
	Nephro and hepatoprotective	Ethanollic extract	500-750 mg/kg	in vivo	40
Seed	Anti-inflammatory	Ethanollic extract	10 mg/kg	in vivo	43
	Anticancer	Ethanollic extract; Methanollic extract	10 µg/mL	HeLa cell lines	7,8]

### PHARMACOLOGICAL ACTIVITIES

- Antioxidant activity
- Anti-inflammatory activity
- Analgesic activity
- Antipyretic activity
- Neuropharmacological activity
- Anti-hyperglycaemic activity
- Immunosuppression
- Anti-ulcer activity
- Madhuca as anti-neoplastic
- Hepatoprotective and nephroprotective activity
- Wound healing
- Anti-fertility activity



### Madhuca as anti-neoplastic

Chemoprevention is the prominence effect of natural or pharmacological agents on reversing, blocking or delaying the onset of cancer with least adverse effect serving in the reduction of cancer-related mortality. Few scientific investigations also showed the chemopreventive action of Madhuca on human cancer cell lines. The *M. longifolia* has also shown the cytotoxic potential against the carcinoma cell. In-vitro cytotoxic assay of Madhuca against the Ehrlich ascites, carcinoma cell lines proves its anticancer potential. The crude acetone and ethanolic extract of stem and leaves are used for in-vitro study at the different dose and showed cytotoxic effect at dose 200 µg/mL. The ethanolic extract showed better potency as compared to acetone extract.

### Formulations available in the market

Mahua bark was used to prepare herbal hand wash which was nontoxic, effective and safer to use. The antimicrobial activity of this herbal hand wash was tested by disc diffusion method and compared with the commercially available hand wash. It was reported that this hand wash was effective and no side effects were observed. The formula of herbal hand wash contains extracts of bark, ginger extract Madhuca indica and extract of lemongrass. The herbal hand wash was made by stirring 4 ml of the suspended water extract (1.25g /4 ml w/v) to 3 g of sodium lauryl sulphate (SLS) Its dose is 10-15 g.

Therapeutic uses of these formulations are Svasa, Daha, Ksaya, Trsna, Srama .

**Madhukasava:** It is a liquid ayurvedic formulation which is used in the cure of various disorders like bleeding disorder, emaciation, skin diseases and tiredness.

**Abhayarishta:** It is a liquid ayurvedic formulation which is used in the cure of constipation and piles.

**Chandanāsava:** It is a liquid ayurvedic formulation which is used in the cure of burning sensation, burning micturition and also spermatorrhoea.

**Nyagrodhadi churna:** It is a powder ayurvedic formulation which is used in the cure of diabetes and urinary disorders and thirst.

**Stanyajanana rasayana:** It is an ayurvedic formulation which is used for postnatal care as it enhances the milk production and provides strength to the lactating mother.[63]

### Conclusion :

It is seen that natural products from medicinal plants to serve as an alternate source of combating infections in human beings which may also be of lower cost and lesser toxicity. Each part of *Madhuca* have great medicinal value. Hence , it is said that *Madhuca longifolia* is highly regarded as an universal panacea in the ayurvedic medicine

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