



## ETHNOMEDICAL USES OF *MADHUCA LONGIFOLIA* – A REVIEW

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### ABSTRACT

*Madhuca longifolia* commonly called as mahua is such a kind of tree involved in day to day activity of tribal people. It belongs to the family Sapotaceae, an important economic tree growing throughout India. The Mahua tree is medium sized to large deciduous tree, usually with a short bole and a large rounded crown. Ethnomedical uses say to possess significant antipyretic, hepatoprotective, anti-inflammatory, analgesic, antitumour, antiprogestational, antiestrogenic and wound healing activity. Traditionally *M. longifolia* bark is used in rheumatism, ulcers, bleedings and tonsillitis. The present review contains the various ethnomedical and traditional uses of bark and leaves of *M. longifolia*.

**KEY WORDS:** *Madhuca longifolia*, Mahua, Ethnomedical uses, Phytochemistry

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## 1. INTRODUCTION

Plants are considered as divine in origin and were worshipped as Mother (Goddess). They have played a significant role in maintaining human health and improving the quality of human life for thousands of years (Moon *et al.*, 1988). In the last few years there has been an exponential growth in the field of herbal medicine and these drugs are gaining popularity both in developing and developed countries because of their origin and less side effects. *Madhuca longifolia* is highly regarded as an universal panacea in the ayurvedic medicine. *Madhuca longifolia* is a large evergreen tree distributed in India, Sri Lanka and Nepal (Saluja *et al.*, 2011). *Madhuca* commonly known as mahua or butternut tree, 17m high with a large top (Ramadan *et al.*, 2006). It belongs to the family Sapotaceae. It has a significant place in tribal culture. The bark is yellowish grey to dark

brown red in colour and milky inside. The bark is recommended for phlegm and in rheumatism bark flakes are mildly heated and tied on joints. The bark is a good remedy for itch, swelling, fractures and snake-bite poisoning (Priyanka *et al.*, 2012). Preliminary phytochemical studies of stem bark with ethanol, water and chloroform extract indicated the presence of starch, terpenoids, proteins, mucilage, anthraquinone glycosides, cardiac glycosides, saponins and tannins (Gopalakrishnan *et al.*, 2012).

## 2. TAXONOMY AND NOMENCLATURE

**Species name:** *Madhuca longifolia* (Koenig) J. F. Macb. var. *latifolia* (Roxb.) Cheval.

**Family:** Sapotaceae

**Synonym(s):** *Madhuca latifolia* Macb., *Bassia latifolia* Roxb., *Mahua indica* J.F. Gmel.

**Varieties:** *Madhuca longifolia* (Koenig) J.F. Macb. var. *longifolia*, and *Madhuca longifolia* (Koenig) J.F. Macb. var. *latifolia* (Roxb.) Cheval.

**Vernacular/Common name:** Honey tree, butter tree (English), mahua (India), mi, illuppai (Sri Lanka).

### 2.1 Distribution and habitat

The species is distributed in northern, central and southern part of peninsular India, Sri Lanka and Burma. Of the two varieties, var. *longifolia* is distributed in Sri Lanka, Southern India extending northwards to Maharashtra and Gujrat; var. *latifolia* is found in some parts of central and north India and Burma. It is common in dry mixed deciduous forests, dry sal forest and dry teak forests. The tree grows on a wide variety of soils but thrives best on sandy soil. It also grows on shallow, bouldery, clayey and calcareous soils. It is found up to an altitude of 1200m, mean annual maximum temperature 28-50°C, minimum 2-12°C; annual rainfall from 550-1500mm. The species is drought-resistant, strong light demander and readily suppressed under shade. It is not frost-hardy.

### 2.2 Used in tribal medicine

In diarrhoea a cup of infusion of bark is taken orally twice a day by the tribals. Besides the stem bark is used in chronic tonsillitis, leprosy and fever (Kirtikar and Basu, 2001). It is commonly used for the treatment of snakebite as antidote for southern part of Tamilnadu, India

(Ramar *et al.*, 2008). Decoction of stem bark is used to cure skin disease, hydrocoele and skin disease (Ayyanar and Ignacimuttu, 2005; Joseph, 2008). Powdered bark is employed for the treatment of scabies. *Madhuca longifolia* leaves are expectorant and also used for chronic bronchitis and cushing's disease (Prajapati *et al.*, 2008). The leaves are applied as a poultice to relieve eczema.

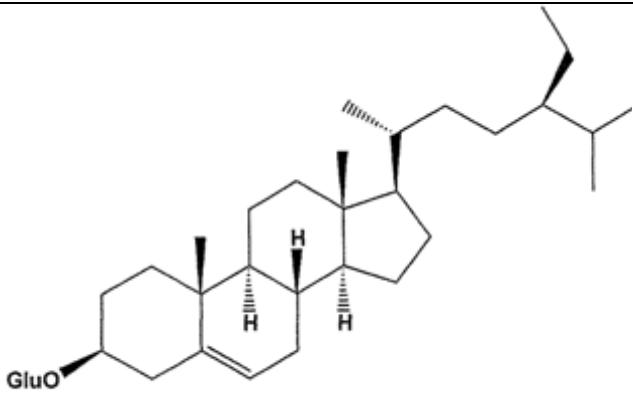
### 2.3 Phytochemistry

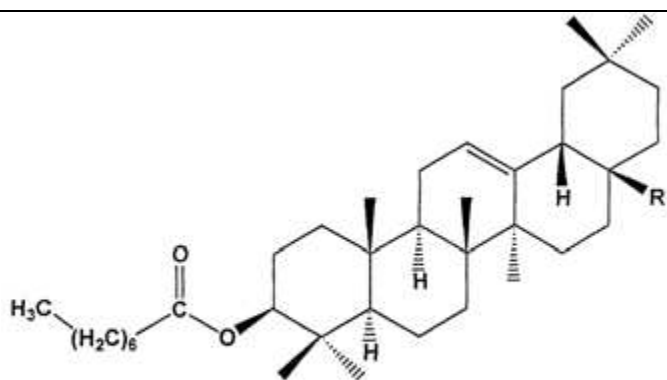
Many medicinal plants constitute a rich source of bioactive chemicals that are largely free from adverse effects and have excellent pharmacological actions, they could lead to the development of new classes of possibly safer drugs. Phytochemistry studies of leaves revealed the presence of  $\beta$ -carotene and xanthophylls; erthrodiol, palmitic acid, myricetin and its 3- O-arabinoside and 3-O-L-rhamnoside, quercetin and its 3-galactoside; 3 $\beta$ -caproxy and 3 $\beta$ -palmitoxy- olean-12-en-28-ol, oleanolic acid,  $\beta$ -sitosterol and its 3-O- $\beta$ -Dglucoside, stigmasterol,  $\beta$ -sitosterol-  $\beta$ -Dglucoside, n-hexacosanol, 3 $\beta$ -caproxyolcan- 12-en-28-ol,  $\beta$ -carotene, n-octacosanol, sitosterol and quercetin. Trunk bark contained lupeolacetate,  $\alpha$ -amyrin acetate,  $\alpha$ -spinasterol, erythrodiol moncaprylate, betulinic acid and oleanolic acid caprylates (Khare, 2007). Some of the constituents of both leaves and bark are mentioned in the Table 2. <sup>1</sup>H NMR spectra of  $\beta$ -amyrin acetate, 21-Hydroxy-3-oleanyl myricitate, Ursolic acid and n-hexyl-3-acetyl betulinate are represented in Figures 1-4.

**Table 1**  
***Ethnomedical uses of bark of Madhuca longifolia***

<b>Ethnomedical uses</b>	<b>Reference</b>
Antidiabetic activity, Itch, Swelling, Fractures and Snake-bite poisoning	Kumar <i>et al.</i> 2011
Wound healing activity	Smitha <i>et al.</i> 2010
Antibacterial activity, Rheumatism, Bleeding and Spongy gums	Tambekar <i>et al.</i> 2010
Antioxidant activity	Roy <i>et al.</i> 2010
Astringent, Stimulant, Emollient, Demulcent, Rheumatism, Piles, Nutritive and Antiepileptic activity	Khond <i>et al.</i> 2009
Rheumatism, Ulcer and Tonsillitis	Prashanth <i>et al.</i> 2010
Skin diseases, epilepsy, Pneumonia and piles	Khare, 2007
Anti-ulcer activity	Roy <i>et al.</i> 2007
Analgesic activity	Chandra, 2008
Anti-inflammatory activity	Gaikwad, 2009

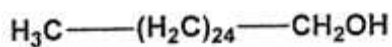
**Table 2**  
***Constituents of Madhuca longifolia***

Name and structure of the derived chemical compound	Reference
 <p align="center"><b><math>\beta</math>-D-Glucoside of <math>\beta</math>-sitosterol</b></p>	

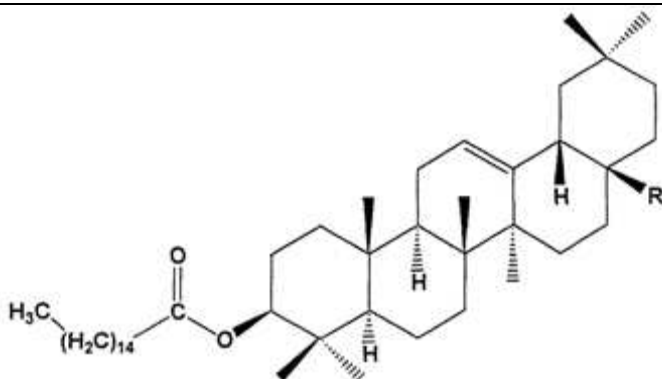


Erythrodiol 3β-caprylate R=CH<sub>2</sub>OH

Oleanolic acid 3β-caprylate R=COOH

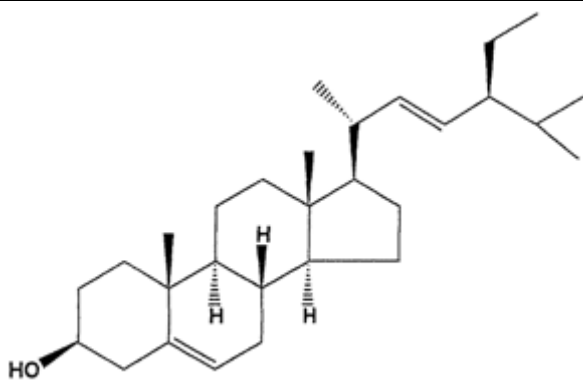


**n-Hexacosanol**

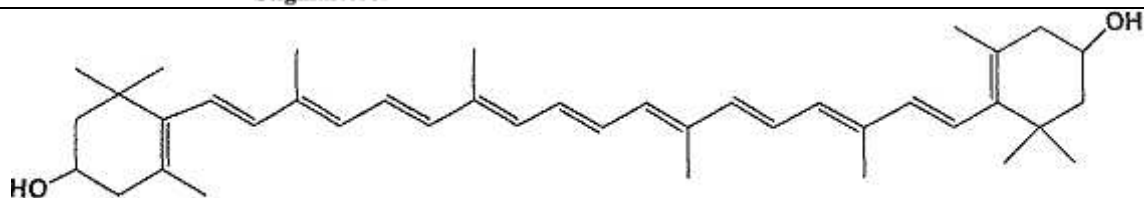


3β-Palmitoxy-olea-12-en-28-ol R=CH<sub>2</sub>OH

Oleanolic acid palmitate R=COOH

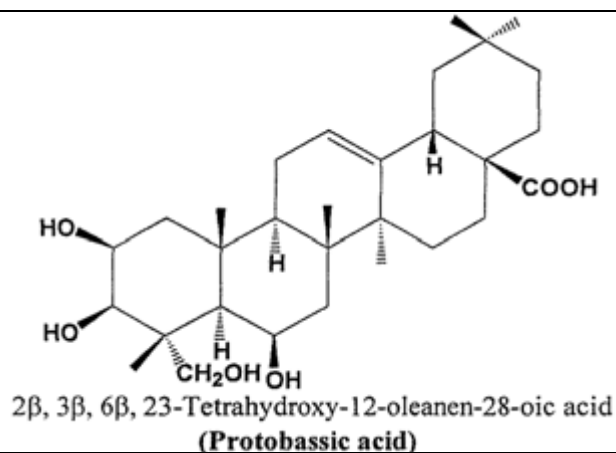


**Stigmasterol**

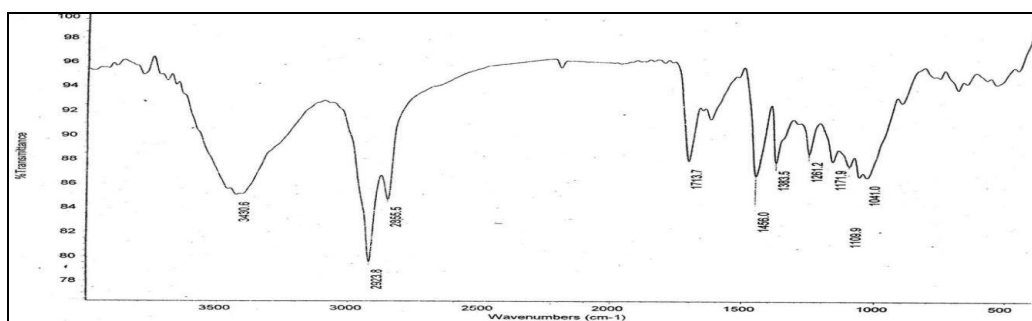


**Xanthophyll**

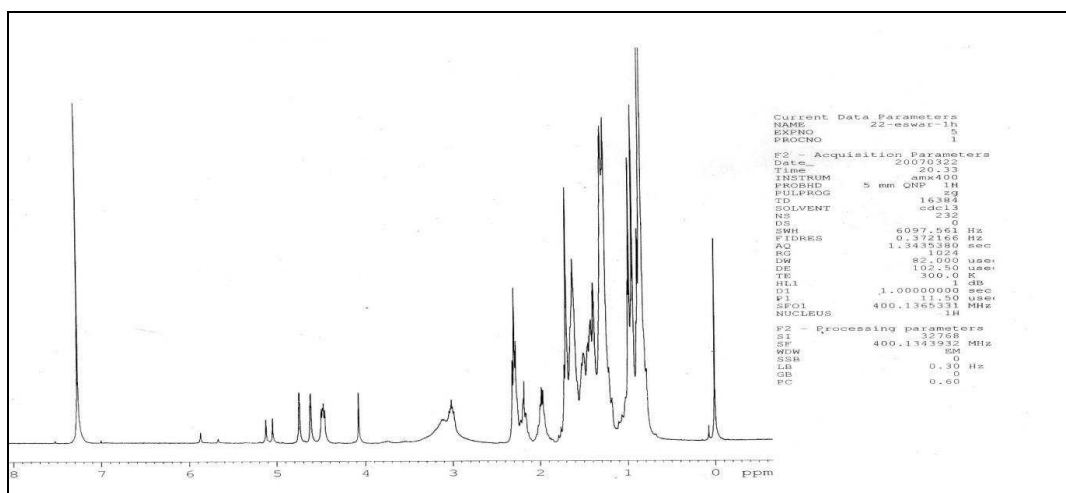
Bhatnagar  
*et al.*  
1972



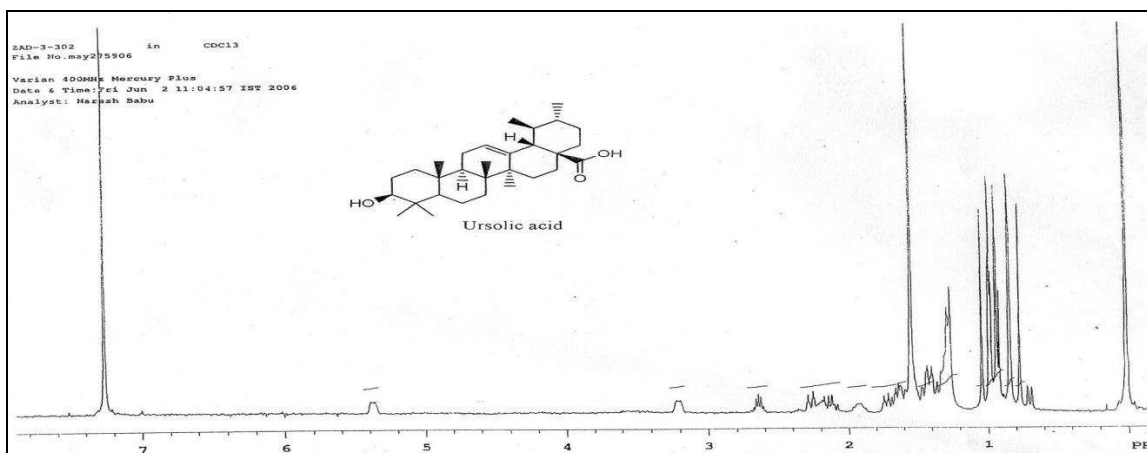
Banerji  
*et al.*  
1985



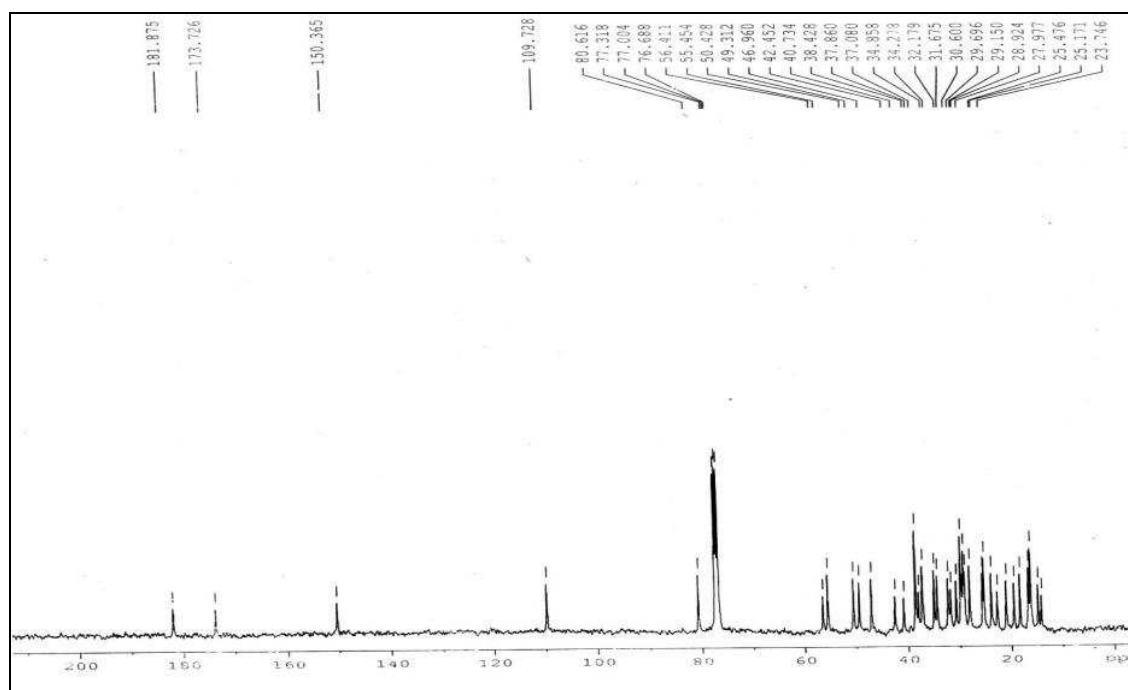
**Figure 1**  
**<sup>1</sup>H NMR spectrum of β-amyrin acetate (Eswaraiah et al., 2011)**



**Figure 2**  
**<sup>1</sup>H NMR spectrum of 21-Hydroxy-3-oleanyl myricitate (Eswaraiah et al., 2011)**



**Figure 3**  
***<sup>1</sup>H NMR spectrum of Ursolic acid (Eswaraiah et al., 2011)***



**Figure 4**  
***<sup>1</sup>H NMR spectrum of n-hexyl-3-acetyl betullinate (Eswaraiah et al., 2011)***

### 3. BIOLOGICAL ACTIVITY

#### 3.1 Antioxidant activity

The 70% ethanolic extract of bark of *M. longifolia* were studied for antioxidant activity. The ethanolic extract was tested by using reducing power and free radical (hydroxyl and superoxide) scavenging models (*in vitro*); the *in*

*vivo* antioxidant activity was assessed by determining the tissue GSH and lipid peroxidation levels (Samaresh et al., 2010). The ethanolic extract of bark of *M. longifolia* shows the antioxidant activity. The antioxidant activity of the bark was evaluated by free radical

scavenging activity using 1, 1-diphenyl-2-picryl hydrazil (BPPH), reducing power assay and superoxide scavenging activity. The result of the assay was then comparing with a natural antioxidant ascorbic acid (Prashanth *et al.*, 2010). The ethanolic extract of leaves of *M. longifolia* shows antioxidant activity in two dose levels of 500 mg kg<sup>-1</sup> and 750 mg kg<sup>-1</sup> body weight on Acetaminophen induced toxicity in rats (Palani *et al.*, 2010).

### 3.2 Wound healing activity

Wound healing activity was observed in animals treated with ethanolic extracts of bark of *Madhuca longifolia* extract treated animals showed a significant reduction in wound area and period of epithelisation. The extract treated animals showed faster epithelisation of wound respectively than the control (Smitha *et al.*, 2010).

### 3.3 Antimicrobial activity

Methanol extract of flowers, leaves, stem and stem bark of *M. longifolia* had been reported to have antimicrobial activity (Trivedi *et al.*, 1980). Extract from stem bark of *M. longifolia* were observed to have better activity than leaves. The acetone, aqueous and ethanolic extracts of stem and leaves of *M. longifolia* shows the antimicrobial activity.

### 3.4 Anti-inflammatory activity

The ethanol extract and saponin mixture at a dose level of 10 and 15 mg kg<sup>-1</sup> and 1.5 and 3 mg kg<sup>-1</sup> significantly reduced the edema induced by carrageenan in acute model of inflammation, inhibiting both phases of inflammation. Results indicated a significant anti-inflammatory activity by *M. longifolia* saponins in cotton pellet granuloma (Ramchandra *et al.*, 2009).

### 3.5 Antipyretic activity

The crude methanolic extract of aerial part of *M. indica* shows antipyretic activity. The antipyretic effects were evaluated by using brewer's yeast-induced pyrexia model. The oral administration

of extracts produced a significant dose dependent inhibition of temperature elevation (Neha *et al.*, 2010).

### 3.6 Antidiabetic and antihyperglycemic activity

The study of antihyperglycemic effects of methanolic extract of *M. longifolia* bark in normal, glucose loaded and streptozotocin induced diabetic rats. All three animal groups were administered the methanolic extract of *M. longifolia* at a dose of 100 and 200mg kg<sup>-1</sup> body weight and the standard drug glibenclamide at a dose of 500 µg kg<sup>-1</sup>. Serum glucose level was determined on days 0, 7, 14 and 21 of treatment. The extract exhibited a dose dependent hypoglycemic activity in all three animal models as compared with the standard antidiabetic agent glibenclamide. The hypoglycemia produced by the extract may be due to the increased glucose uptake at the tissue level and/or an increase in pancreatic β-cell function, or due to inhibition of intestinal glucose absorption. The study indicated the methanolic extract of *M. longifolia* to be a potential antidiabetic agent, lending scientific support for its use in folk medicine (Akash *et al.*, 2010). The ethanolic extract of bark of *M. longifolia* exhibited a dose dependent hypoglycemic activity in three animal models (normal, glucose loaded and streptozotocin induced diabetic rat) as compared with the standard antidiabetic agent glibenclamide (Samaresh *et al.*, 2010). The hydroethanolic extract of the leaves of *M. longifolia* shows hypoglycemic activity when administered orally to alloxan-induced diabetic rats. The hydroethanolic extract significantly lowered blood glucose levels (Ghosh *et al.*, 2009).

### 3.7 Anticancer activity

Anticancer activity of ethanol extract of *M. longifolia* leaves (EEML) against Ehrlich Ascites Carcinoma (EAC) in mice. The activity was assessed using Mean Survival Time, Tumor volume, Tumor weight, Tumor cell count, Body weight, Haematological studies and *in vitro*

cytotoxicity. Results found that oral administration of EEML increased the mean survival time. Tumor volume, Tumor weight, Body weight and Tumor cell count were also significantly reduced. Haematological parameters including protein and PCV, which were altered by tumor inoculation, were restored. EEML also exhibited significant cytotoxic activity at  $200\mu\text{g ml}^{-1}$ . The effects of EEML was comparable with standard drug 5-Flourourasil. The efficacy of *M. longifolia* against EAC described investigation offer the potential for reaching on understanding of anticancer potency (Sangameswaran *et al.*, 2012).

### 3.8 Anti-epileptic Activity

*Madhuca longifolia* at the dose of  $400\text{ mg kg}^{-1}$  prolonged the onset time of seizure and decreased the duration of seizures compared to saline group ( $p < 0.001$ ). Flumazenil and naloxone suppressed anticonvulsant effects of *M. longifolia*. It appears that *M. longifolia* may be useful for the treatment of absence seizures and that these effects may be related to its effect on opioid systems. This result suggests that *M. longifolia* possesses biological active constituents which may contribute to the anti-convulsant activity of *M. longifolia*. This supports the ethnomedical claims of the use of plant in the management of epilepsy. The results of the study have demonstrated that the *M. longifolia* extract possessed anticonvulsant activity on the animal models investigated and this provides a rationale for its use in traditional medicine for the management of epilepsy (Sandip *et al.*, 2011).

## 4. CONCLUSION

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Scientists have realized an immense potential in 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. The flowers, seeds and seed oil of *Madhuca* have great medicinal value. Externally, the seed oil massage is very effective to alleviate pain. In skin diseases, the juice of flowers is rubbed for oleation. It is also beneficial as a nasya (nasal drops) in diseases of the head due to pitta, like sinusitis. The seed oil is used in manufacturing of soaps and is used as an edible also. Internally, *Madhuca* is used in vast range of diseases. The decoction of the flowers is a valuable remedy for pitta diseases. As a general tonic, the powder of flowers works well with ghee and honey. The decoction of flowers quenches the thirst effectively. Because of its astringent property, madhucarista is salutary in diarrhoea and colitis. In raktapitta, the fresh juice of flowers is used with great benefit to arrest the bleeding. The flowers play an important role in augmentation the breast milk in lactating mothers and in boosting the quantity of seminal fluids also. *Madhuca* is beneficial in urinary ailments like burning micturition, dehydration, fever and tuberculosis. The combination of the powders of the bark skin of *Madhuca*, pippali and marica fruits, rhizomes of vaca and salt in equal parts is used in the form of nasal drops, in the treatment of epilepsy, with excellent benefit. *Madhuca* is the best nervine and salutary in the diseases due to vata. The nasya-nasal therapy is useful in hysteria, cough and sinusitis. The bark skin powder is given along with ghee and honey to improve the vitality and sexual vigor. *Madhuca longifolia* is highly regarded as an universal panacea in the ayurvedic medicine.



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