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MADHUCA LONIGFOLIA (SAPOTACEAE): A REVIEW OF ITS TRADITIONAL USES, PHYTOCHEMISTRY AND PHARMACOLOGY

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ABSTRACT

Madhuca longifolia (Mahua) belongs to family Sapotaceae. *Madhuca* commonly known as the Butter nut tree is a medium to large sized deciduous tree distributed in Nepal, India and Sri Lanka. *Madhuca longifolia* is a large tree, about 17m high with a large top. Mahua is a large, shady, deciduous tree doting much of the central Indian landscape, both wild and cultivated. Mahua seeds are of economic importance as they are good source of edible fats. Medicinal herbs are moving from fringe to mainstream use with a great number of people seeking remedies and health approaches free from side effects caused by synthetic chemicals. *Madhuca longifolia* is reported to contain sapogenins, triterpenoids, steroids, saponins, flavonoids and glycosides. It is used as spasmogenic, oxytocic, uterotonic, anti-bacterial, anti-implantation, anti-tumour, anti-progestational, antiestrogenic activity against menorrhagia and anti-cancer. This review contains the traditional uses of various parts of plant, Phytochemical constituent and different reported pharmacological activity.

Keywords: *Madhuca longifolia,* fam. Sapotaceae, phytochemistry

1. Introduction

Madhuca longifolia (Mahua) belongs to family Sapotaceae. *Madhuca* commonly known as the Butter nut tree. Mahua is a medium to large sized deciduous tree distributed in Nepal, India and Sri Lanka.[1] Mahua is a large tree, about 17m high with a large top. Leaves clustered at end of the branches; young branches, leaves and petiole pubescent or tomentose. Leaves coriaceous, elliptic, shortly acuminate, base cuneate. Flower numerous, near the ends of branches, drooping on pedicels. Calyx coriaceous, densely clothed rusty tomentum. Corolla yellowish-white, tube fleshy. Stamens 20-30, usually 24 or 26, anthers hispid at the back with stiff hairs. Fruits berries, ovoid, fleshy and green, seeds 1-4. Flowers during March- April and fruits during April-May.[2] Mahua is a large, shady, deciduous tree doting much of the central Indian landscape, both wild and cultivated. Mahua seeds are of economic importance as they are good source of edible fats.[3] The flowers have been traditionally used as cooling agent, tonic, aphrodisiac, astringent, demulcent and for the treatment of helminthes, acute and chronic tonsillitis, pharyngitis as well as bronchitis.[4] *Madhuca longifolia* leaves are expectorant and also used for chronic bronchitis and cushing's disease.[5] The distilled juice of the flower is considered a tonic, both nutritional and cooling and also in treatment of helminthes, acute and chronic tonsillitis, as well as bronchitis. The leaves are applied as a poultice to relieve eczema. The aerial parts are used for treatment of inflammation. The bark is a good remedy for itch, swelling, fractures and snake-bite poisoning, internally employed in diabetes mellitus. Previous phytochemical studies on *Madhuca indica* included characterization of sapogenins, triterpenoids, steroids, saponins, flavonoids and glycosides.[6]

1.1. Use in traditional medicine: The flowers are used as tonic, analgesic and diuretic. The bark is used for rheumatism, chronic bronchitis and diabetes mellitus. *Madhuca longifolia* leaves are expectorant and also used for chronic bronchitis and Cushing's disease.[5] Flowers have been traditionally used as cooling agent, tonic, aphrodisiac, astringent, demulcent and for the treatment of helminths, acute and chronic tonsillitis, pharyngitis as well as bronchitis.[4] *Madhuca indica* bark used as decoction for rheumatism, bleeding and spongy gums.[7] *Madhuca indica* J.F. Gmel (Mahudo) leaf was used in verminosis, gastropathy, dipsia, bronchitis, consumption, dermatopathy, rheumatism, cephalgia and hemorrhoids.[8] The fat obtained from mahua seeds has many medicinal application. The seeds fat has emuluscent property, used in skin disease, rheumatism, headache, laxative, piles and sometimes as galactogogue. The medicinal properties attributed to this plant are stimulant, demulcent, emollient heating and astringent. The bark is a good remedy for itch, swelling, fractures and snake- bite poisoning, internally employed in diabetes mellitus, fruits are astringent and largely

employed as a lotion in chronic ulcer, in acute and chronic tonsillitis and pharyngitis.[9] Seeds are used as laxative in habitual constipation and piles, gummy juice applied in rheumatism and skin affection, oil used in skin disease, flower used as anthelmintic, demulcent, laxative, stimulant and tonic, fomentation with dried ones produces relief in orchitis, decoction used as expectorant; benifical in impotence due to general debility when administered with milk; bark (decoction): astringent, emollient, hypoglycemic and tonic.[2]

2. Phytochemistry: [2]

2.1. Flower: Vitamins A and C.

2.2. Bark: ethylcinnamate, sesquiterene alcohol, α-terpeneol, 3β-monocaprylic ester of eythrodiol and 3β-capryloxy oleanolic acid. α- and β- amyrin acetates.

2.3. Fruits: α- and β- amyrin acetates.

2.4. Nut –shell: *n*-hexacosanol quercetin and dihyroquercetin, β-sitosterol and its 3β-D-glucoside.

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

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

3. Biological activity

3.1. Analgesic activity: The both aqueous and alcoholic extract of flowers of *Madhuca longifolia* exhibited analgesic effect. The analgesic effect were screened through tail flick, hot plate and chemical Graded doses of both aqueous and alcoholic extract of *Madhuca longifolia* (4.0 to 64.0 mg/kg, *i.m.* for 3 days) produced dose dependent analgesic effect in all the three nociceptive methods carried out either in rats or mice.[4] The crude Methanolic extract of aerial part of *Madhuca indica* shows analgesic activity. The analgesic effect were evaluated using acetic acid-induced abdominal pains i.e., nociception response. The methanolic extracts (50- 200mg kg-1i.p) were significantly reduced acetic acid-induced abdominal constrictions and stretching of hind limbs in a dose dependent manner.[10]

3.2. Antidiabetic and antihyperglycemic activity: Methanolic extract of *Madhuca indica* shows significant anti diabetic activity against streptozotocin and streptozotocin – nicotinamide induced diabetic models in wistar rats.[11] The methanolic extract of bark of *Madhuca indica* shows a dose dependent hypoglycemic activity in all three animal models (normal, glucose loaded and streptozotocin induced diabetic rat) as compared with the standard antidiabetic agent glibenclamide.[12] The ethanolic extract of bark of *Madhuca 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.[13] The hydroethanolic extract of the leaves of *Madhuca longifolia* shows hypoglycemic activity when administered orally to alloxan–induced diabetic rats. The hydroethanolic extract significantly lowered blood glucose levels.[14] The ethanolic extract of seeds of *Madhuca indica* was effective in reducing the plasma glucose level in normal albino rats in a dose dependent manner, producing hypoglycemic effect by stimulating the release of insulin from the β-cells and/ or increasing the uptake of glucose from the plasma.[9]

3.3. Antioxidant activity: The ethanolic extract of leaves of *Madhuca longifolia* shows antioxidant activity in two dose levels of 500 mg/kg and 750 mg/kg body weight on Acetaminophen induced toxicity in rats.[15] The 70% ethanolic extract of bark of *Madhuca 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.[16] The ethanolic extract of bark of *Madhuca 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 (vitamin C).[13]

3.4. Wound healing activity: Significant wound healing activity was observed in animals treated with ethanolic extracts of leaves and bark of *Madhuca longifolia. Madhuca longifolia* extract

compared with those who received the standard (Betadine) and control treatment. In excision wound modal, *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 then the control.[17]

3.5. Anticancer activity: The acetone and ethanol extracts of leaves of *Madhuca longifolia* shows the cytotoxic activity against Ehrlich Ascites Carcinoma cell lines using different *in-vitro* cytotoxic assay at 200µg/ml. Results found that both extracts exhibited significant cytotoxic activity, but higher cytotoxic activity was found in ethanol extract.[1]

3.6. Antimicrobial activity: The acetone, aqueous and ethanolic extracts of stem and leaves of *Madhuca longifolia* shows the antimicrobial activity. Extract from stem bark of *Madhuca longifolia* were observed to have better activity than leaves. Acetone and water extract of plant were found to have broad range antibacterial activity.[18] Methanol extract of flowers, leaves, stem and stem bark of *Madhuca longifolia* had been reported to have antimicrobial activity.[19]

3.7. Anti-inflammatory: The crude Methanolic extract of aerial part of *Madhuca indica* shows anti-inflammatory activity. The anti-inflammatory effects were evaluated by using carrageenan induced edema right hind paw model. The methanolic extracts (50 - 200mg kg-1i.p) were markedly inhibited carrageenan induced rat paw oedema.[10] The ethanol extract and saponin mixture of seeds of *Madhuca longifolia* were evaluated for anti- inflammatory activity using acute (carrageenan-induced inflammation), sub-acute (formaldehyde-induced inflammation), and chronic (cotton pellet granuloma) models of inflammation in rats. The ethanol extract and saponin mixture at a dose level of 10 and 15 mg/kg and 1.5 and 3 mg/kg significantly reduced the edema induced by carrageenan in acute model of inflammation, inhibiting both phases of inflammation. Both the extracts had a more effective response than the reference drug diclofenac sodium in the sub-acute inflammation model. Results indicated a significant anti-inflammatory activity by *Madhuca longifolia* saponins in cotton pellet granuloma.[20] The ethanolic and crude alkaloidal extracts of seeds of *Madhuca indica* possess dose dependent inhibitory activity on carrageenan-induced edema, inhibiting prostaglandins or mediators involved in prostaglandin synthesis, the second phase of inflammation. The crude alkaloid extract exhibited a significant anti-inflammatory only.[9]

3.8. Antiulcer activity: The crude alkaloid extract and ethanolic extract of seeds of *Madhuca indica* were evaluated for anti-ulcer activity. The result shows that ethanolic extract was significantly effective in protecting pylorus-ligation-induced gastric ulcers. The ethanolic extract at a dose level of 10 mg/kg showed a significant decrease in the ulcer index compared to vehicle, and was near to that of lansoprazole used at a dose level of 40 mg/kg, while crude alkaloid extract exhibited no significant gastro-protective effect.[9]

3.9. Antipyretic activity: The crude methanolic extract of aerial part of *Madhuca 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.[10]

3.10. Hepatoprotective activity: The methanolic extract of flowers of *Madhuca longifolia* shows the hepatoprotective activity against paracetamol induced hepatotoxicity. Two doses of methanolic extract of *Madhuca longifolia* (100 and 200 mg/kg) were administered orally to the animals with hepatotoxicity induced by paracetamol (2 gm/kg). The methanolic extract showed significant protective effect by lowering serum levels of various biochemical parameters such as serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), serum alkaline phosphatase (ALP) and total bilirubin, and by increasing serum levels of total protein and albumin in the selected model.[21]

4. Traditional uses of *Madhuca longifolia*

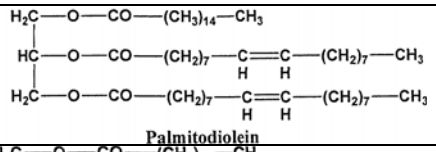
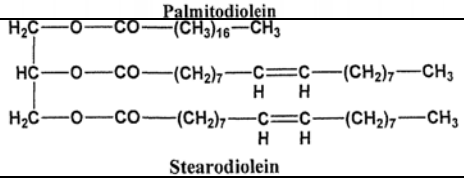
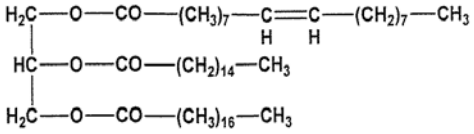
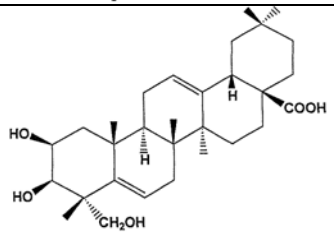
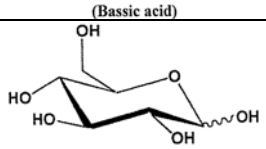
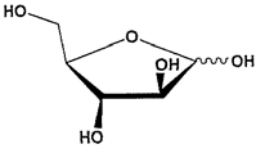
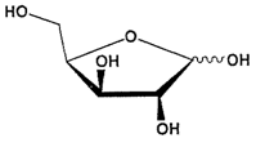
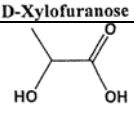
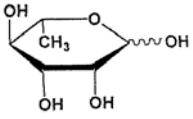
Place, country	Part(s) used	Ethno medical uses	Preparation(s)	Reference(s)
India	Seeds cake	Anti-inflammatory, anti ulcer, and hypoglycaemic activity	Ethanolic & crude alkaloid extract	Seshagiri M. *et al* 2007
India	Bark	Antidiabetic activity	Methanol, water, & petroleum ether	K Pavan Kumar *et al* 2011
India	Bark	Antihyperglycemic and antioxidant	Ethanolic extract	Srirangam Prashanth *et al* 2010
India	Flower	Analgesic activity	Aqueous and	Dinesh Chandra *et al*

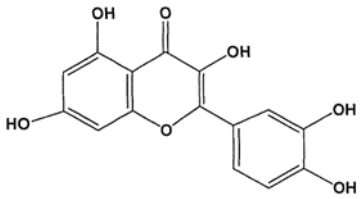
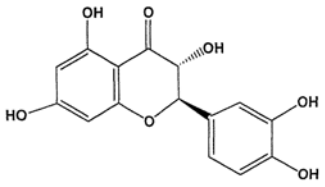
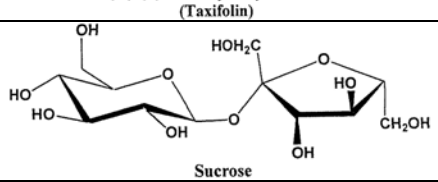
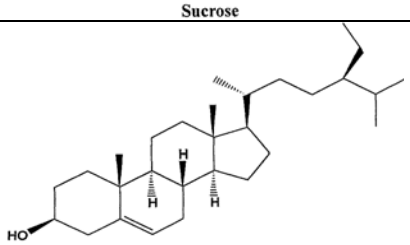
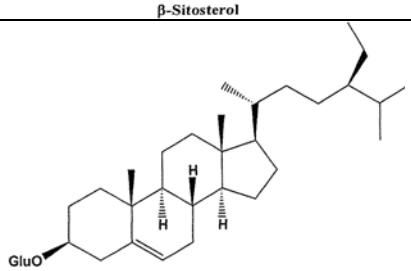
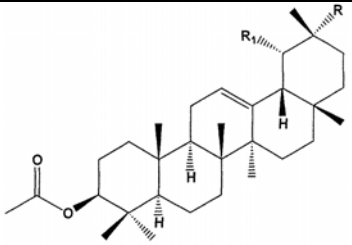
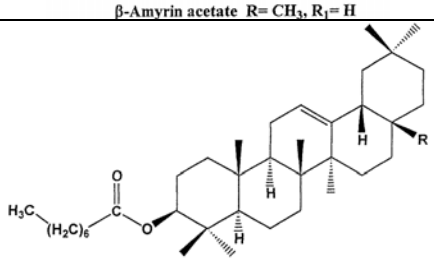
			alcoholic extracts	2001
India	Leaves & bark	Wound healing activity	Ethanolic extract	Smita Sharma *et al* 2010
India	Leaves	Nephro and hepato protective activity	Ethanolic extract	S. Palani *et al* 2010
India	Leaves	Antioxidant activity	Ethanolic extract	S. Palani *et al* 2010
India	Leaves	Cytotoxic activity	Petroleum ether, chloroform, ethanol acetone and water	Saluja. M.S. *et al* 2011
India	Bark	Antibacterial activity	Aqueous , ethanol, methanol and acetone	Tambekar D.H.*et al*. 2010
India	Leaves and stem bark	Antimicrobial activity	Hexane, ethanol chloroform, acetone and water	Mangesh Khond *et al*. 2009
India	Bark	Antioxidant activity	70% ethanolic extract	Samaresh Pal Roy *et al* 2010
India	Aerial part	Anti inflammatory, analgesic and antipyretic activity	Methanolic extract	Neha Shekhawat *et al*. 2010
India	Flowers	Hepatoprotective activity	Methanolic activity	M. Umadevi *et al* 2011
India	Seeds	Anti inflammatory	Ethanol extract and saponin mixture	Ramchandra D. *et al* 2009
India	Leaves and stem bark	Astringent, Stimulant, Emollient, Demulcent, Rheumatism, Piles and Nutritive.	ND	Mangesh Khond *et al*. 2009
India	Leaves	Verminosis, gastropathy, Dipsia, bronchitis, consumption, dermatopathy, rheumatism, cephalgia and hemorrhoids	ND	Y. Vaghasiya *et al* 2009
India	Bark	Rheumatism, bleeding and spongy gums	Decoction	Tambekar D.H.*et al*. 2010
India	Bark	Rheumatism, ulcer and tonsillitis	ND	Srirangam Prashanth *et al* 2010
India	Flower	Skin diseases	Juice	Srirangam Prashanth *et al* 2010
India	Seeds	Effective to alleviate pain	Oil	Srirangam Prashanth *et al* 2010
India	Bark	Itch, swelling, fractures and snake-bite poisoning	ND	K Pavan Kumar *et al* 2011
India	Leaves	Expectorant, chronic bronchitis and cushing's disease	ND	Saluja. M.S. *et al* 2011
India	Flowers	Tonic, analgesic and diuretic	ND	Saluja. M.S. *et al* 2011
India	Flowers	Cure cough	Roasted flowers	S. Palani *et al* 2010
India	Fruits	Asthma and phthisis	Roasted fruits	S. Palani *et al* 2010
India	Leaves	Antihyperglycemic activity	Hydroethanolic extract	Rumi Ghosh *et al* 2009

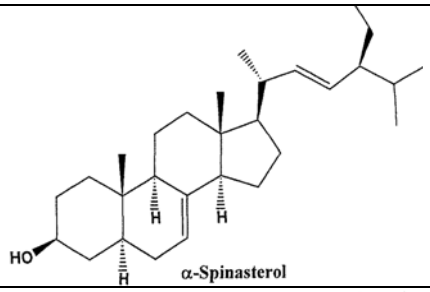
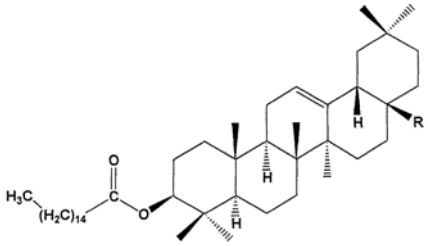
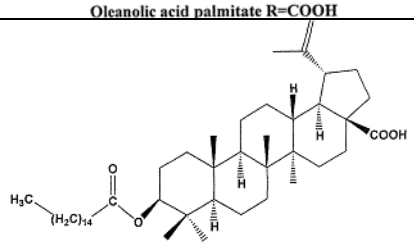
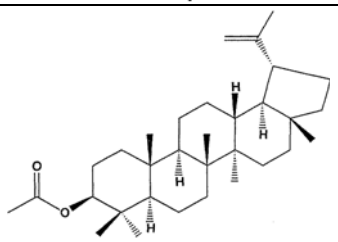
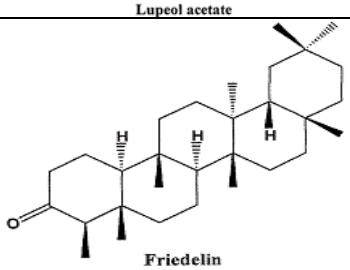
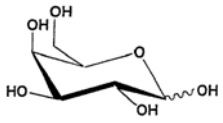
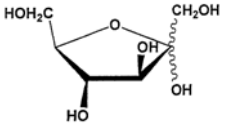
ND- Not Define

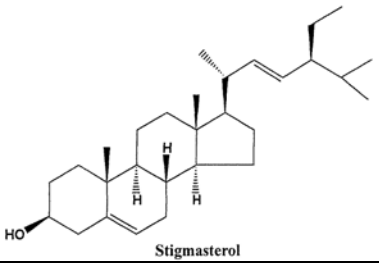
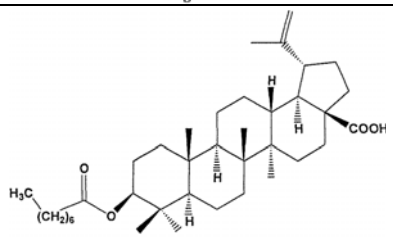
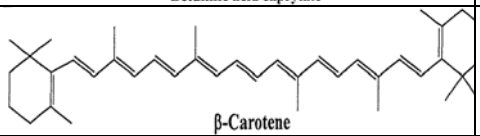
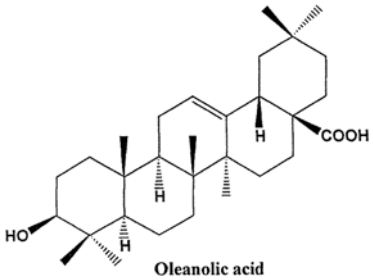
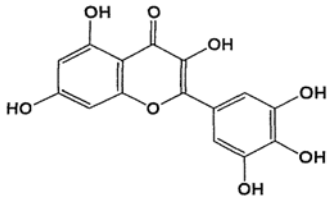
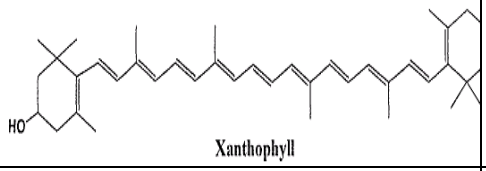
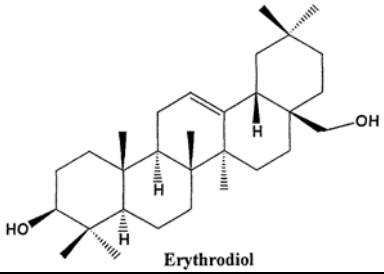
5. Constituents of *Madhuca longifolia*

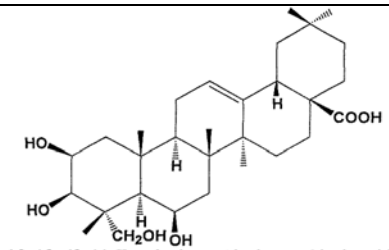
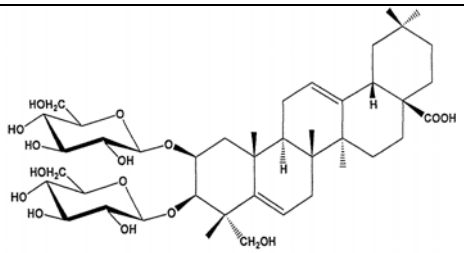
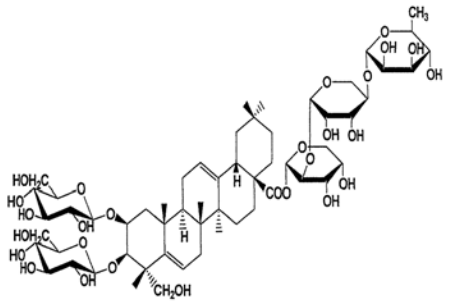
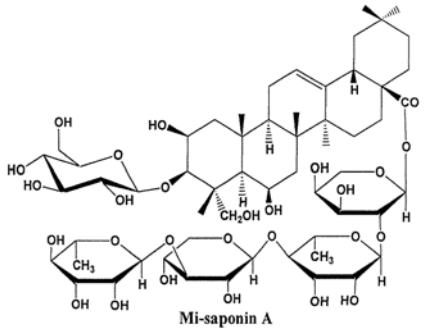
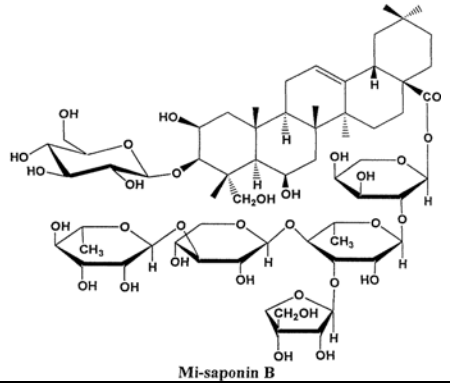
S.No.	Name and structure	Plant species	Plant part	References
1.	$CH_3(CH_2)_{16}COOH$ **Stearic acid**	*B.latifolia* *M. butyracea*	Seeds Seeds	29, 62 22
2.	$CH_3(CH_2)_{14}COOH$ **Palmitic acid**	*B.latifolia* *M. butyracea* *M.latifolia*	Seeds Leaves Seeds	29, 62 22 58
3.	$CH_3(CH_2)_{12}COOH$ **Myristic acid**	*B.latifolia*	Seeds	29
4.	$CH_3(CH_2)_{18}COOH$ **Arachidic acid**	*B.latifolia*	Seeds	29

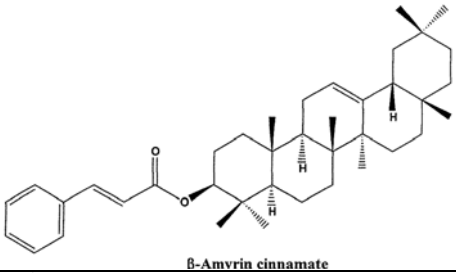
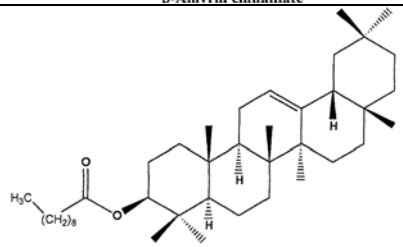
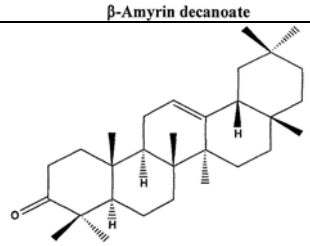
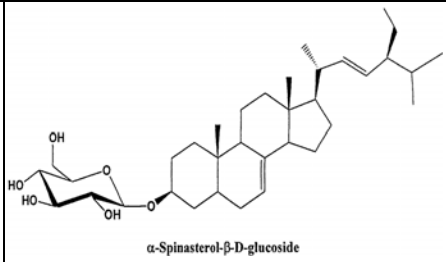
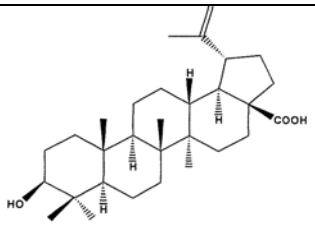
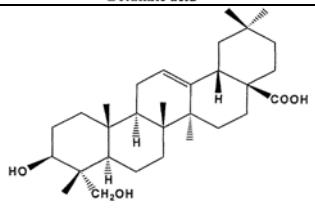
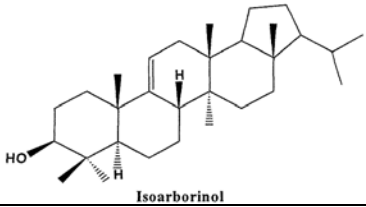
5.	$CH_3(CH_2)_7CH{=}CH(CH_2)_7COOH$ **Oleic acid**	*B.latifolia* *M. butyracea*	Seeds Seeds	29, 62 22
6.	$CH_3(CH_2)_4CH{=}CHCH_2CH{=}CH(CH_2)_7COOH$ **Linoleic acid**	*B.latifolia* *M. butyracea*	Seeds Seeds	29, 62 22
7.	 **Palmitodiolein**	*M.latifolia* *M. butyracea*	Seeds Seeds	64 22
8.	 **Stearodiolein**	*M. latifolia*	Seeds	64
9.	 **Oleopalmitostearin**	*M. latifolia*	Seeds	64
10.	 2β, 3β, 23-Trihydroxy-5,12-olea-dien-28-oic acid **(Bassic acid)**	*B.latifolia* *M. butyracea*	Seeds Seeds	23, 52 23, 52
11.	 **D-Glucopyranose**	*B.latifolia* *M. latifolia* *M. indica*	Seeds Trunk bark Flower	42 75 44
12.	 **D-Arabinofuranose**	*B. latifolia* *M. indica*	Seeds Flower	42 43, 44
13.	 **D-Xylofuranose**	*B. latifolia* *M. latifolia* *M. indica*	Seeds Trunk bark Flower	42 75 43
14.	 2-Hydroxypropanoic acid **(Lactic acid)**	*B. latifolia*	Flower	46
15.	 **L-Rhamnose**	*B. latifolia* *M. latifolia* *M. indica*	Seeds Trunk bark Flower	42 75 43

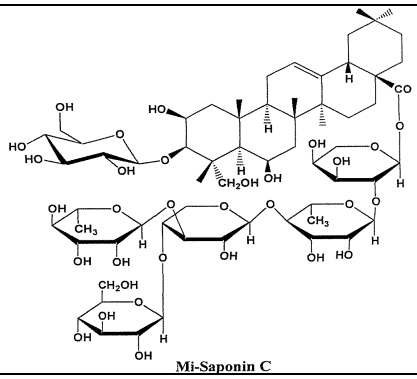
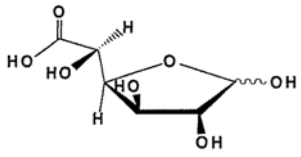
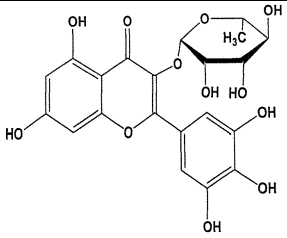
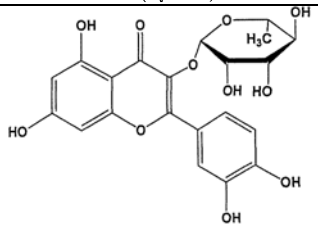
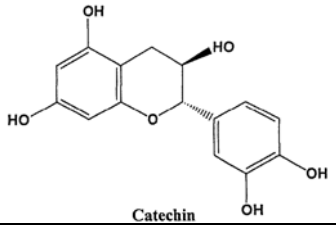
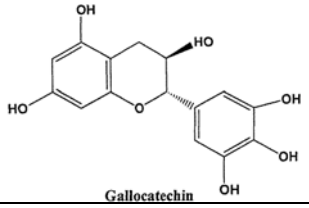
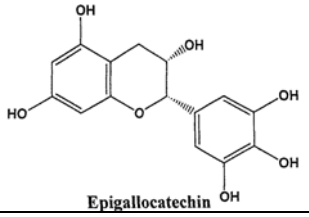
16.	 3,3',4',5,7-Pentahydroxyflavone **(Quercetin)**	*B. butyracea* *M. latifolia*	Nut shell Nut shell Leaves	72 73 58
17.	 3,3',4',5,7-Pentahydroxyflavanone **(Taxifolin)**	*M. butyracea* *M. latifolia*	Nut shell Nut shell	72 73
18.	 **Sucrose**	*M. latifolia*	Nut	27
19.	 **β-Sitosterol**	*M. latifolia*	Nut Mesocarp Leaves	27 73 58
20.	 **β-D-Glucoside of β-sitosterol**	*M. latifolia* *M. butyracea* *M. longifolia*	Nut Mesocarp Trunk bark Leaves Nut Mesocarp Fruit pulp Bark Leaves	27 73 75 58 27 74 58
21.	 **α-Amyrin acetate R= H, R_1= CH_3** **β-Amyrin acetate R= CH_3, R_1= H**	*M. latifolia* *M. butyracea* *M. nerrifolia* *M. moonii* *M. fulva* *M. microphylla*	Mesocarp, Trunk bark Bark, Leaves Timber Bark, Timber Bark, Timber Bark	73, 74 75 74 50 60 60 60 60
22.	 **Erythrodiol 3β-caprylate R=CH_2OH** **Oleanolic acid 3β-caprylate R=COOH**	*M. latifolia* *M. longifolia*	Mesocarp, Trunk bark Leaves	73 75 58

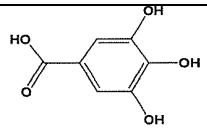
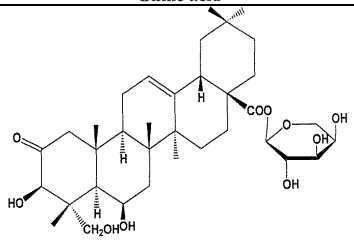
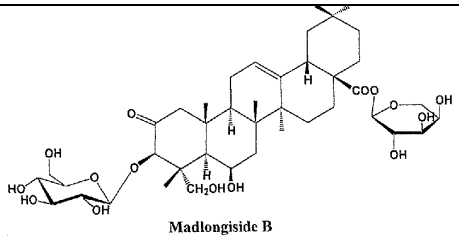
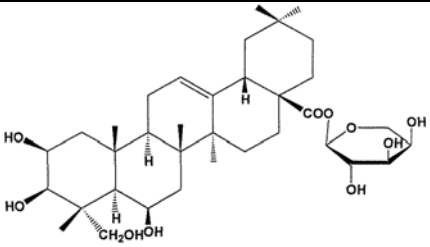
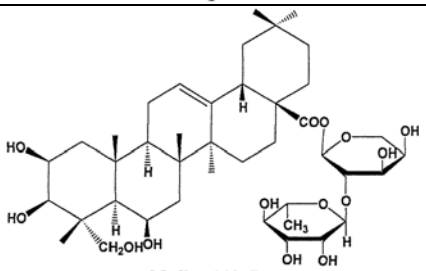
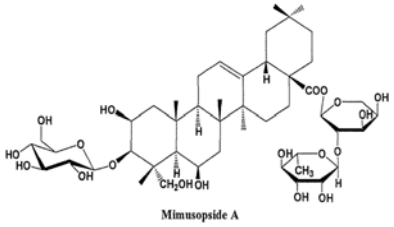
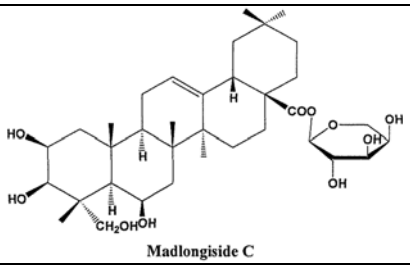
23.	H_3C——$(H_2C)_{24}$——CH_2OH **n-Hexacosanol**	*M. latifolia* *M. longifolia* *M. butyracea*	Mesocarp Leaves Leaves	73 58 50
24.	 **α-Spinasterol**	*M. latifolia* *M. butyracea* *M. nerrifolia* *M. fulva* *M. pasquiery*	Trunk bark Bark, Fruit pulp, Leaves Timber Timber Bark, Leaves	75 74 50 60 60 25
25.	 **3β-Palmitoxy-olea-12-en-28-ol R=CH_2OH** **Oleanolic acid palmitate R=COOH**	*M. butyracea* *M. longifolia*	Fruit pulp Leaves	74 58
26.	 **Betulinic acid palmitate**	*M. butyracea* *M. pasquiery*	Barks Leaves	74 25
27.	 **Lupeol acetate**	*M. latifolia*	Trunk bark	75
28.	 **Friedelin**	*M. butyracea* *M. nerrifolia* *M. pasquiery*	Barks Barks, Timber Leaves	74 60 25
29.	 **D-Galactose**	*M. latifolia* *M. indica*	Trunk bark Flower	75 43, 44
30.	 **D-Fructose**	*M. latifolia*	Seeds	

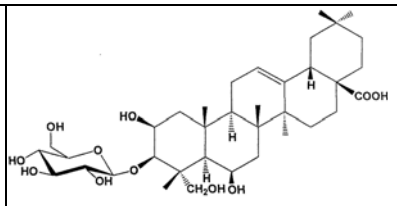
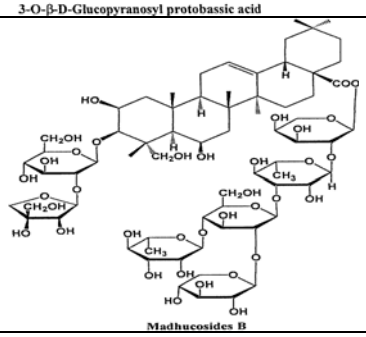
31.	 Stigmasterol	*M. latifolia* *M. longifolia*	Leaves Leaves	58 58
32.	 Betulinic acid caprylate	*M. latifolia*	Trunk bark	75
33.	 β-Carotene	*M. latifolia*	Leaves	58
34.	H_3C——$(H_2C)_{26}$——CH_2OH **n-Octacosanol**	*M. latifolia*	Leaves	58
35.	 Oleanolic acid	*M. latifolia*	Leaves	58
36.	 3,3',4',5,5',7-Hexahydroxyflavone **(Myricetin)**	*M. latifolia* *M.indica* *M. pasquiery*	Leaves Leaves ND	58 61 70
37.	 Xanthophyll	*M. longifolia*	Leaves	58
38.	 Erythrodiol	*M. latifolia*	Leaves	58

39.	 2β, 3β, 6β, 23-Tetrahydroxy-12-oleanen-28-oic acid **(Protobassic acid)**	*M. longifolia* *M. indica*	Seeds Leaves	32 51
40.	 2,3-Di-O-glucopyranoside of bassic acid **(Saponin A)**	*M. latifolia*	Seeds	69
41.	 Rhamnopyranosyl 1 →4 xylopyranosyl 1 →2 arabopyranosyl 1→OOC (28) of saponin A **(Saponin B)**	*M. latifolia*	Seeds	69
42.	 **Mi-saponin A**	*M. longifolia* *M. butyracea*	Seeds Seeds	33 59
43.	 **Mi-saponin B**	*M.longifolia*	Seeds	33

44.	 ß-Amyrin cinnamate	*M. moonii* *M. fulva*	Barks, Timber Timber	60 60
45.	 β-Amyrin decanoate	*M. nerrifolia* *M. fulva*	Barks, Timber Barks	60 60
46.	 β-Amyrenone	*M. nerrifolia*	Timber	60
47.	 α-Spinasterol-β-D-glucoside	*M. nerrifolia*	Timber	60
48.	 Betulinic acid	*M. nerrifolia* *M.microphylla* *M. pasquiery*	Barks Barks Barks	60 60 25
49.	 Hederagenin	*M. nerrifolia*	Timber	60
50.	 Isoarborinol	*M. nerrifolia*	Barks	60

51.	 Mi-Saponin C	*M. lonifolia*	Seeds	34
52.	 D-Glucuronic acid	*M. indica*	Flower	43, 44
53.	 3,3',4',5,5',7-Hexahydroxyflavone-3α-O-L-rhamnopyranoside (Myricitrin)	*M. pasquiery*	ND	70
54.	 3,3',4',5,7-Pentahydroxyflavone-3α-O-L-rhamnopyranoside (Quercitrin)	*M. pasquiery*	ND	70
55.	 Catechin	*M. pasquiery*	ND	70
56.	 Gallocatechin	*M. pasquiery*	ND	70
57.	 Epigallocatechin	*M. pasquiery*	ND	70

58.	 Gallic acid	*M. pasquiery*	ND	70
59.	 2β,6β,23-Trihydroxy-2-oxo-olean-12-en-28-oic acid 28-O-α-L-arabinopyranoside **(Madlongiside A)**	*M. longifolia*	Seeds	76
60.	 **Madlongiside B**	*M. longifolia*	Seeds	76
61.	 **Madlongiside C**	*M. longifolia*	Seeds	76
62.	 **Madlongiside D**	*M. longifolia*	Seeds	76
63.	 **Mimusopside A**	*M. longifolia*	Seeds	76
64.	 **Madlongiside C**	*M. longifolia*	Seeds	76

65.	 3-O-β-D-Glucopyranosyl protobassic acid	*M. longifoli*	Seeds	76
66.	 Madhucosides B	*M. indica*	Barks	56

Conclusion

Madhuca longifolia is highly regarded as an universal panacea in the ayurvedic medicine. It is one of the universal plant having medicinal activities .This versatile plant is the source of various types

of compounds. In the present scenario many plant are used to treat many diseases. *Madhuca longifolia* is reported to contain sapogenins, triterpenoids, steroids, saponins, flavonoids and glycosides. It is used as spasmogenic, oxytocic, uterotonic, anti-bacterial, anti-implantation, anti-tumour, anti-progestational, antiestrogenic activity against menorrhagia and anti-cancer. As the global scenario is now changing towards the use of nontoxic plant product having traditional medicine use, development of modern drug from *Madhuca longifolia* should be emphasized for the control of various diseases.

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