



Received on 09 August 2015; received in revised form, 01 September 2015; accepted, 17 September 2015; published 30 September 2015

A REVIEW ON PHYTOCHEMICAL AND PHARMACOLOGICAL PROPERTIES OF *MICHELIA CHAMPACA* LINN. FAMILY: MAGNOLIACEAE

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Keywords:

Chitosan, Cellulose,
Heavy metals, Adsorption
and water treatment

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ABSTRACT: *Michelia Champaca* Linn., belonging to family Magnoliaceae, is commonly known as Champa. It is a medium size evergreen tree highly distributed in eastern Sub-Himalayan tract, West Bengal, Myanmar, and South India in addition to China. This plant is useful either as an ornamental purpose or as traditional ethnomedicine. Now, the purpose of this article is to describe the pharmacognostic, pharmacological and chromatographic profile of this plant. This article provides the collective information about the phytochemical constituents isolated from various parts of this plant used in a modern scenario for the treatment of various ailments like β -sitosterol, sesquiterpenes, parthenolide, dihydro parthenolide, gallic acid, quercetin, liriodenine, essential oils, starch, etc. Traditional uses of the plant in the treatment of various disease like rheumatism, gout, diuretic, febrifuge, etc. This article also gives information about reported pharmacological activities such as anti-diabetic, anti-microbial, anti-inflammatory, diuretic, anti-ulcer, analgesic, burn wound healing, anti-helmintholytic, Procognitive activity, anti-oxidant and some other activities.

INTRODUCTION: *M. champaca* Linn. belonging to the family (Magnoliaceae) is an evergreen plant mainly cultivated in Indian gardens and near temples for its fragrant flowers and handsome foliage¹. In the traditional system of medicines, plants are the primary source for the treatment of various ailments. *Michelia* is the genus consisting of 80 species distributed throughout the tropical and subtropical region and of which about 70 species are native to China and found in southwestern and eastern mountainous region². One of these 80 species, *M. champaca* which is commonly known as Champa in Hindi; Champaka in Bengali; Atigandhaka in Sanskrit³.

It is highly distributed in the Sub-Himalayan tract and Assam, Western Ghats, South India, Burma-Yunnan, Indo-China, Siam, Malaya⁴. Different parts of the plant have medicinal importance in various ailments. Its flowers are used traditionally as bitter, demulcent, anti-pyretic, anti-emetic, diuretic, scabies and in gonorrhoea; fruits in the treatment of dyspepsia and renal disease; seeds in the healing of crack feet whereas roots are employed in the treatment of menstruation disorders.

This plant possesses the yellow to orange color flowers with strong fragrance⁵. Leaves and root bark contain parthenolide, and stem bark contain michampanolide, 8-acetoxy parthenolide, Magnograndiose, costunolide, dihydro parthenolide, β -sitosterol, liriodenine, ushinsunine, magnoflorine and micheliolide from root bark⁶⁻¹¹. This plant possesses various pharmacological activities like antidiuretic¹², anti-diabetic¹³, anti-microbial¹⁴, anti-ulcer¹⁵, etc.

	<p>DOI: 10.13040/IJPSR.0975-8232.IJP.2(9).430-36</p>
	<p>Article can be accessed online on: www.ijpjournal.com</p>
<p>DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.IJP.2(9).430-36</p>	

Botanical Description: *M. champaca* family *Magnoliaceae* is a tall, handsome and evergreen tree having a straight trunk, ascending branches, spreading, with closed head². It is medium sized tree about 50 cm in height, and the stem bark is bole straight, cylindrical about 200 cm in diameter. The bark is smooth, grey to greyish white externally and yellowish brown internally, fibrous and the crown is conical to cylindrical¹⁶. Leaves are acuminate, lanceolate; Blade-20.3-25.4cm long and 3.7- 10.2 cm wide, entire, glabrous above and more or less beneath. Petioles are 18-25 mm long³⁻⁴. Plant possess wide yellow or orange colored flowers, with strong fragrance about 2.5-5.1 cm in diameter, 15 petals, carpels densely packed on sessile gynophore, about 1-4 seeds of brown color are present inside the fruit⁵ as shown in **Fig. 1**.



FIG. 1: PICTURE OF PLANT

Geographical Distribution: *M. champaca* is native to the temperate Himalayan region and is distributed throughout the subtropical and tropical countries such as India, South China, Indonesia, Philippines, and some Pacific Islands¹⁷. Including Taiwan, Malaysia, Vietnam, Sumatra and in India, it is highly distributed in Eastern Himalayan tract and lower hills up to 3000 ft., Assam, Myanmar, Western Ghats, South India, and Bangladesh, Arunachal Pradesh, Bihar¹⁸⁻²⁰.

Ecology: *M. champaca* is well grown in moist, deep and fertile soil and is found scattered in primary lowland in rain forest, up to 2100 m altitude at absolute maximum temperature 35-40 °C and minimum temperature 3-10°²¹. The growing season for this plant mainly is monsoon from June to September²². This Plant is rich in volatile oil

constituents, concentration of which vary due to seasonal variation like sesquiterpene content are found be constant in concentration during January, March, May, July, December about (5-7%) and 21% in September and terpenoid derivatives like aliphatic C₁₅ and C₁₆ alcohol have constant amount (14-17%) all over the year²³.

Synonyms: Two synonyms of *M. champaca* Linn²⁴ are mentioned below:

M. Pilifera Bakh. F; *M. Velutina* BL

Vernacular Names: *M. champaca* is also known by various local names as given below³:

Assam- Phulchopa, Phulsopa; **Bengal-** Champa, Champaka; **Bombay-** Champa; **English-** Golden champa, Yellow champa; **Gujerati-** Champa, Sonchampa; **Hindi-** Champ, Champa, Champaca, Champac; **Kathiawar-** Pilochamp, Sonchamp; **Konkani-** Champa, Champo; **Marathi-** Kudchampa, Sonchampa; **Punjabi-** Champa, Chamoti; **Sanskrit-** Anjana, Atigandhaka, Hempushpa, Kanchana; **Tamil-** Amariyam, Sambagam; **Telugu-** Champakmu; **Uriya-** Champa, Chamoka.

Taxonomy Classification: The plant is taxonomically classified²⁵ as given below:

Kingdom: Plantae

Subkingdom: Tracheobionta

Division: Magnoliophyta

Class: Magnoliopsida

Subclass: Magnoliidae

Order: Magnoliales

Family: Magnoliaceae

Genus: Michelia

Species: *Michelia champaca*

Identity, Purity & Strength: There are certain standardized parameters **Table 1** which help in the identification of this plant either in strength and purity²⁶.

TABLE 1: STANDARDIZED PARAMETERS OF *M. CHAMPACA* LINN

Standardized parameters	Value (% W/W)
Foreign matter	Not more than 2
Total Ash	Not more than 11
Acid-insoluble ash	Not more than 1.5
Alcohol-soluble extractive	Not less than 9
Water-soluble extractive	Not less than 12

Ayurvedic Preparations: *M. champaca* is widely practiced in Ayurvedic system of medicine, and its various formulations like Candanabalalaksadi Taila, Baladhatriyadi Taila, Pushpa churna are available in the market ²⁶.

TLC and HPTLC of constituents from *m. Champaca*:

TLC of β - Sitosterol: TLC of methanolic extract of leaves and stem bark of *M. champaca* is carried out by using three different solvent system, detection under UV radiation and R_f is calculated as given below ²⁷.

TABLE 2: TLC/ HPTLC ANALYSIS OF CONSTITUENTS ISOLATED FROM *M. CHAMPACA* L.

S. no.	Solvent system	Detection	R_f values	
			Leave	Stem bark
1.	Toluene: ethyl acetate (8:2)	Anisealdehyde-Sulphuric acid (stem); UV(leaves)	0.61	0.55
2.	Benzene: Methanol (9:1)	Anisealdehyde-Sulphuric acid (stem);UV (leaves and stem-bark)	0.30	0.44
3.	Toluene: Methanol (9:1)	Anisealdehyde-Sulphuric acid (stem); UV (leaves and stem-bark)	0.25	0.20

Phytochemistry: Numerous active principles and secondary metabolites **Fig. 2** have been isolated from various parts of *M. champaca*. Phytochemical studies on stem bark show the presence of triterpenoids, steroids, fatty acid ⁴ and other studies revealed the presence of sesquiterpene lactones, alkaloids, flavonoids, tannins and saponins in leaves, stems, and roots of *M. champaca* ^{6, 12, 30-31}. *Michelia chmpaca* reported containing liriodenine, parthenolide, and guaianolides ³²⁻³⁵. Volatile oil has been isolated from the leaves of *M. champaca* containing compounds like benzyl acetate, linalool, isoeugenol ³⁶. Stem bark contains michampanolide, 8 - acetoxy parthenolide, magnograndiolide, costunolide, dihydro parthenolide, β -sitosterol, ushinsunine, magnoflorine, and micheliolide from root bark ^{1, 5-8}. There are some aporphine compounds like compound like (-)-anonaine ³⁷, (-) - asimadoline, (-) romerine, (-) - *N*-acetylanonaine ³⁸, (-) - nuciferine ³⁹, (-)-anolobine ⁴⁰; lignan –

HPTLC of Gallic Acid: HPTLC of Gallic acids is carried out to identify the quantity of gallic acid in leaves and stem-bark by using reference standard of gallic acid and by preparing the serial dilution (200 to 1000 $\mu\text{g MI}^{-1}$) and then detected at 254 nm in UV apparatus and calculate the concentration in test samples. Results show the presence of 736.963 and 595.287 μgMI^{-1} for leaves and stem-bark respectively, amounting to 73.696 and 59.287 mg/g in drug sample. Leaves are the richest source of Gallic acid ²⁸.

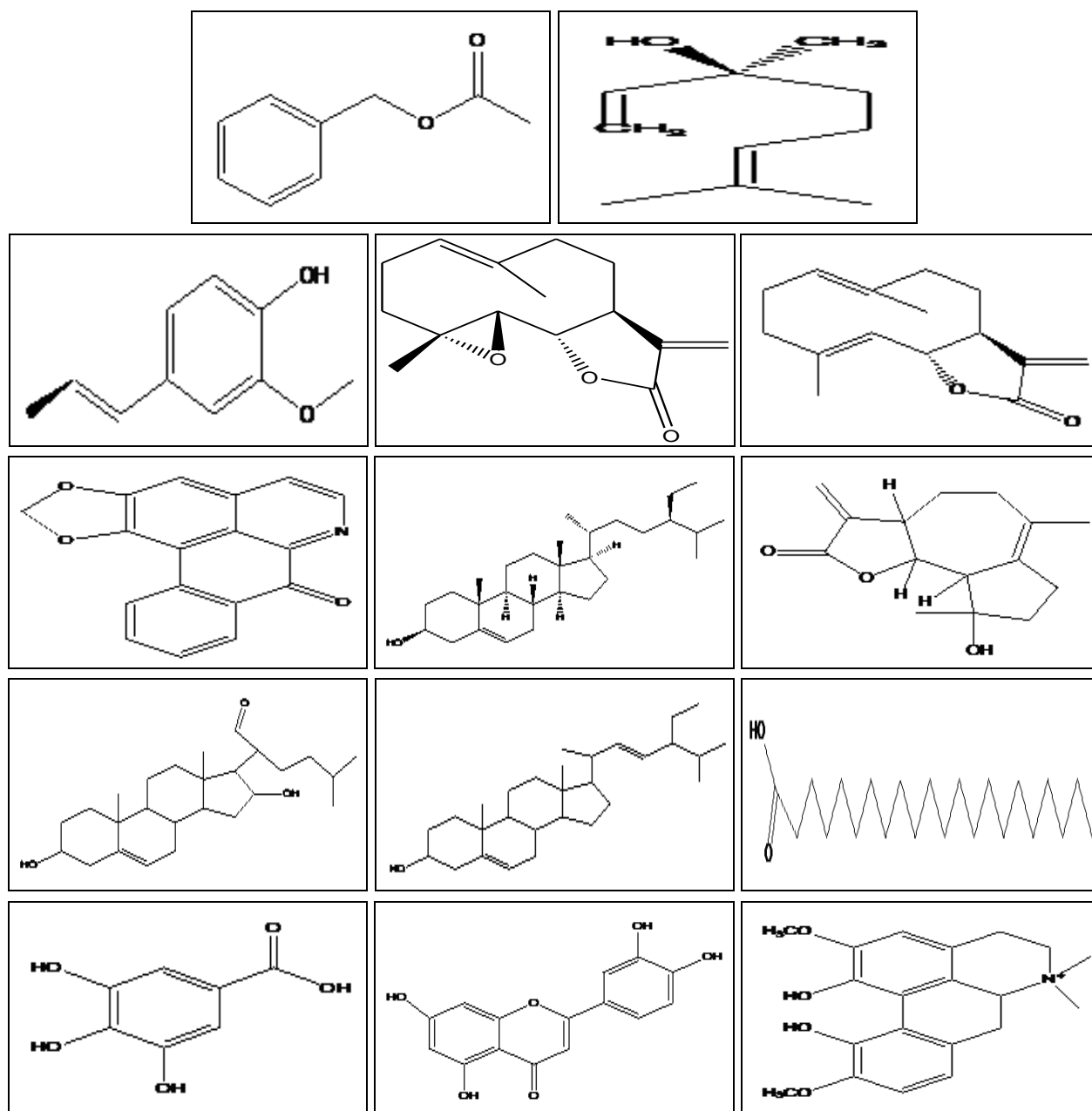
HPTLC of Quercetin: HPTLC of quercetin is carried out to check its concentration in n-hexane extract of leave and stem-bark in *M. champaca* by preparing the serial dilution of reference standard (200 to 1000 $\mu\text{g MI}^{-1}$) and then detected at 366 nm result shows the amount are 682.235 and 498.158 $\mu\text{g MI}^{-1}$ for leaves and stem-bark respectively, amounting to 68.223 and 49.851 mg/g in drug sample ²⁹.

syringaresinol ¹; amide- *N* trans-feruloyl tyramine ⁴¹ and scopoletin ⁴², vanillin ⁴³, vanillic acid ³⁷ are isolated from the branches ⁴⁴. There are some other constituents have been isolated from the stem bark of *M. champaca* like 3 β -16 α -dihydroxy-5-cholesterin-21-al, n-docosanoic acid and stigmasterol ¹⁶; Polyphenolic compounds like gallic acid from the stem bark ²⁸; quercetin from stem bark and leaves of *M. chamapaca* ²⁹. Bark also contains volatile oil, essential oil, fixed oil, resin, tannin, mucilage, starch, sugar ³².

Traditional Uses: The different parts of plant *M. champaca* have been used in the treatment of various disease traditionally like stem bark is used in the treatment of eye disorders, inflammation, antidote for scorpion and snake venoms, cough, gonorrhoea ⁴⁵⁻⁴⁶. It is commonly used in traditional medicine for the treatment of stomach ulcer and as diuretic ⁴⁷.

It is also useful in Cephalgia, ophthalmia, gout and rheumatism 48. Traditionally it is used as a disinfectant, astringent, diuretic, cooling property, parasitic infection and disease due to vitiated blood 3.

It is used also used for fever, colic, leprosy, postpartum protection, in childbirth and as febrifuge 49.



Uses of Different Parts of the Plant: The plant has fragrant flowers; therefore, it is grown near the temples and churches. These are used as a stimulant, expectorant, in rheumatism (Uuani), to treat the bilious condition. These are used for in India for the extraction of essential oil and as a hair adornment. Leaves are used to remove the fetid odor of vaginal discharge in combination with other drugs 3-4. Stem-Bark is used in gastritis, fever, and cough and root bark is used in the treatment of inflammation, constipation and dysmenorrhoea 50.

Pharmacological Activities: *M. champaca* possesses a large number of reported activities given as mentioned below:

Diuretic Activity: Traditionally, *M. champaca* is used in ethnomedicine as a diuretic agent. In the traditional system of medicine, this plant is used in the form of aq. extract of leaves and stem bark as a diuretic. This plant possesses diuretic activity at dose of 250 and 500 mg/kg in adult Swiss albino Wister rats with higher dose exhibit more

promising responses. Aq. Extract of stem possesses much diuretic activity as compare to leaves. It is also used in other kidney disease and dysuria¹².

Anti-microbial activity: *M. champaca* possess anti-microbial activity with methanolic extract of leaves, seed, stem, root bark, stem, root heart-wood, and activity is increased after fractionization (petrol, dichloromethane, ethyl acetate, butanol). Fractionation leads to broad-spectrum antibacterial activity in all fraction of stem bark and dichloromethane fraction of root bark. It also possesses antifungal activity. Liriodenine is the active constituent in plant responsible for antimicrobial activity¹⁴.

Antiulcer Activity: *M. champaca* Linn. flower and leaves aq. and alcoholic extract shows the anti-ulcer activity at a dose of 300 g/kg in male albino rats. It causes a decrease in gastric juice, total acidity, ulcer index and an increase in pH. It decreases the acid and pepsin outputs which are required to maintain the gastric mucosal strength¹⁵.

Anti-diabetic Activity: *M. champaca* Linn. flower buds possess the anti-diabetic activity at doses of 200 and 400 mg/kg in Wistar rats but unable to produce hypoglycemic activity in fasted normal rats. Aqueous and petroleum ether extracts also show some hypoglycemic activity but only at the end of the first hr. Only ethanolic extract is effective to elevate the biochemical parameters⁴⁷. Leaves of this plant also exhibited the anti-hyperglycemic activity at a dose of 200 mg/kg in diabetic rats¹³.

Anti-inflammatory Activity: Flower methanolic extract at dose 100 mg/kg of *M. champaca* produces anti-inflammatory action against Cotton pellet granuloma rats⁵¹.

Burn Wound Healing Activity: *M. champaca* Linn. flowers ethanol extract at a dose of 100 mg/kg possess the burn wound healing activity in Wistar rats. It shows improvement in wound healing either by oral and topical administration. It is useful in the treatment of burn wounds in immunocompromised patient⁵².

Anti-oxidant Activity: *M. champaca* Linn. leaf methanol extract possess the DPPH free radical scavenging activity at a dose of 0.1 ml of plant

extract in 3 ml of 0.004% methanol solution of DPPH. The activity of extract increases with increase in dose⁵³.

Analgesic Activity: *M. champaca* Linn. Leaves methanol extract at a dose of 200 and 400 mg/kg exhibited the analgesic activity in acetic acid induced writhing model. The action of extract increases with increase in dose⁵³.

Helmintholytic Activity: Methanolic and aqueous extracts of *M. champaca* Linn. Leaves at doses of 30 g/ml and 70 mg/ml in earthworms showed significant paralysis and death time which is much more as compare to albendazole⁵⁴.

Procognitive Activity: *M. champaca* Linn. leaf hexane extract at a dose of 100 and 200 mg/kg exhibited procognitive activity in memory deficit mice using rectangular maze and Y maze (interoceptive behavioral models). The activity of extract increased with increase in dose. Higher dose leads to memory enhancing and as a result, better learning enhancement is recognized in mice⁵⁵.

Anti-Cancer: The compound liriodenine which have been isolated from the branches of *Michelia champaca* shows the anti-cancer activity. It shows the inhibition action on *MDA-MB-231* human breast adenocarcinoma Cells and A549 human lung adenocarcinoma cell. It shows its maximum inhibition action with 20 μ m in 48 hrs⁴⁴.

Other Activities: The plant *M. champaca* also exhibited some other activities helpful in the treatment of various diseases like Flowers of this plant have been taken through oral route in stomachache, as carminative and to treat the dyspepsia⁵⁶. In Siddha system of medicine, flower oil of *M. champaca* is used in the treatment of joint swelling⁵⁷. The seed of plant is eaten to improve the appetite and in liver disorders⁵⁸. Leaves infusion are used in the treatment of colic with honey and paste of fruits and seeds is used in treating the cracks of feet⁵⁹.

CONCLUSION: Traditional natural remedies are used all over the world due to low cost, safety and due to lack of side effects. *M. champaca* is an ethnomedicine found to be the traditional healer in the treatment of various diseases in Ayurveda and

Unani system of medicines. Traditionally, it is useful as anti-diabetic, anti-oxidant, anti-microbial, emmenagogue, and in menstrual disorders. The present review provides the composite information on this plant, and it seems that it acts as a curative tool for ailments due to various constituents. Further investigation on this plant may be helpful in the prevention of other diseases in the future by preparing formulations in combination with other drugs.

ACKNOWLEDGEMENT: Nil

CONFLICT OF INTEREST: Nil

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How to cite this article:

Taprial S: A review on phytochemical and pharmacological properties of *Michelia champaca* Linn. Family: magnoliaceae. Int J Pharmacognosy 2015; 2(9): 430-36. doi: 10.13040/IJPSR.0975-8232.2(9).430-36.

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