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JASMINUM SAMBAC LINN (MOTIA): A REVIEW

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Abstract: *Jasminum sambac* Linn. (Family-*Oleaceae*) commonly known as Motia or lily jasmine is a scandent or sub-erect shrub with young pubescent branches, broadly ovate or elliptic, opposite leaves, white, very fragrant flowers cultivated nearly throughout the tropical and sub-tropical parts of the world. Traditionally plant is used in fever or cough, indolent ulcer, abdominal distension, diarrhoea, lowering the blood glucose level, regulating menstrual flow, to clean kidney waste, inflamed and blood shot eyes. Root, flowers, leaves act as lactifuge, arrest the secretion of milk in the puerperal state in case of threatened abscess. Pharmacological activities of the plant reported so far are antidiabetic, antitumor, antimicrobial, antioxidant, anti-acne, A.N.S stimulating effect. The present review is an attempt to highlight the various ethno botanical and traditional uses as well as phytochemical and pharmacological activities reported so far from *J. sambac*.

Keywords: *Jasminum sambac* Linn, Traditional uses, Pharmacognosy, Phytochemistry, Pharmacological activities.

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INTRODUCTION

Jasmine is an essential oil bearing plant belongs to the family *Oleaceae*. The fragnant world of *Jasmine* comprises different varieties of bela, chameli and juhi. The distribution of the genus is wide but majority of the species were centred around India, China and Malaya. It comprises about 200 species. The critical analysis of the species position revealed the true species to be 89 [(1)].

Sr. No.	Name of the *jasmine* species	Common name	Natural distribution
1	*Jasminum grandiflorum* (L.)	Chameli	Subtropical north west Himalayas, Nilgiri. Pulney and Tinny valley Hills Alt. 700-1800 meters
2	*Jasminum officinale* Linn.	Sweet jasmine	Throughout India, common in subhimalyan tract and moist forest
3	*Jasminum multiflorum* Roth.	Safed chameli	Western. Coast, Western. Ghats in the south kanara. Mysore, Malabar and Western. nilgiris Altitude 1300 mtrs
4	*Jasminum humile* Linn.	Pili chameli	North West Himalayas, Nilgiri Altitude 700- 2000mtrs
5	*Jasminum heterophyllum* Roxb.		Mishmi Hills
6	*Jasminum glandulosum* Wall.	*J. dichotomum*	Subtropical Himalaya, Kumaon, Kharia Hills Akei and Lushai Hills Altitude 700-2000 mtrs.
7	*Jasminum angustifolium* Vahl.	Wild Jasmine	Deccan Peninsula, south Travancore
8	*Jasminum arborescence* Roxb.	Tree jasmine	Tropical north west Himalaya, Deccan peninsula, Chota Nagpur, Orissa.
9	*Jasminum androphyllum* Wall.		Kashia Hills
10	*Jasminum*	Joohi, jui	North West India, Deccan Peninsula, Bengal, South Travancore and western

	auriculantum Vahl.		Ghats.
11	*Jasminum anastomosans* Wall.	*J. strinerve* Roxb.	Kashia Hills, Cuttak
12	*Jasminum attenuatum* Roxb.		Assam, Kashia Hills, Altitude 200-1300 mtrs
13	*Jasminum azoricum* Backer.		South west India especially in Ghats
14	*Jasminum braviloburn* Roxb.	*J. nilaglricum* Pl.	Ghats, Nilgiri Hills, Pulney Hills Alt 1000-2000 mtrs
15	*Jasminum brevipetiolum* Duthe.		Forest in the pilibhit district of Rehil Khand and the kheri districts of upper gangetic plains
16	*Jasminum calophyllum* Wall.	*J. courtollense* Wt.	South Deccan Peninsula, Nilgiri Hills, Western Ghats, Annamalai and Tinnevely Hills. Alt up to 1300 mtrs
17	*Jasminum caudatum* Walt.	*J. ovatum* Walt.	Kashia and Mishmi Hills, Alt up to 1300 mtrs
18	*Jasminum coaretatum* Roxb.	*J. reticulatum* Walt.	Assam, Khasia and Lushi Hills. Alt 0-1000 mtrs
19	*Jasminum cardifolium* Walt.	*J. eretiflorum* wt.	Western Ghats, Nilgiri Coimbatore, Tinnelvelly. South and middle Andaman
20	*Jasminum dispermum* Wall.		Temperate Himalaya, Kashmir, Kashia and Jaintia Hills. Alt 1000- 2500 mtrs
21	*Jasminum flexile* Vahl.		Deccan Peninsula in rain forest of southern Ghats of North Kanara, West Coast and Western Ghats in all districts up to 1700 mtrs.
22	*Jasminum malabaricum* Wt.	Mogra	Western. Coast, Western. Ghats in the South Kanara, Malabar, West Nilgiris. Alt 1300 mtrs.

23	*Jasminum dumicolum* W. W. Smith.	Naga Hills, Manipur

Jasminum sambac Linn. (Family-*Oleaceae*) commonly known as Motia or lily jasmine is a scandent or sub-erect shrub with young pubescent branches, broadly ovate or elliptic, opposite leaves, white, very fragrant flowers cultivated nearly throughout the tropical and sub-tropical parts of the world[2]. Our thorough literature search revealed an interesting fact that though the plant is a popular remedy for a variety of ailments, very little effort have been made to verify its efficacy through scientific screenings in animal model. The present review highlights the various folk, Ayurvedic uses, pharmacognostical, phytochemical and pharmacological studies conducted on *J. sambac* and also highlight unexplored potential of it.

World Wide Distribution

J.sambac (Linn.) Ait. probably originated in India and was brought to Malaysia and Java around the 3rd century; since then widely cultivated throughout the Malaysian region for its heavily scented flowers and tropics of both Hemispheres.In Tamilnadu, Andhra Pradesh, Kannad, Chazipur, Sikanderpur and Karnataka, the Jasmine particularly *J.sambac* (L.) Ait. are commercially cultivated for flowers [2, 3].

Vernacular Names [2]

Bengali- Bel/Beli; **Hindi and Marathi**- Mogra, Chamba, Bel, Motia, Mugra; **Sanskrit-** Mallika, Ananga, Ashtapadi, Devalata, Gauri, Mudgara, Janeshta, Gandhraja; **Telugu-** Mallepuvvu, Boddumalle, Bondmalle, Gundemalle, Malle, Virajadi, Virajaji; **Tamil-** Mallikaipu, Anangam, Iruvachi, Iruvadi, Karmugai, Malli, Maladi, Peramalli; **Kannada-** Dundu Mallige; **Urdu**- Kaliyan, Azad, Raibel, Sosan; **Punjabi**- Chamba, Chambeli, Mugra; **Marathi**- Mogara, Mogra, Java- Melati ; **Malayalam-** Cherupichakam, Chirakamulla ; **Spanish**- Chamela, Gamela, Jazmine de Arsbia ; **Tulu**- Ma lligedai ; **Uriya** – Belophulo, Bondumalle, Moli, Molli, Mollika.

Botanical / Scientific Classification [2, 4]

Taxon: *Jasminum sambac* (L.) Aiton

Family: *Oleaceae*

Tribe: Jasmineae.

Group: Dicot

Class: Magnoliopsida – Dicotyledons

Subclass: Asteridae

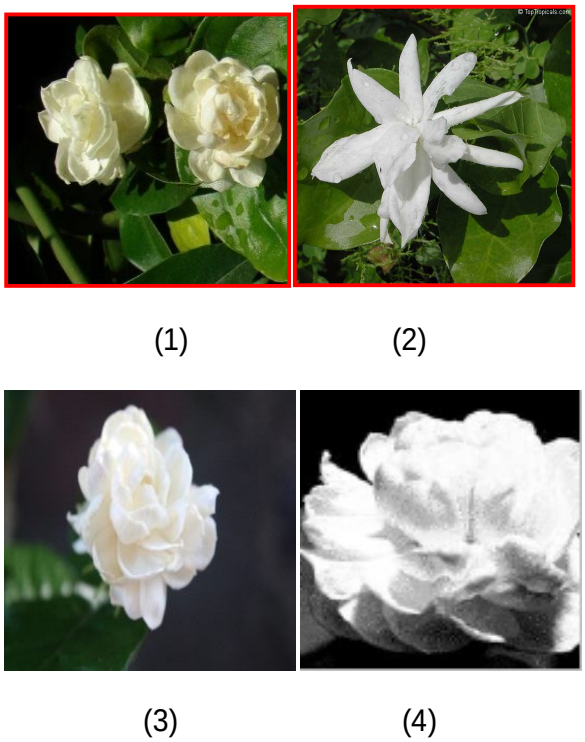
Order: Scrophulariales

Genus: Jasminum

Species: *Jasminum sambac* (L.)

J. sambac is variable and includes a large number of cultivars bearing single, double flowers with elongated or rounded petals. Four distinct sub-varieties of *J. sambac* on the basis of shape of flower bud, petal shape and number of whorls are reported[4]. The different varieties showed minor variations in habit, internode length, size, shape of leaf, calyx, number of whorls of petals and their size and shape, size of open flower and in the number of stamen, but marked difference were observed in the length of style and stigma [(1)].

1. **Motiya bela**- This group is with double flowers, rounded petals and globular buds.
2. **Bela**- It is also with double flowers with elongated petals.
3. **Hazara bela**- It is with single flowers.
4. **Mungra**- It is with multi-whorled petals which are rounded and the buds measuring about one inch in diameter.



(1) (2)

(3) (4)

Fig 1: 1.Motiya bela 2. Bela

3. Hazara bela 4. Mungra

Botanical Description

It's a suberect or scrambling shrub, 1-3 m tall, young branches pubescent. Leaves are Opposite, membraneous, 3.8-11.5 by 2.2-6.3 cm, variable in shape, broadly ovate or elliptic, acute, obtuse or acuminate, entire,

glabrous, base rounded or subcordate, rarely acute, main nerves 4-6 pairs, petioles 3-6mm long, hairy. Flowers are White, very fragrant, solitary, usually in 3-flowered, terminal cymes, bracts linear-subulate, pedicals 6mm long, hairy. Calyx 1-1.3cm, long, hairy, teeth 5-9, linear-subulate, 6-10mm. long. Corolla tube 1.3 cm. long, lobes as long as tube, narrowly oblong, acute or obtuse in cultivation orbicular, ripe carpels 1-2, subglobose, 6 mm. diam, black, surrounded by the suberect calyx teeth [2, 4].

Fig 2: 1. Whole plant 2. Sten
3. Flower 4. Corolla

Fig 3 Whole Plant

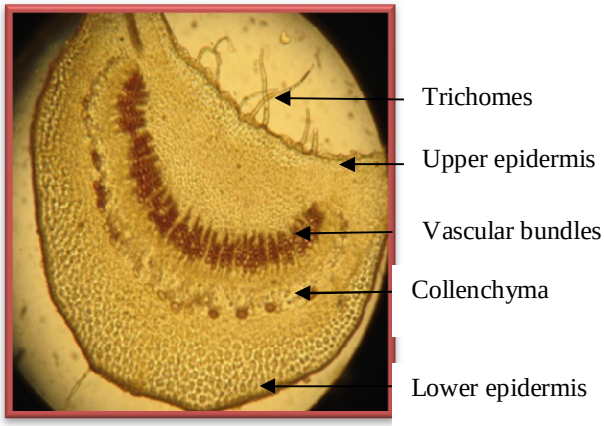


Fig 4. T.S of *Jasminum sambac* leaf

10 feet (3m). It is native to India and widely cultivated in South China. Resistant to full sun and reflected heat in phoenix. Regular watering is required for optimum growth. Plenty of water is required during the summer growing season but reduce watering in winter. It Blooms from June to September but it can bloom all year long in the greenhouse. Flowers are ¾ to 1 inch across and are powerfully fragrant. It can be planted 1.25cm either way in a square any time between June-December but it is preferable to plant in the evenings. The bushes are irrigated three days after planting, and once a week during the flowering season. The first pruning is done in the year following planting and thereafter once a year. The bushes are pruned during December-January every year. Dosage recommended per application per unit-Cattle manure or compost- 10 kg, Amm. Sulphate- 300 kg [3, 5].

Enviromental conditions and cultivation

Plant is propagated using medium-mature stems (8 to 10 inches long) by planting in perforated plastic bags filled with sandy-loam soil and watered daily. In its cultivation, water is critical especially during the establishment period where rooting and rapid plant growth occurs. The soil should be saturated with moisture to the root zone for good growth. The flowering of jasmine is not correlated with the amount of rainfall although the water status in the soil prior to

induction may influence the intensity of flowering. The harvesting of flowers is done from 2nd year after planting and the commercial yields commence from third year onwards [5].

Economic importance

Flowers are used in making garland, bouquets, in religious offerings, extraction of perfume (otto) and in cosmetic industries. Morphological variation of *Jasminum sambac* with particular reference to distinguishing characters of economic value to the flower trade has been studied. *J. sambac* are commercially cultivated for flower and value added products like essential oils.[1] The plant is much valued for its exquisitely fragrant flowers and it is estimated that nearly 400md. of flowers are annually used for the extraction of perfumed oils and 250md for the preparation of attar [4].

Traditional Uses

Plant parts used: whole plant

In India, plant is traditionally used for cooling, skin disorders, leprosy, ulcers, in cases of insanity, weakness of sight and affections of mouth[2, 6]. Plant is used with opium for gangrenous ulcers of the gums [3].

Leaves

It is used in Fever, cough, indolent ulcers, skin disorders, lowering the blood glucose level [4, 7, 8]. Juices from the leaves are applied to remove corns, in treating gallstones, abdominal distention, diarrhea, and in wound healing [3, 9, 10]. Leaves if boiled in oil, exudes a balsam which is used for anointing the head in eye complaints, and to strengthen vision [11]. Oil prepared with the juice of the leaves is poured in to the ear in otorrhoea. In ulceration or eruptions in the mucous membrane of mouth the leaves are recommended to be chewed [2].

Root

Root material in combination with other drugs is applied as external poultice in Sprains and fractures [12]. It is used as emmenagogue, in headache as analgesic, opthalmopathy and in Diabetes mellitus [2, 3, 8]. Roots are used with leaves in eye lotions [13].

Flowers

The flower is bitter, pungent, cooling, cures "tridosha", biliousness, itching sensation, useful in diseases of the eye, ear and mouth, acting as tonic to the brain, purgative, allays fever, very good in toothache, suppurations, in diseases of blood, diseases of mouth, indolent ulcers, abdominal distention, and diarrhea [2]. Aroma-therapists find the Jasmine flower antidepressant and relaxing herb which is said to help with dry or sensitive skin and tiredness. In vapour therapy Jasmine oil can be useful for addiction, depression, nervousness, coughs, relaxation and tension[3]. Decoction of dried flowers is used as eyewash during reddening and swelling pain in the eye, in cancers, conjunctivitis

dermatitis, stomatopathy, opthalmopathy, prurities, cephalalgia, leprosy, hiccough, otopathy, vomiting, insanity, galactorrhoea [2, 3, 8, 11]. Flowers act as lactifuge, and are said to arrest the secretion of milk in the puerperal state in case of threatened abscess. For this purpose about two or three handfuls of the flowers are bruised and applied moistened to each breast and renewed once or twice a day. The secretion is sometime arrested in twenty-four hours, though this generally requires two or even three days [2].

Ethnobotanical Uses

Asian and Indian folk practitioners recommend Jasmine for liver complaints, dysentery, various types of pain including painful menstruation, and skin diseases such as leprosy. In addition, Jasmine oil applied externally is used to soften and smooth the skin, for cancer, heart disease, and a variety of other ills. Aroma therapists believe Jasmine oil can be useful as an antidepressant, as a calming agent to soothe stress, pain, and anxiety, and as an aphrodisiac. Its reputation as an intoxicant is legendary. Apart from that inhaling Jasmine scent increases *θ* waves in the brain, which are associated with increased states of alertness [14].

Miscellaneous uses

Cosmetic

•Infusion of flowers used as a face wash because of its fragrance, cleansing and soothing properties.

•Flowers in bean oil or coconut oil for hair, facial or body use or as a perfume oil or perfume base.

•Digestion with vegetable oil to make oil tinctures or liniments.

Ornamental

•A favourite floral offering and adornment for altars.

Edibility

•Flowers used to make jasmine tea [3].

•Flowers yield a yellow pigment used as substitute for saffron [13].

Phytochemical studies:

Leaves: contain major phytoconstituents as alkaloids, glycosides, saponins, flavonoids and terpenoids. Mainly the Iridoid glycosides are present. These include sambacin, Jasminin, Sambacoside A (I), Sambacolingoside. Flavonoids include quercetin (II), isoquercetin (III), rutin (IV), kempferol (V) and luteolin (VI),[7,15] Seco-iridoid glucoside- sambacolignoside along with oleoside 11-methyl ester.[16,17] Oligomeric irridoids like molihuasides A is a dimeric irridoid glycoside and Molihuasides C-E is a trimeric irridoid glycoside[18].

Leaves of *J. sambac* (L.) Ait. var. trifoliatum Hort. (Oleaceace) has led to the isolation of oleoside 7,11-dimethyl ester, jasminoside, jaslanceosides B, sambacoside[19].

Roots: yielded: oleanolic acid, and hesperidin (VII), iridane triol, iridane tetraol,

and *β*-daucosterol, benzyl-*o*-*β*-*D*(1-6)-*β*-D-xylopyranoxyl, molihuaoside D, sambacoside A, sambacoside E, rutin, kaempferol-3-*o*-(2,6 di-*o*-*α*-*L*-rhamnopyranosyl)-*β*-*D*-galactopyranoside and quercetin-3-*o*-(2,6-di-*o*-*α*-*L*-rhamnopyranosyl)-*β*-*D*-galactopyranoside[20, 21].

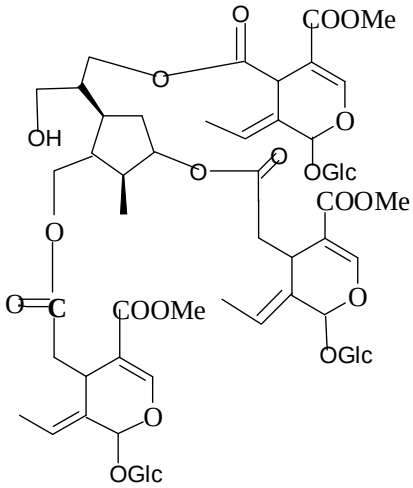
From the leaves and stem: isolated Jasminol (VIII) is characterised as lup-20-en-28beta-ol; C_{20}-C_{30} hydrocarbons, palmitic (IX), stearic (X), linolenic, linoleic, malvalic acid, betulinic, ursolic (XI) and oleanolic acid, D- mannitol, inositol (XII), xylitol and sorbitol, friedelin (XIII), lupeol (XIV), betulin (XV), alpha-amyrin (XVI), triterpenoids, flavanoids, six oligomeric irridoid glycosides have been isolated[21].

Flowers: contains 3-hexenol, 2-vinylpyridine (XVII), indole (XVIII), myrcene (XIX), linalool (XX), geranyl linalool (XXI), alpha terpenol (XXII), beta terpenol, linalyl acetate (XXIII), nerolidol (XXIV), phytol (XXV), isophytol (XXVI), farnesol (XXVII), eugenol (XXVIII), benzyl alcohol (XXIX), methyl benzoate (XXIX) , benzyl cyanide (XXX), benzyl acetate (XXXI), methyl dihydrojasmonate, methyl anilate, cis-jasmone, methyl N-methylanthranilate, vanillin (XXXII), cis-3-hexenylbenzoate, benzoate, methylpalmitate and methyl linoleate (XXXIII), 8,9-dihydrojasminin, 9-deoxyjasminigenin (XXXIV)[16, 22, 23].

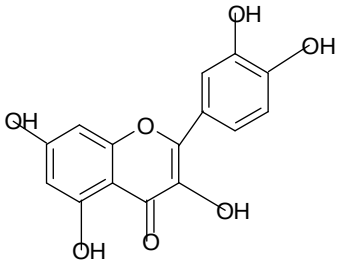
Glycosidic aroma precursor like benzyl *6-O-β-D* xylopyranosyl-*β*-D-glucopyranoside (*β*-primeveroside), 3(2-phenylethyl 6-*O*-*α*-*L*-rhamnopyranosiyl-*β*-D-glucopyranoside (*β*-rutinoside) are identified from the flowers[24].

Benzyl acetate, benzyl alcohol and cis-jasmone give the fruity aromatic jasmine qualities. Linalyl- *β*-D-glucopyranoside and its 6-*O*-malonate, the aroma precursor of linalool and farnesol give the flowery character and are the main compounds involved in the production of scented tea.[25] Yellow-flower of some Jasminum spp. contains verbascoside but are absent from the white-flowered *J. sambac*[26].

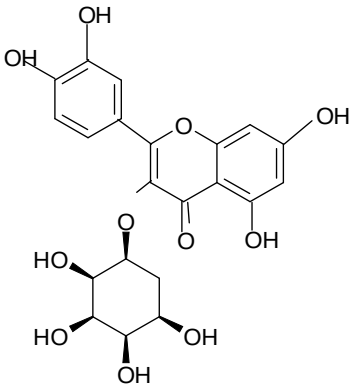
Jasmine oil: Methyl jasmonate, Jasminoside (XXXV), Jasminol (XXXVI), Jasminolactone (XXXVII) Multiforin (XXXVIII), Olueropin (XXXIX), benzyl benzoate, linalool, linalyl acetate, benzyl alcohol, indole, jasmone, methyl anthranilate, *P*-cresol (XL), geraniol (XLI), racemic (5-pent-2-enyl)-5,1-pentanolide, benzyl benzoate, nerol, 1-*á*-terpineol, *d* and *dl*-linalool, *α*-jasmolactone, farnesol, nerolidol and eugenol [(14)].



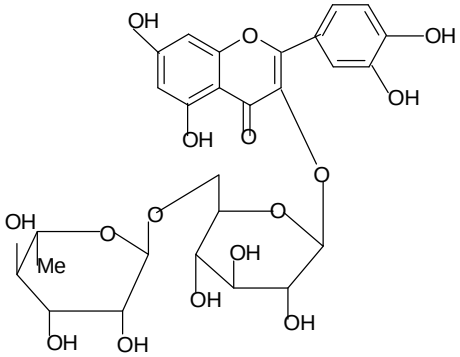
Sambacoside (I)



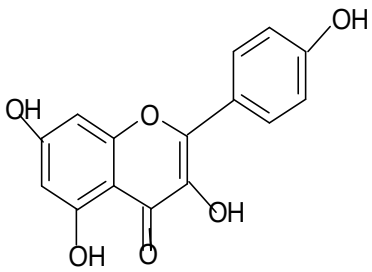
Quercitin (II)



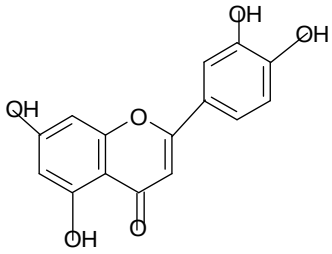
Isoquercitin (III)



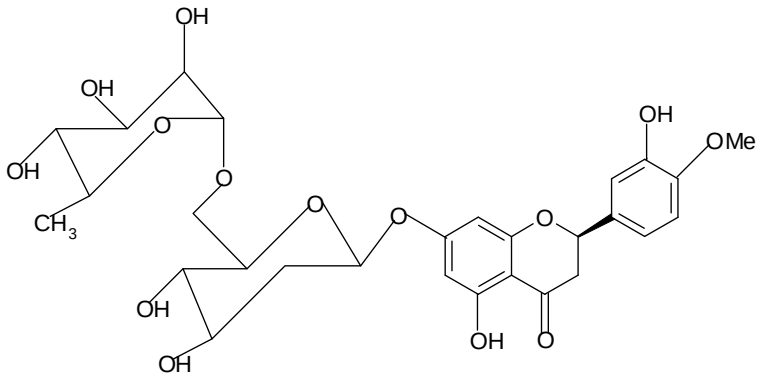
Rutin (IV)



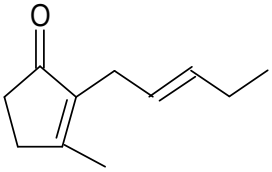
Kaempferol (V)



Luteolin (VI)

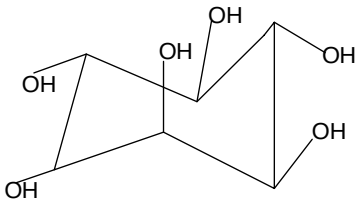


Hesperidin (VII)

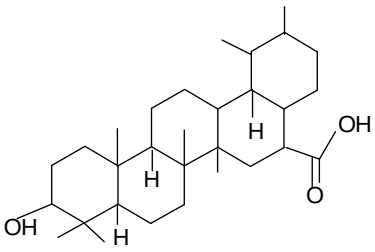


Jasminol (VIII)

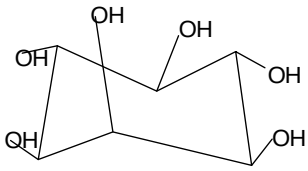
Palmtic acid (IX)



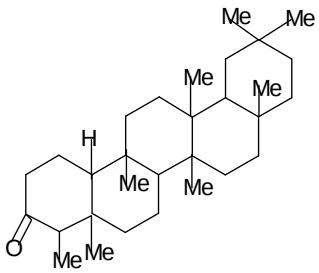
Stearic acid (X)



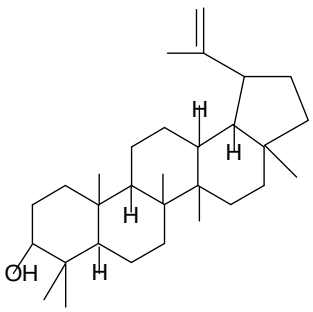
Ursolic acid (XI)



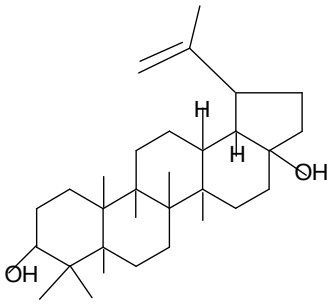
Inositol (XII)



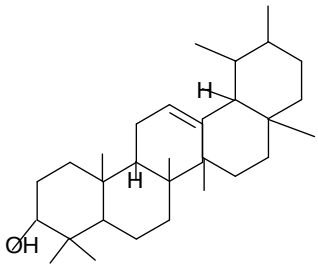
Fridelin (XIII)



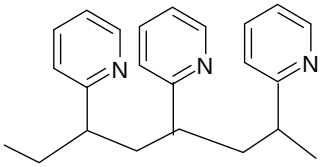
Lupeol (IVX)



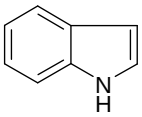
Betulin (XV)



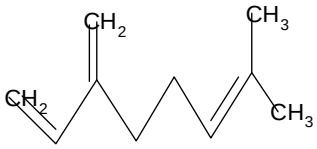
α amyrin (XVI)



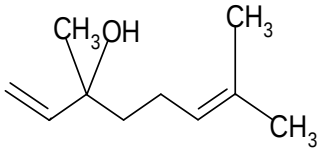
2- Vinylpyridine (XVII)



Indole (XVIII)

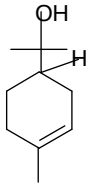


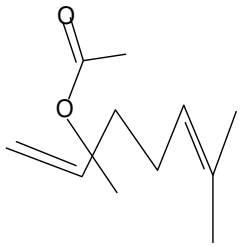
Myrcene (XIX)



Linalool (XX)

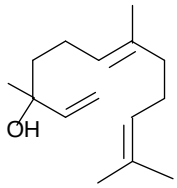
Geranyl linalool (XXI)



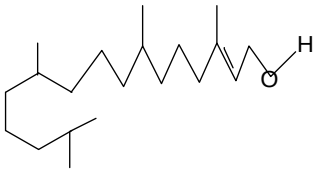


Linalyl acetate (XXIII)

α Terpenol (XXII)

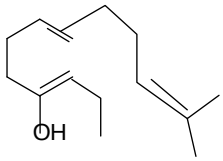


Nerolidol (XXIV)

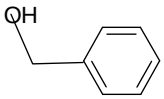


Phytol (XXV)

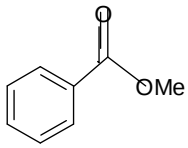
Isophytol (XXVI)



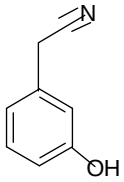
Farnesol (XXVII)



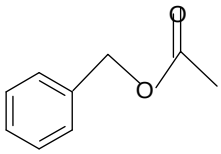
Benzyl alcohol



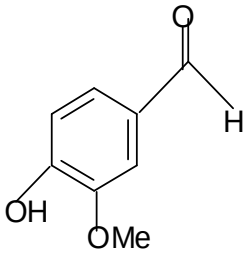
Methyl benzoate (XXIX)

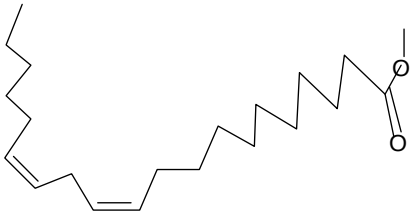


Benzyl cyanide (XXX)

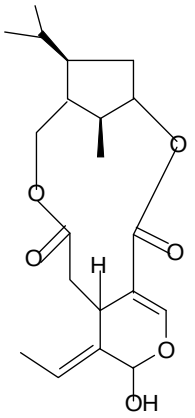


Benzyl acetate (XXXI)



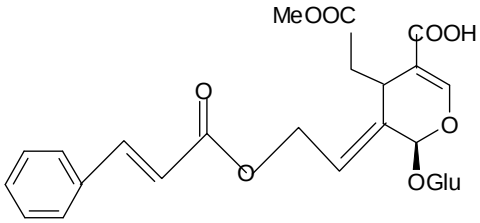


Vannilin (XXXII)

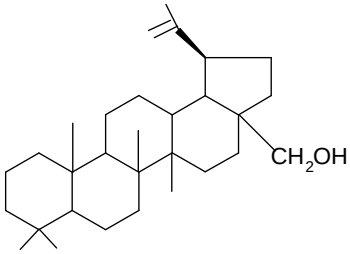


Deoxyjasmigenin (XXXIV)

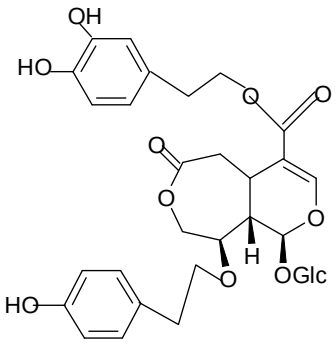
Methyl linoleate (XXXIII)



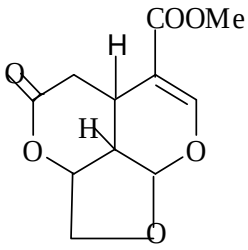
Jasminoside (XXXV)



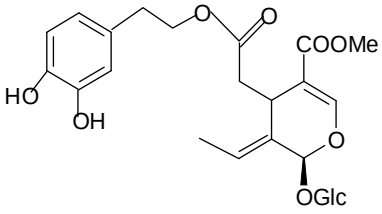
Jasminol (XXXVI)



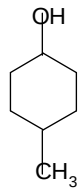
Jasminolactone (XXXVII)



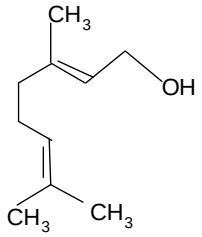
Multiforin (XXXVIII)



Oleuropein (XXXIX)



p cresol (XL)



Geraniol (XLI)

Microscopical Study

In transverse section the leaf appeared dorsiventral in nature showing three layers. It showed the presence of single layered epidermis composed of flat rectangular cells covered by thin cuticle while lower epidermis covered by thick cuticle. The uniseriate, unicellular and multicellular covering trichomes were present in the upper and lower epidermis as shown in Fig. 4[27].

Standards for identity and purity

The following standards for identity and purity are reported [27]

Quantitative Standrards

Parameters	Values
Total ash	14%
Water soluble ash	7%
Acid insoluble ash	8.5%
Alcohol soluble extractive	32%
Moisture content	6.11%
Crude fiber content	15%
Swelling index	1
Foaming index Less than	100

Analytical study:

TLC: TLC of ethanol extract of the drug on Silica gel 'G' plate using Acetic acid: Conc. HCl: Water (3:0.3:1) shows under U.V. light (366 nm) three fluorescent zones at Rf. 0.65, 0.86 and 0.9

TLC of Aqueous extract of the drug on Silica gel 'G' plate using Acetic acid: Conc. HCl: Water (3:0.3:1) shows under U.V. light (366 nm) three fluorescent zones at Rf. 0.9, 0.40 and 0.63 as shown in Fig. 5 & 6[27] .

Fig. 4: TLC (Ethanol Extract)

Fig. 5: TLC (Aqueous Extract)

Pharmacological Activities:

Antidiabetic Activity

❖ Different extracts viz. ethyl acetate and water extract of leaves of *Jasminum sambac* at a dose of 300mg/kg, p.o on blood glucose level for 21 days were evaluated in alloxan induced diabetic rats. Aqueous extract showed significant ($p<0.01$) reduction of elevated blood glucose level. Ethyl acetate extract was found to be less active as compared to aqueous extract at 300mg/kg dose level [7].

Antitumour Activity

❖ The screening of antitumour activity and antimicrobial activity against Gram +ve bacteria, Gram -ve bacteria, yeast and fungi was carried out on isopropanol extracts prepared from isolates of endophytic fungi isolated from *Jasminum sambac* (L.) Ait. in Malaysia. Sixteen endophytic fungal isolates tested were also found to exhibit antitumor activity in the yeast cell-based assay test around the disk of 6 mm or more were defined as positive for biological activity [28].

❖ Ethanol extract of *Jasminum sambac* (L.) Ait. used traditionally as anticancer agents was evaluated *in vitro* for their antiproliferative activity against Hep-2, MCF-7, and Vero cell lines. *Jasminum sambac* (L.) Ait. extract demonstrated significant antiproliferative activity against one or more of the cell lines [29].

❖ Cytotoxic activity using ethanol extract of dried leaves of *Jasminum sambac* (L.) Aiton (Family - *Oleaceae*) was evaluated. The crude ethanol extract produced the most prominent cytotoxic activity against brine shrimp Artemia salina (LD_{50} = 50 g/ml and LC_{90} = 100 g/ml). Results provide a support for the use of this plant in traditional medicine and its further investigation [30].

Antimicrobial Activity

❖ Antimicrobial activity using ethanol extract of *Jasminum sambac* (L.) Ait was tested against an array of Gram +ve, (*Staphylococcus aureus*, methicillin resistant *Staphylococcus aureus* (MRSA), *Bacillus subtilis* and *Bacillus cereus)* Gram -ve bacteria (*Escherichia coli*, *Klebsiella pneumoniae*, *Salmonella typhimurium*, *Pseudomonas aeruginosa* and *Chromobacterium violaceum*) filamentous fungi *Aspergillus niger*, *Aspergillus fumigatus*, *Candida albicans* and *Candida glabrata* and yeasts. In addition, their antipathogenic potential was checked by examining the antiquorum sensing activity of such extracts using *Chromobacterium violaceum* assays. Ethanol extracts of the callus of *J. sambac* exhibited antibacterial activity against both Gram +ve *S. aureus* and Gram -ve *S. typhi* and *P. mirabilis*. *Jasminum sambac* (flowers and leaves) extracts were very active (>15 mm inhibition zone) against Gram +ve methicillin resistant *S. aureus*, *B. subtilis*, as well as against Gram -ve *E. coli*, *S. typhimurium* and *K. pneumoniae* and fungi, including the filamentous *A. niger*, *A. fumigates*, and the yeasts *Candida albicans* and *Candida glabrata*[31].

❖ Antifungal activity using methanol extract of *Jasminum grandiflorum, Jasminum sambac* (L.) Ait was evaluated using disc diffusion method for the inhibition of fungal growth and spore formation. *Alternaria sp*. *Alternaria sp*, *Aspergillus Niger*, *A. flavus*, *A. fumigatus* and *Curvularia species* are the most prevalent fungi causing nail infection in human beings. Methanol extract of *Jasminum grandiflorum* and *Jasminum sambac* proved to be active against, *Alternaria sp*[32].

❖ Antibacterial activity using ethanol extract of *J. sambac* (L.) Ait plant was evaluated against the following 3 strains: *Proteius mirabilis*, *Staphylococcus al bus*, and *Salmonella typhii* and was found to be active against all the tested strains [33].

❖ Antimicrobial activity using ethanol extract of *Jasminum sambac* Ait. (Oleaceae) leaves, flowers, fruits and stem bark was evaluated against nine bacteria and four fungi using Agar diffusion assay and Minimum Inhibitory Concentration (MIC) determinations. Study shows that flowers

and leaves extracts of *Jasminum sambac* exhibited almost good activity (10-15mm inhibition zone) against Gram +ve bacteria including the Methicillin resistant *Staphylococcus aureus* (MRSA) and *Bacillus subtilis* while a moderate activity was recorded against Gram -ve bacteria including *Escherichia coli* and *Klebsiella pneumonia*[34].

❖ Antibacterial activity of jasmine (*Jasminum sambac* L.) flower hydro distilled essential oil, synthetic blends and six major individual components was evaluated against *Escherichia coli* (MTCC 433) strain. Study proved the antibacterial activity and mechanism of action of *jasminum sambac* natural oil and its synthetic blends against *E. coli* strain [35].

Antioxidant Activity

❖ Antioxidant activity using essential oil and methanol extract of *Jasminum sambac* (L.) Ait. leaves was evaluated by two complementary test systems, namely DPPH free radical scavenging and -carotene-linoleic acid assays. Butylated hydroxytoluene (BHT) was used as positive control in both test systems. In the β-carotene-linoleic acid system, oxidation was effectively inhibited by *Jasminum sambac* [36].

Analgesic Activity

❖ Analgesic activity using dried leaves extract of *Jasminum sambac* (L.) Aiton (Family - *Oleaceae*) was evaluated. The extract produced significant (P<0.001) writhing inhibition in acetic acid-induced writhing in mice at the oral dose of 250 and 500 mg/kg of body weight comparable to the standard drug diclofenac sodium at the dose of 25 mg/kg of body weight. The obtained results provide a support for the use of this plant in traditional medicine and its further investigation [30].

Anti-Acne Activity

❖ Antiacne activity of essential oil of jasmine (*Jasminum grandiflora* L., *Oleaceae*) was evaluated towards Propionibacterium acnes and *in vitro* toxicology against three human cancer cell lines. Result showed that cytotoxicity of essential oil on human prostate carcinoma cell (PC-3) was significantly stronger than on human lung carcinoma (A549) and human breast cancer (MCF-7) cell lines [37].

❖ Ethanol flower extract of *Jasminum sambac* (L.) Ait. was evaluated against the etiologic agents of acne vulgaris using agar well diffusion and broth dilution methods. The results from the disc diffusion method showed that ethanol extract of *Jasminum grandiflorum* could inhibit the growth of Propionibacterium [38].

Anti-herpes Simplex Viruses and Anti-adenoviruses Activity

❖ Anti-herpes simplex viruses (HSV; including HSV-1 and HSV-2) and anti-adenoviruses (ADV; including ADV-3, ADV-8 and ADV-11) activities of hot water (HW) extract of *Jasminum sambac* flowers was evaluated using XTT-based colorimetric

assay. Results showed that the tested hot water extracts exhibited anti-HSV and anti-ADV activities at different magnitudes of potency [39].

Suppression of puerperal lactation

❖ Efficacy of jasmine flowers (*Jasminum Sambac* (L.) Ait.) applied to the breasts to suppress puerperal lactation was compared with bromocriptine. Both bromocriptine and jasmine flowers brought about a significant reduction in serum prolactin, the decrease was significantly greater with bromocriptine. Jasmine flowers seem to be an effective and inexpensive method of suppressing puerperal lactation and can be used as an alternative in situations where cost and nonavailability restrict the use of bromocriptine [40].

Autonomic Nervous Stimulating Effect

❖ The effect of aromatherapy massage with jasmine oil (*Jasminum sambac* L., *Oleaceae*) on humans was investigated. Human autonomic parameters, i.e. blood pressure, pulse rate, blood oxygen saturation, breathing rate, and skin temperature, were recorded as indicators of the arousal level of the autonomic nervous system. In conclusion, our results demonstrated the stimulating/activating effect of jasmine oil and provide evidence for its use in aromatherapy for the relief of depression and uplifting mood in humans [41].

Antilipidemic Activity

❖ Anti-lipid peroxidation effect of methanol extract of *J. sambac* (L.) Ait. using the standard antioxidants Butylated hydroxytoluene (BHT), Vitamin C, Vitamin E and Rutin was evaluated. The methanol extract of the *J. sambac* (L.) Ait. flowers showed anti-lipid peroxidative effect which is similar to that of all standards. Results of this study suggests that the methanol extract of *J. sambac* (L.) Ait. can be used as therapeutic agents to treat against various diseases caused by free radicals and other chemical agents [42].

Autonomic Nervous Sedative Effect

❖ The effects of the odor of *jasmine* tea on autonomic nerve activity and mood states in a total of 24 healthy volunteers. R–R intervals and the POMS test were measured before and after inhalation of the odors for 5 min. Both jasmine tea and lavender odors at perceived similar intensity caused significant decreases in heart rate and significant increases in spectral integrated values at high-frequency component in comparison with the control ($P < 0.05$). In the POMS tests, these odors produced calm and vigorous mood states. Thus, the low intensity of jasmine tea odor has sedative effects on both autonomic nerve activity and mood states, and (R)-(–)-linalool, one of its components, can mimic these effects [43].

Antistress Activity

❖ The antistress activity of the methanol extract of *Jasminum sambac* (L.) Ait. leaves was studied against swimming stress

induced gastric ulceration in rats and swimming endurance test in mice. Antistress activity of *Jasminum sambac* Linn. leaves was compared with that of Geriforte (43mg/kg), which was used as standard. Methanol extract of *Jasminum sambac* at a dose of 100 mg/kg and 200 mg/kg p.o., exhibited good antistress effect in both the tested models [44].

Spasmolytic Activity

❖ Spasmolytic activity of *Jasmine* on guinea pig ileum (post synaptic and not atropine-like) and rat uterus was evaluated. The mechanism of action of the spasmolytic activity, studied *in vitro* using a guinea-pig ileum smooth muscle preparation, was postsynaptic and not atropine-like. The spasmolytic effect of Jasmine absolute was most likely to be mediated through cAMP, and not through cGMP. The contradictory effect *in vitro* and *in vivo* has been suggested probably due to the solely physiological effects of jasmine absolute *in vitro* (producing a relaxation) compared with that *in vivo*, where it has a strong psychological input, producing a stimulant effect in man and enhanced movement in animals [45].

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