



(REVIEW ARTICLE)



Michelia alba DC (Botany, benefits and its essential oils)

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GSC Biological and Pharmaceutical Sciences, 2023, 22(01), 365–370

Publication history: Received on 14 December 2022; revised on 27 January 2023; accepted on 30 January 2023

Article DOI: <https://doi.org/10.30574/gscbps.2023.22.1.0044>

Abstract

Michelia alba (Magnoliaceae) has been used as a source of essential oils and traditional medicine. This study aims to explain the botany, utilization, bioactivity and essential oil of *M. alba*. The research was conducted with literature studies obtained from Google Scholar using the keywords *M. alba*, *M. alba* bioactivity and *M. alba* essential oil. The results obtained are synthesized so that they are explained comprehensively about the botany, utilization, bioactivity and *M. alba* essential oil. In traditional medicine it is used to treat fever, syphilis, gonorrhoea and malaria, bronchitis, prostatitis, malaria, and cancer. The bioactivities of *M. alba* such as: anti-microbial, antioxidant, anti-cancer and skin whitening. Almost all *M. alba* organs produce essential oils, but the levels and types vary from one organ to another. The main essential oils in *M. alba* are linalool, α -terpineol, phenylethyl alcohol, β -pinene, and geraniol. *M. alba* essential oil has great potential for the pharmaceutical and beauty industry, especially as a skin whitener. The bioactivity of *M. alba* as a skin whitener is related to its activity as an inhibitor of the tyrosinase enzyme.

Keywords: *Michelia alba*; Anti-microbial; Anti-tyrosinase; Botany

1. Introduction

Michelia alba is a multi-functional plant that is easy to find in Indonesia and is known as the magnolia flower. This plant produces a strong fragrance, especially at night [1], so it is often associated with mysticism. The distinctive aroma possessed by *M. alba* is one of the characteristics used to identify it. The fresh flower of *M. alba* have been long been traded in various traditional markets, especially for ritual ceremonies [2].

M. alba is a plant native to Indonesia and has been used by indigenous Malays in Indonesia and Malaysia for medicinal purposes [3]. The potential of *M. alba* has great to be used in the prevention and treatment of disease as well as the management of human health and fitness [4]. *M. alba* is a flowering tree known for its essential oil, which has long been used as a fragrance ingredient in perfumes and cosmetics [4]. In traditional medicine it is used to treat fever, syphilis, gonorrhoea and malaria, [3,5] bronchitis, prostatitis, malaria, and cancer [5]. Bioactivity *M. alba* has tyrosinase inhibitory, antimicrobial, antidiabetic, anti-inflammatory and antioxidant activities [3].

The use of *M. alba* as a traditional medicine is related to its bioactivity and secondary metabolite content, especially essential oils [6,7,8]. The all organs of *M. alba* produce essential oils, but the types and concentrations vary. In general, floral organs produce higher levels of linalool compared to others. The compound 1,10-di-epi-cubenol is only found in stems, while borneol, copaene, selinene and ethyl 2-phenylhexanoate are only found in leaves [8]. The essential oil of *M. alba* such as: linalool, terpineol, geraniol, pinene, phenylethyl alcohol have anti-cancer, anti-inflammatory, anti-depressive, anti-ulcer, anti-hypertriglyceridemia, and anti-hypertensive activities [4]. The bark and roots contain costunolide, parthenolide, 11 α ,13-dihydroparthenolide, 9 β -hydroxy-dihydroparthenolide, (-)-bisparthenolidine, 11 α ,13-dihydro- β -cyclocostu-nolide, cadinol, and magnograndiolide [9].

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Empirically, the existence of these *M. alba* is decreasing, even though they have many benefits in the health sector and have good economic potential. This study aims to explain the botany, utilization, bioactivity and content of *M. alba* essential oils so that their utilization and conservation potential can be increased.

2. Material and methods

The method in research is library research obtained from Google Scholar using the keywords *M. alba*, *M. alba* bioactivity and *M. alba* essential oil. The results obtained are synthesized so that they are explained comprehensively about the botany, utilization, bioactivity and *M. alba* essential oil.

3. Results and discussion

3.1. Botany of *Michelia Alba* DC

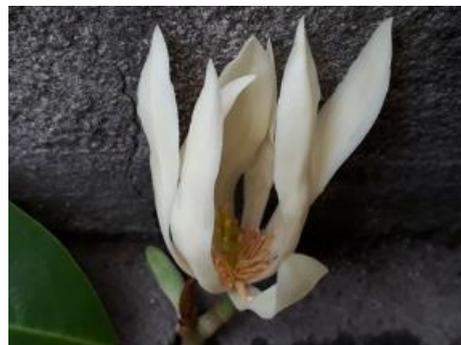
The Magnoliaceae has about 240 species, most of them (160 species) belonging the genera of *Manglietia*, *Magnolia* and *Michelia*. The *Michelia* sp. is a species used as a producer of essential oils and is the second largest genus of Magnoliaceae [10,11]. The *Michelia* is mainly distributed in tropical and subtropical Asia [11] and has about 30 species [5]. Until now, the taxonomic status of *Michelia* L. unclear, but the results of phylogenetic analysis show that *M. alba* is closely related to *M. odora* [12]. The *M. alba* is generally cultivated in tropical and sub-tropical areas such as Southeast Asia [3] (Lee et al 2014). *Michelia* × *alba*, sinonim *Michelia alba* D.C., Figlar, *Magnolia* (D.C.) Figlar × *alba*, *Magnolia champaca* × *Magnolia montana*, *Magnolia longifolia* Blume, Verh. Bat. Gen., *Magnolia longifolia* var. *racemosa* Blume, Fl. Java Magnol., *Magnolia champaca* auct. non Linne, *Sampacca* × *longifolia* (Blume) Kuntze [13].



A



B



C

Figure 1 *Michelia alba* DC. A. habitus; B. Twig with inflorescence; C. Flowers are blooming

Description: habitus of tree that produces this flower ranges from 10 to 15 meters in height and can grow up to 20 meters if cultivated in areas with high humidity. Cracks in the bark in a reticulate pattern along the stem. *M. alba* is an annual flowering plant; generally, flowers start to bloom at night, with a pervasive fragrance; the scent starts to fade in the afternoon [3]. The green leaves are elliptical to obovate-elliptic in shape, measuring 15–35 cm × 5.5–11 cm.

Coriaceous leaf blade, glabrous above, sparsely pubescent and tapering apex. Flowers produce an aromatic smell, especially after dark with a diameter of 5 cm. Tepals are white or cream in color and measure 30–55 mm. Lanceolate: 3–5.5 × 0.3–0.5 mm. The stamens are 8–10 mm long. This plant does not produce fruit and is propagated by grafting. Carpel: sterile, most abortive with little maturation, ovate to ellipsoidal, 5 mm long [4].

3.2. Uses and Bioactivities

M. alba has long been used as material for ritual ceremonies and also for traditional medicine. In traditional medicine it is used to treat fever, syphilis, gonorrhoea and malaria, [3,5] bronchitis, prostatitis, malaria, and cancer [5]. The use of *M. alba* as a traditional medicine is related to its bioactivity. In the following, the bioactivity of *M. alba* as an anti-microbial, antioxidant, anti-cancer and skin whitening will be explained further.

3.3. Anti-microbial

Pathogenic microbes cause various infections in humans. Empirically it can be seen that *M. alba* flower extract is widely used as an additional ingredient in the development of perfumes or aromatherapy related to its activity as an anti-microbial [14]. *Propionibacterium acnes* is a bacterium that causes acne [15]. Research on *M. alba* as an anti-microbial has been reported by Khairan & Septiya [16], Asaruddin et al [17], Nasution et al [14], Munira et al [15] and Songsamoe et al [18]. The bioactivity of activity as an anti-microbial can be developed as a natural preservative. The essential oil of *M. alba* extended the shelf life of brown rice by four times compared to controls treated without essential oil [18,19].

M. alba extract inhibits the growth of *Staphylococcus epidermidis* [16], *S. aureus* [6,8,14,16], *Escherichia coli* [6,8,14], *P. acnes* [15], *Trypanosoma cruzi* [17], *Xanthomonas oryzae*, *Bacillus subtilis* [7], and *Candida albicans* [8] and *Aspergillus flavus* [18]. The bioactivity of *M. alba* extracts depends on the extraction compounds, concentrations and types of microbes [14,16]. In general, the concentration of the extract is directly proportional to the diameter of the inhibition zone [14,15]. The ethyl acetate extract of *M. alba* flowers provides higher antibacterial activity compared to the methanol extract against *S. epidermidis* and *S. aureus* [16]. The methanol extract of *M. alba* flowers has a higher inhibition zone compared to the n-hexane extract on the *P. acnes* [15]. The ethanol extract from *M. alba* stem bark inhibited the growth of *T. cruzi* [17].

M. alba bioactivity as an anti-bacterial is related to essential oils [6,7,8]. The n-hexane extract of *M. alba* contains flavonoids, terpenoids, and steroids, while the ethyl acetate and methanol extracts contain alkaloids, flavonoids, terpenoids, and steroids [16]. *M. alba* bark extract has trypanocidal activity associated with the content of caryophyllene oxide, costunolide, dihydrocostunolide, parthenolide, dihydroparthenolide, 11,13-dehydrolanuginolide, santamarine and dehydrolinalool oxide [17]. The activity of inhibiting germination of spores and mycelium of *A. flavus* correlated strongly with the combination of linalool/caryophyllene [18].

3.4. Antioxidant

The leaves methanol extract of *M. alba* has antioxidant properties using the 1,1-difenil-2-pikrilhidrazil (DPPH) test. *M. alba* as a new source of more effective and more save antioxidant, cardiovascular and anticancer drugs [20]. The main component of *M. alba* is the monoterpenoid linalool (65.03%) [21]. The concentration of 2-methylbutanoic acid was predominant in the hexane extract (36.54%) and the dichloromethane extract (33.07%). The main compound in the case of ether extract, is -linalool (37.32%), the same as in *M. alba* essential oil, which has good potential from *M. alba* vapor to control mold growth on the surface of brown rice [18]. Essential oils and *M. alba* fragrant extracts have α -amylase activity in vitro and can be used to treat diabetes [21]. The michephyll A compound from *M. alba* leaves has antioxidant activity [22].

3.5. Anti-Cancer

Genera of *Michelia* has been used by indigenous peoples for the treatment of cancer and stomach tumors [5,23]. One type of cancer with a high incidence rate in Indonesia is breast cancer [23]. Natural ingredients are an alternative treatment for cancer because they have been proven empirically in treating various diseases. Molecular docking results showed that α -terpineol, geraniol, β -pinene, limonene, linalool, β -phenyl ethyl alcohol, and 1,8-cineol from *M. alba* had a lower docking score than the quercetin control. Physicochemical and pharmacokinetic analysis revealed that *M. alba* essential oil compounds had good absorption, distribution, metabolism, excretion, and toxicity profiles [23]. The bioactivity of *M. alba* as an anti-cancer is thought to be related to its essential oil content [5].

3.6. Skin Whitening

The essential oil of *M. alba* has been long used as a fragrance ingredient for perfumes and cosmetics [4]. Tyrosinase is an enzyme involved in the synthesis of the pigment melanin which colors hair, skin and eyes. The compound (-)-N-formylanonaine isolated from the leaves of *M. alba* inhibits fungal tyrosinase with an IC₅₀ of 74.3 M and has tyrosinase and melanin reducing activity in human epidermal melanocytes with no apparent cytotoxicity to human cells, superior to known tyrosinase inhibitors, such as kojic acid and 1-phenyl-2-thiourea [22].

3.7. Essential Oil of *Michelia alba* DC

Essential oil or also known as essential oil is one of the secondary metabolites of monoterpene and sesquiterpene groups that easily evaporate [24] to produce aroma. Essential oils are widely used in the pharmaceutical, beauty and food industries. *M. alba* is used as a flavor enhancer in *nam dok mai* (traditional Thai food) desserts [25].

Almost all *M. alba* organs produce essential oils, but the levels and types vary from one organ to another. Stem essential oil content is higher than leaves, especially linalool [8] and flowers are higher than leaves [26]. The concentration of linalool in various parts of the *M. alba* leaves (0.21-0.65%), flowers (1.63-4.89%) and twigs (0.43%). All *M. alba* organs contain relatively high concentrations of linalool, and juvenile phase flowers contain the highest concentrations of linalool [26]. The main types of essential oils in flowers and leaves are almost the same, namely linalool, fenchene, eugenol methyl ether, (E)-ocimene, 2,4-diisopropenyl-1-methyl-1-vinylcyclohexane, caryophyllene, germacrene D, isoeugenol methyl ether, nerolidol, α -humulene and eucalyptol [13].

The following will explain the essential oil content of each *M. alba* organ. The main volatile compound component of *M. alba* leaves is linalool and its content differs between fresh and dry leaves, especially caryophyllene, β -elemene and selinene. *M. alba* leaves contain compounds (-)-N-Formylanonaine, (-)-oliveroline, (+)-nornuciferine, lysicamine, (+)-cyperone, (+)-epi-yangambine, ficaprenol-10, pheophytin a, aristophyll C and michephyl A [22]. Linalool is the main component of the leaves while the minor components are β -caryophyllene, β -elemene, caryophyllene oxide, and nerolidol [27], (Z)- β -ocimene, (E)- β -ocimene, Cis- β -elemene, β -caryophyllene, humulene, (E)-nerolidol and caryophyllene oxide [8].

M. alba root contains ushinsunine, oxoushinsunine, salicifoline, michealbine, limonene, benzyl acetate, linalool, nerol, hydroxycitronellal, benzaldehyde, benzyl benzoate, and methyl eugenol [5] while the *M. alba* root bark contains costunolide, parthenolide, 11 α ,13-dihydroparthenolide, 9 β -hydroxy-dihydroparthenolide, (-)-bisparthenolidine, 11 α ,13-dihydro- β -cyclocostunolide, cadinol, magnograndiolide [9].

The main compounds in the stem are 1,10-di-epi-cubenol, (Z)- β -ocimene, (E)- β -ocimene, caryophyllene, (E)-nerolidol, caryophyllene oxide and epi- α -muurolol (=T-muurolol) [8]. Other ingredients of the stem are aporphine, (-)-anonain, (-)-norushinsunin, (-)-ushinsunin, (-)-N-formylanonaine, (-)-romerin, and (-)-asimilobine; two oxoaporphines, lirioidenine and oxoxylopin, (+)-syringaresinol, N-trans-feruloyltyramine 4-hydroxybenzaldehyde, p-anisaldehyd, veratraldehyde, 3,4,5-trimethoxybenzoic acid, 3,4-dimethoxybenzoic acid, eugenol, and methyl isoeugenol, ficaprenol, sitosterol and stigmasterol [28]. Bark contains hexadecanoic acid, methyl ester; 4H-tomentosine; 4H-tomentosine (compound isomer 2); 3-hydroxy pregnancy-4-ene-20-one; Tomentosine; 2-hydroxytomentosin; Tert-butyl-2-aminophenylcarbamol; 2H-cyclohepta [b] furan-2-one, 3,3a, 4,7,8,8a-hexahydro-7-methyl-3-methylene-6-(2-formyl-3-oxobutyl)-; Isoxanthanol and Xanthanol [29]. Bark costunolide, parthenolide, 11 α ,13-dihydroparthenolide, 9 β -hydroxy-dihydroparthenolide, (-)-bisparthenolidine, 11 α ,13-dihydro- β -cyclocostunolide, -cadinol, magnograndiolide [9].

M. alba flowers contain essential oils such as: linalool [1,7,30,31], 2-methyl butanoate [1,30], myrcene, (S)-limonene, (R)-fenchone, camphor, caryophyllene, germacrene D [31], cyclohexane methyl ester, 1-etenyl-1-methyl-2,4-bis (1-methylethylene) [1], terpeneol, phenylethyl alcohol, pinene, methyl 2-methylbutyrate, geraniol, 1, 8-cineole, caryophyllene, elemene, caryophyllene oxide, nerolidol [27], Michelaine, (-)-anonaine, (-)-norushinsunine, (-)-ushinsunine, (-)-N-acetylanonaine, lirioidenine, atherospermidine, (+)-syringaresinol, N-trans-feruloyltyramine, p-hydroxybenzaldehyde, vanillin, vanillic acid, syringic acid, coniferyl aldehyde, siringin, scopoletin, 4-acetonyl-3,5-dimethoxy-p-quinol, -cytostenone, and stigmasta-4,22-dien-3- [32], 3 7-dimethyl-1 6-Oktadien-3- ol myristcin 1-ethylenyl-1-methyl-2 4-bis(1-methylethylene)l-cyclohexane ethyl-2-methylbutyrate 1 2-dimethoxy-4-(2-propenyl)-Benzene Bicyclo[7.2.0]undec-4-ene 4 11 11- trimethyl-8-methylene 5-(2-ropenyl)-1 3-Benzodioxol 1 2 4a 5 6 8a-hexahydro-4 7-dimethyl-1-(1-methylethyl)-Naphthalene 3 7-dimethyl-1 3 7-octatriene and 3 7-dimethyl-1 3 6-Oktatriene [6].

The content of essential oils in flowers is influenced by their development process. *M. alba* flower essential oil at each stage varies, namely dihydrocarveol (early phase), linalool (late phase), butanoic acid-2-methyl, methyl ester and

cyclohexane, 1-etenyl-1-methyl-2,4-bis (1-methylethylene) (middle phase). The dihydrocarveol compound makes a significant contribution during the development of the buds where the buds turn yellow and start to swell until the petals are just starting to open, while linalool contributes significantly to the aroma, especially in the final phase of flower development which and during the phase, the fragrance is very strong [1].

4. Conclusion

- *Michelia alba* in traditional medicine is used to treat fever, syphilis, gonorrhoea and malaria, bronchitis, prostatitis, malaria, and cancer.
 - *Michelia alba* bioactivity includes: anti-microbial, antioxidant, anti-cancer and skin whitening.
 - The main essential oils in *Michelia alba* are linalool, α -terpineol, phenylethyl alcohol, β -pinene, and geraniol.
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Compliance with ethical standards

Acknowledgments

I express my gratitude to the Indonesian Christian University for funding this research.

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