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Phytochemistry and Therapeutic Applications of *Eucalyptus* – An Overview

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A B S T R A C T

Eucalyptus globulus, which is commonly seen, has immense potential for medicinal purposes. The blue gum, scientifically called *Eucalyptus globulus*, is a type of plant that belongs to the Myrtaceae family. It consists of abundant amounts of phytochemical constituents such as flavonoids, alkaloids, tannin, and propanoids which can be found in the leaves, stem, bark and roots of the plant. Multiple researchers have reported the existence of different attributes in these properties, including anti-inflammatory, antibacterial, antiseptic, astringent, anti-diabetic, anti-oxidative, antiviral, antitumor, antihistaminic, anticancer cytochrome p_{450} inhibitor, and hepatoprotective effects. This review article thoroughly examines different phytochemicals present in *Eucalyptus globulus*and highlights the various therapeutic uses of these compounds.

Introduction

French explorers stumbled upon *Eucalyptus globulus* on the island of Tasmania in 1972. Eucalyptus trees have a fast growth rate, and numerous varieties can reach impressive heights. Eucalyptus is a type of tree or shrub that is always green and can be quite tall (http://www.botinical.com). It belongs to the Myrtaceae family. Even though it originates from Australia and Tasmania, it has greatly expanded its distribution to various other countries. The *Eucalyptus genus* encompasses approximately 700 species, with over 300 of them having volatile oil present in their leaves. Different types of eucalyptus species produce essential oils that are utilized in the pharmaceutical, toiletries, cosmetics, and food sectors (Marzoug *et al.*, 2011). In 1843, *Eucalyptus globulus*, also known as blue gum, was brought to India for use as a source of fuel. The eucalyptus plant thrives in high-altitude areas such as Nilgiris, Annamalai and Palani hills, Himachal Pradesh, and Shilong in India.

Many different types of eucalyptus are grown in these regions, especially in sub-tropical and warm climates, due to their economic significance. In India, numerous species, approximately 100 in total,

have been experimented with at various points in time, and a few of them are currently being cultivated (Sastri *et al.,* 2002).

Eucalyptus globulus has been used by traditional communities for a long time due to its abundant medicinal properties. The plant has been documented to have strong antiseptic, astringent, deodorizing, perspiring, expectorating, inhalant, insect-repelling, redness-inducing, and pus-promoting properties (Febrer, 1995). Insects are the primary pollinators of *Eucalyptus globulus* flowers, but birds and small mammals can also play a role in pollination (Boland *et al.,* 1980).

Eucalyptus globulus has various names based on its geographic location, including "Australian Fever Tree," "Tasmania Blue Gum," "Southern Blue Gum," "Blue Gum," "Blue Gum Tree," and "Stringy Bark." In the Arabic language, the terms "ban" and "kafur" are used to refer to the same thing. In the language of Burma, it is referred to as "pyilon-chantha". The common name for *Eucalyptus globulus* is "blue gum".

The term used in the Amharic language is "nechbahirzaf" common to use contractions in casual speech and writing. Frequently referred to as "turpentine gas", the plant is also known as "Tasmanian blue gum eucalypt", "Tasmanian blue gum", "southern blue gum", "fever tree", "blue gum eucalyptus", and simply "blue gum". In the Japanese language, this is referred to as "yukari-no-ki". The term used in the Spanish language is "eucalipto". In the Swahili language, it is referred to as "mkaratusi" while in the Tigrigna language, it goes by the name of "tsaeda-kelamitos" (Orwa *et al.,* 2009).

Demography/ Distribution of *Eucalyptus globulus*

Eucalyptus globulus has the ability to thrive in diverse climates and can adapt to various environmental changes. However, it is typically observed to grow best in countries that have a warmer climate. According to the source, Eucalyptus can be commonly found in a variety of countries including Albania, Tunisia, Argentina, Bangladesh, Cambodia, Brunei, Eritrea, Greece, Ethiopia, Indonesia, Italy, Israel, Laos, Kenya, Malaysia, Myanmar, Morocco, Namibia, Nigeria, Nepal, Pakistan, Spain, Philippines, Sudan, Uganda, Tanzania, Thailand, Malta, and the United Kingdom (Mbuya *et al.,* 1994). Australia has a vast expanse of *Eucalyptus globulus* forest, covering 92 million hectares or 227 million acres. This makes up three quarters of the total area covered by native forests in the country. Similarly, it is estimated that the total extent of *Eucalyptus globulus* cultivation in India surpasses 2,500,000 hectares (Midgley *et al.,* 2003).

The *Eucalyptus glabrous*, known as the "Tasmanian Blue Gum," "Southern Blue Gum," or simply "Blue Gum," is a highly cultivated plant and has the largest cultivation area to date (Kaikini, 1961). In Australia, in the year 2006, approximately 65 percent of the total plantation hardwood consisted of an area of about 4,500 km that had been planted. *Eucalyptus globulus* is widely used as the main source of eucalyptus oil production globally. Over the past decade, *Eucalyptus globulus* has become a prominent crop in the north-western regions of Uruguay (Chingaipe, 1985). In that area, there is a potential forested land of 1,000,000 hectares, which accounts for about 29% of the entire country's territory dedicated to forestry. Out of this, around 800,000 hectares are currently covered by a monoculture of *Eucalyptus globulus.* In Brazil, there is approximately 7 million hectares of planted land that has the potential to yield up to 100 cubic meters per hectare annually.

Phytochemistry and Phytoconstituents of *Eucalyptus globulus*

The valuable chemical compounds found in *Eucalyptus globulus* are present in the essential oils extracted from its leaves, bare branches, flower buds, and mature fruits. The oils extracted from the leaves were discovered to have varying amounts of 1,8-cineole (ranging from 4.10% to 50.30%), which depended on the maturity level and the location where the leaves were collected. Additional primary

constituents found in the oils extracted from the leaves include α-pinene (0.05–17.85%), p-cymene (trace-27.22%), cryptone (0.00–17.80%), and spathulenol (0.12–17.00%). On the other hand, the fruit, bud, and branch oils have different compositions of α-thujene, 1,8-cineole, and aromadendrene. The fruit oil does not contain α-thujene, the bud oil contains 11.95% α-thujene, and the branch oil contains a trace amount of α-thujene. The fruit oil has 15.31% 1,8-cineole, the bud oil has 36.95% 1,8-cineole, and the branch oil has 56.96% 1,8-cineole. Aromadendrene is present in the highest percentage in the fruit oil at 23.33%, followed by the bud oil at 16.57%, and the branch oil at 8.24%.The medicinal eucalyptus essential oil is extracted from the fresh leaves through a process of distillation using water. It appears as a transparent or pale yellow liquid, with a distinct smell and flavour. It can easily dissolve in an equal amount of alcohol. The main component in Eucalyptus is Eucalyptol, which can be found in *E. Globulus* up to a maximum of 70% of its volume (http://plants.usda.gov/java/classification servlet).

Chemical Constituents

Chemical Constituents of the Leaves of *Eucalyptus globulus*

The chemical components found in the leaves of *Eucalyptus globulus* have been identified. The majority of the essential oil was composed of oxygenated monoterpenes, monoterpenes, and oxygenated sesquiterpenes. Among these compounds, eucalyptus accounted for 72.71%, α-terpined constituted 2.54%, terpiene-4-ol contributed 0.34%, and linalool made up 0.24% of the oxygenated monoterpenes. As for the sesquiterpenes, α-eudesmol accounted for 0.39%, (-)- globulol constituted 2.77%, and epilobulol contributed 0.44%. Some important compounds found were α-terpineol acetate (3.1%), geranyl acetate (0.71%), L-pinocarveol (0.36%), β-sabinene (0.25%), and terpinolene (0.19%). A small fraction (0.26%) of the entire components remains unknown (Song *et al.*, 2009).

Chemical Constituents in the Fruit of *Eucalyptus globulus*

A total of 15 compounds were acquired and identified as beta-sitosterol, betulinic acid, stigmasterol, euscaphic acid, 2a-hydroxybetulinic acid, macrocarpol B, macrocarpal A, oleanolic acid 3,4,3 - O- trimethylelladic acid, 3-O- methylellagic acid 4-O-(2”-O-acetyl) – alpha-L-rhamno-pyranoside, 3-O-methylellafic acid, ellagic acid, and gallic acid (Yang *et al.*, 2007).

Chemical Constituents of the Wood of *Eucalyptus globulus*

The primary compounds detected encompassed sterols, sterol esters, fatty acids, steroid ketones, hydrocarbons, and triglycerides. Additional lipid components found in *Eucalyptus globulus* include small compounds like fatty alcohol, mono- and diglycerides, waxes, and tocopherols.

Globulus wood. Sterols, sterol esters, fatty acids, steroid ketones, hydrocarbons, and triglycerides were the key substances that were discovered and identified (Gutierrez, 1999).

Therapeutic / Medicinal Applications of Eucalyptus

Eucalyptus (Myrtaceae) is used as an expectorant for symptomatic treatment of mild inflammation of the respiratory tract and bronchitis. Also for symptomatic treatment of asthma, fever and inflammation of the throat describe in pharmacopoeias and in traditional systems of medicines.

Treatment of cystitis, diabetes, gastritis, kidney, disease (unspecified), laryngitis, leucorrhoea, malaria, pimples, ringworm, wounds, ulcers, of the skin, urethritis and vaginitis uses described in folk medicines, but not supported by experimental or clinical data (Mohamed *et al.*, 2007). Eucalyptus is employed as a remedy for numerous allergic conditions (Kokate and Purohit, 1999).

Table.1 Scientific Classification (http://plants.usda.gov/java/classificationServlet)

S. No.	Kingdom	Plantae
1	Subkingdom	Tracheobionta
2	Super division	Spermatophyte
3	Division	Magnoliophyta
4	Class	Dicotyledons
5	Subclass	Rosidae
6	Order	Myrtales
7	Family	Myrtaceae
8	Genus	Eucalyptus
9	Species	Eucalyptus globulus Labill.

Table.2 Major Species of Eucalyptus (Gagan *et al.*, 2016)
There exist more than 500 types of Eucalyptus. The following are the main ones listed:

Major Species of Eucalyptus	Major Species of Eucalyptus
Eucalyptus amygdalina	*Eucalyptus microtheca*
Eucalyptus australiana	*Eucalyptus nitens*
Eucalyptus botryoides	*Eucalyptus ovate*
Eucalyptus calophylla	*Eucalyptus pauciflora*
Eucalyptus camaldulensis	*Eucalyptus perriniana*
Eucalyptus citriodora.	*Eucalyptus pilularis*
Eucalyptus cladocalyx	*Eucalyptus polyanthemos*
Eucalyptus consideniana	*Eucalyptus polybractea*
Eucalyptus cypellocarpa.	*Eucalyptus populnea*
Eucalyptus dives	*Eucalyptus radiate*
Eucalyptus gigantean	*Eucalyptus regnans*
Eucalyptus globulus	*Eucalyptus risdonni*
Eucalyptus gomphocephala	*Eucalyptus robusta*
Eucalyptus grandis	*Eucalyptus rossi*
Eucalyptus gunnii	*Eucalyptus rostrata*
Eucalyptus incrassate	*Eucalyptus saligna*
Eucalyptus kino	*Eucalyptus sideroxylon*
Eucalyptus largeflorens	*Eucalyptus sieberiana*
Eucalyptus lesouefii	*Eucalyptus smithii*
Eucalyptus macrocarpa	*Eucalyptus tereticornis*
Eucalyptus macrorhyncha	*Eucalyptus tetrodonta*
Eucalyptus maculate	*Eucalyptus umbra*
Eucalyptus marginata	*Eucalyptus urophylla*
Eucalyptus melanophloia	*Eucalyptus viminalis*
Eucalyptus melliodora	*Eucalyptus wandoo*
Eucalyptus grandis	*Eucalyptus rossi*
Eucalyptus gunnii	*Eucalyptus rostrata*

The medicinal Eucalyptus oil is likely the most potent antiseptic in its category, particularly as it ages and interacts with the air, forming ozone. It possesses a disinfectant property and is effective in eliminating microorganisms (Kumar *et al.,* 2011). Eucalyptus oil is used as a stimulant and antiseptic gargle. When applied locally, it impairs sensibility and increases cardiac action (Kumar *et al.,* 2011).

Although it cannot replace Cinchona, its antiseptic properties provide some antimalarial benefits. For some years Eucalyptus- chloroform was employed as one of the remedies in the tropics for hookworm, the presence of phytochemical constituents such as borneol, cineol, linalool, gernayl acetate, saffrol, antheol exhibited anthelmintic action of different intestinal worms (Arti *et al.,* 2012).

An emulsion made by shaking up equal parts of the oil and powdered gum-arabic with water has been used as a urethral injection, and has also been given internally in draxhum doses in pulmonary tuberculosis and other microbial diseases of the lungs and bronchitis (Nagpal *et al.,* 2010). Eucalyptus oil is administered to treat influenza. It is also used for parasitic skin infections (Nagpal *et al.,* 2010). 1, 8-cineole, major constituents present in violate oil of Eucalyptus was reported to treat inflammation in bronchial asthma and other steroid-sensitive disorders (Ikawati *et al.,* 2001).

Hexane extract of leaves, ethanol extract of fruits and leaves of *Eucalyptus globulus* inhibited IgE dependent histamine release from RBL-2H3 cells (Takasaki *et al.,* 1990). Twelve euglobals from *Eucalyptus globules* and their twenty-six related compounds were examined for their inhibitory effects on Epstein-Barr virus infection *in vitro*. The results showed the most of the euglobals having monoterpene structures had strong inhibitory activity (Zhou *et al.,* 2003). Antitumor-promoting activity of Euglobals Ia1, Ia2, Ib, Ic, IIa, IIb, IIc, III, IVa, IVb, and V and VII was tested *in vitro* on 12-O-tetradecanoylphorbol-13-acetate (TPA)-induced Epstein-Barr virus early antigen (EBV-EA) activation test system. Euglobal-III showed strong inhibitory activity, followed by euglobals Ib, IIa, Ic, Ia1, Ia2. *Eucalyptus globulus* oil inhibits the nuclear translocation of NF-kappa B induced by LPS in THP-1 cells (Vijaykumar *et al.,* 2006).

Treatment of human facial demodicidosis with freshly prepared camphor oil (*Eucalyptus globulus*) with or without glycerol dilutions gave complete cure *Eucalyptus globulus* leaf extracts and oil showed antifungal property as they progressively inhibited the growth of *Malassezia furfur* (Sato *et al.,* 1998). *Eucalytus globulus* may be useful in inhibiting dental plaque formation (Unger and Frank, 2004).

Eucalyptus oil (*Eucalyptus globulus*), is identified as inhibitor of six major cytochrome P_{450} enzymes with the IC_{50} values ranging between 20 and 1000µg/MI (Monzon *et al.,* 1994). *Eucalyptus globulus* leaves were found to be potent against *Culex quinquefasciatus* and *Culex tritaeniorhynchus* (Moreira *et al.,* 2001). Terpineol, a vital component present in the essential oil of *Eucalyptus globulus* (Eucalyptus), is widely used in folk medicine and aromatherapy. The effect of terpineol on the compound action potential (CAP) of rat sciatic nerve was studied; terpineol induced a dose-dependent blockade of the CAP (Takasaki *et al.,* 1990).

Eucalyptus globulus has been recognized for many years due to its valuable ethno medicinal and therapeutic significance. Different plant-derived phytochemicals have been widely acknowledged to possess diverse therapeutic effects.

Many different types of Eucalyptus plants have been extensively researched for their numerous therapeutic properties, including pain relief, viral and bacterial inhibition, inflammation reduction, diabetes management, antioxidant effects, tumour suppression, allergy relief, cancer prevention, and liver protection. In this current review, our aim was to gather information on Eucalyptus species, including their description, phytochemical composition, therapeutic applications, and other relevant details.

References

Arti, D., R. Ankur, S. Vijender (2012). *Eucalyptus globulus*: A New Perspective in Therapeutics. International Journal of Pharmaceutical & Chemical Sciences. 1(4):1678-1683.

Boland, D., M. Brooker, J. Turnbull, D. Kleinig, (1980). Eucalyptus seed.Division of Forest Research. In CSIRO, Canberra, Australia.

Chingaipe, T. (1985). Early growth of *Eucalyptus camaldulensis* under agroforestry conditions at Mafiga, Morogoro, Tanzania. Forest Ecology and Management. 11(4): 241-244.

Febrer, F. J. L. (1995). *Eucalyptus globules* & medicine. Med Hist.; (58):1-16.

Gagan, S., B. Jaideep, S. Varinder (2016). *Eucalyptus genus*: A Review. 10(10):609-617.

Gutierrez, A. (1999). Chemical Composition of Lipophilic Extractives from *Eucalyptus globulus* Labill. Wood Holzforschung. (53):5. https://doi.org/10.1515/HF.1999.079

Ikawati, Z., S. Wahyuono, K. Maeyama. Screening of several Indonesian medicinal plants for their inhibitory effect on histamine release from RBL-2H3 cells J Ethnopharmacol. 2001; (75):249-256. https://doi.org/10.1016/s0378-8741(01)00201-x

Kaikini, K. (1961). In *Eucalyptus in Mysore state*, Proceedings of the tenth all India silvicultural conference, Dehra Dun, 1961; 1961; pp 546-553.

Kokate, C. K and A. P. Purohit (1999). Textbook of Pharmacognosy, Nirali Prakashan. (12):267-268.

Kumar, H. D and S. Laxmidhar (2011). A Review on phytochemical and Pharmacological of *Eucalyptus globulus*: A multi-purpose tree. International Journal of Research In Ayurveda and Pharmacy. 2(5):1527-1530.

Marzoug, H. N. B., M. Romdhane, A. Lebrihi (2011). *Eucalyptus oleosa* essential oils - chemical composition and antimicrobial and antioxidant activities of the oils from different plant parts steam, leaves, flowers and fruit. 16(2):1695-1709. https://doi.org/10.3390/molecules16021695

Mbuya, L., H. Msanga, C. Ruffo, A. Birnie, B. Tengnas (1994). Useful trees and shrubs for Tanzania.SIDA (Swedish Intern. Develop. Auth.), Nairobi, Kenya, 542p.

Midgley, S. J., J. W. Turnbull, K. Pinyopusarerk (2003). Industrial Acacias in Asia: Small brother or big competitor. Eucalyptus plantations–research, management and development.19-36.

Mohamed A. G and Sabrin R. M. Ibrahim (2007). Eucalypt one G. A new phloroglucinol derivative and other constituents from *Eucalyptus globulus* Labill Arkivoc. (15):281-291. http://dx.doi.org/10.3998/ark.5550190.0008.f27

Monzon, R. B., J. P. Alvior, L. L. Luczon, A. S. Morales, F. E. Mutuc (1994). Larvicidal potential of five Philippine plants against *Aedes aegypti* (Linnaeus) and *Culex quinquefasciatus* (Say). Southeast Asian J Trop. Med. Public Health. (25):755-759.

Moreira, M. R., G. M. P. Cruz, M. S. Lopes, A. A. C. Albuquerque, J. H. Leal-Cardoso (2001). Effects of terpineol on the compound action potential of the rat sciatic nerve. Brazilian Journal of Medical & Biological Research.(34):1337-1340. https://doi.org/10.1590/s0100-879x2001001000015

Nagpal, N., G. Shah G, M. N. Arora, R. Shri and Y. Arya (2010). Phytochemical & Pharmacoogical Asects of *Eucalyptus genus*, International Journal of Pharmaceutical & Research. 1(12):28-36. http://dx.doi.org/10.13040/IJPSR.0975-8232

Orwa, C., A. Mutua, R. Kindt, R. Jamnadass, A. Simons (2009). Agroforestree database: a tree species reference and selection guide version 4.0. World Agroforestry Centre ICRAF, Nairobi, Kenya.

Sastri, B. N (2002). The Wealth of India - A Dictionary of India Raw materials &

Industrial Products. Raw materials, Council of Scientific & Industrial Research, New Delhi. (5):203-204.

Sato. S., N. Yoshinuma, K. Ito, T. Tokumoto, T. Takiguchi, Y. Suzuk (1998). The inhibitory effect of funoran & eucalyptus extract-containing chewing gum on plaque formation. J Oral Sci. (40):115-157. https://doi.org/10.2334/josnusd.40.115

Song, A., *et al.*, (2009). Study on the chemical constituents of the essential oil of the leaves of *Eucalyptus globulus* Labill from China, Asian Journal of Traditional Medicines; 4(4).

Takasaki, M, T. Konoshima, K. Fujitani, S. Yoshida, H. Nishimura, H. Tokuda (1990). Inhibitors of skin-tumor promotion. VIII. Inhibitory effects of euglobals & their related compounds on Epstein-Barr virus activation. Chem. Pharm Bull. (38):2737-2739. https://doi.org/10.1248/cpb.38.2737

Unger, M. and A. Frank (2004). Simultaneous determination of the inhibitory potency of herbal extracts on the activity of six major cytochrome P450 enzymes using liquid chromatography/mass spectrometry and automated outline extraction. Rapid.Commun.Mass. Spectrom. 2004; (18):2273-2281. https://doi.org/10.1002/rcm.1621

Vijaykumar. R., C. Muthukumar, T. Kumar, R. Saravanamuthu (2006). Characterization of *Malassezia furfur* and its control by using plant extracts. Indian J Dermatol. (51):145-148. https://doi.org/10.4103/0019-5154.26942

Yang, X., Q. Mei, Y.Gua (2007). Studies on chemical constituents in fruits of *Eucalyptus globulus*.China journal of Chinese material medica. 32(6):496-500.

Zhou, J. Y., F. D. Tang, G. G. Mao, J. Shao, Y. Wang, R. L. Bian (2003). Effect of *Eucalyptus globulus* oil on activation of nuclear factor-kappa B in THP-1 cells. https://doi.org/10.3785/j.issn.1008-9292.2003.04.011

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