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A review on therapeutics application of eucalyptus oil

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Abstract

Eucalyptus globulus a widely observed plant has a tremendous latent in term of medicinal uses. *Eucalyptus globulosa* plant from family Myrtaceae, commonly known as blue gum grow well in Nilgiris, Annamalai, Palani and Shimla hills. It rich sources of phytochemical constituents which contain flavonoids, alkaloids, tannin and propanoids. Which are present in leaf, stem, and root of the plant. They are various properties like anti-inflammatory, antibacterial, antiseptic, astringent, anti-diabetic, anti-oxidative, antiviral, antitumor, antihistaminic, anticancer cytochrome p450 inhibitor and hepatoprotective effect have also been reported by many researcher. The present review article critically discusses about various phytochemical associated with the plant along with numerous therapeutics application exhibited by the plant.

Keywords: Eucalyptus, phytochemical, therapeutics application

1. Introduction

Eucalyptus globulus was discovered in island of Tasmania in 1972 by French explorers. Eucalyptus tree are quick growers and many species reach height ^[1]. Eucalyptus is an evergreen, tall tree, or shrub, belonging to Myrtaceae family. Although it is native to Australia and Tasmania, it has extensively spread to other countries. The genus eucalyptus contains about 700 species; among them, more than 300 contains volatile oil in their leaves. Essential oils of various eucalyptus species are used in the pharmaceutical, toiletries, cosmetics and food industries ^[2]. *Eucalyptus globulus* commonly known as blue gum was introduced into India as a fuel tree in 1843. The plant grows well in Nilgiris (5,000-8,300 Ft.) the Annamalai and palni hills in the Himachal Pradesh and Shilong, in the of India ^[3]. Various species of eucalyptus are cultivated, particularly in sub-tropical and warm temperature regions, on a account of their economic value. About 100 species have been tried in India at different time and some of them are under cultivation ^[4]. *Eucalyptus globulus* has a long history of folk usage because of its rich medicinal values. The plant has been reported to possess potent antiseptic, astringent, deodorant, diaphoretic, expectorant, inhalant, insect repellent, rubefacient and suppurative properties ^[5, 6].

1.1. Scientific Classification ^[7].

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Dicotyledons
Subclass	Rosidae
Order	Myrtales
Family	Myrtaceae
Genus	Eucalyptus
Species	<i>Eucalyptus globulus</i> Labill.

1.2 Major Species [8].

There are over 500 species of Eucalyptus. The major ones are enlisted below.

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

1.3 Vernacular Names

It has many Indian names, depending on the geographical region or the language, for example: *Eucalyptus globulus* (Latin name), Tail Parn, Sugandh Patra (Sanskrit name), Gum Tree, Gum Eucalypt (English), Neelgir (Hindi), Nilgiri (Kannad), Harit Parn (Gujrati).

1.4 Description

The leaves are leathery in texture, hang diagonally or vertically, and are studded with glands contain a fragrant

volatile oil. The flower in bud are closed with a cup-like covering (hence the name of the genus, derived from the Greek eucalyptus well-covered), which is unnerved off as a lid while the flower expand. The fruit is bounded by a woody, cup shaped container and contains abundant minute seeds.

1.4.1 Part used widely: The oil of the leaves.

1.4.2 Habitat: Australia, North and South Africa, India and southern Europe.

1.5. Morphological Characters

The flower in bud are covered with a cup-like member (hence the name of the genus, derived from the Greek eucalyptus well covered), which is thrown off as a lid when the flower expands. The fruit is surrounded by a woody, cup shaped receptacle and contains numerous minutes' seeds. The first leaves are broad, without stalks, of a shining whitish-green and are opposite and horizontal, but after four or five years these are succeeded by other of a more sword-shaped form, 6 to 12 inches long, bluish-green in hue, which are alternate and vertical i.e. with the edges turned towards the sky and earth, and arrangement more suited to the climate and productive of peculiar of light and shade. The flower are single or in cluster, almost stalkless.

An adult eucalyptus may take the form of a low shrub or a very large tree. There are three main behaviors that species can divide into.

1. Woodland trees are single-stemmed even have a crown from a minor amount of the whole tree height.
2. Woodland trees are singled-stemmed even though they may branch at a small space above ground level.
3. Mallees are multi-stemmed from position level, usually less than 10m (33ft) in height.

Tree sizes follow the convention of:

- Small – to 10m (33ft) in height
- Medium-sized – 10-30 m (33-98ft)
- Tall – 30-60m (98-197 ft.)
- Very tall – over 60m (200ft) [9].



Fig 1: Flower of (*E.G*) [10].



Fig 2: fruit of (*E.G*) [11].



Fig 3: Whole tree of (*E.G*) [12].



Fig 4: Rainbow (*E.G*) [13].

2. Phytoconstituents

The essential oil of eucalyptus used in medicine is obtained by aqueous distillation of the fresh leaves. It is colorless or straw-colored fluid when properly prepared, with a characteristic odour and taste, soluble in its own weight of alcohol. The important constituents is Eucalyptol, present in *E. globulus* up to 70% of its volume [7].

3. Chemical Constituents

3.1. Chemical Constituents of the Leaves of *Eucalyptus Globulus*

The essential oil consisted mainly of oxygenated monoterpenes, monoterpenes and oxygenated sesquiterpenes. Of these, 1, 8-eucalyptus (72.71%) α -terpinene (2.54%), terpine-4-ol (0.34%), and linalool (0.24%) were the main oxygenated monoterpenes, while α -eudesmol (0.39%), (-)-globulol (2.77%), and epilobulol (0.44%) were the main sesquiterpene. Several significant compounds were α -terpineol acetate (3.1%), geranyl acetate (0.71%), L-pinocarveol (0.36%), β -sabinene (0.25%), and terpinolene (0.19%). A portion (0.26%) of the total constituents remains unidentified [14].

3.2. Chemical Constituents in the Fruit of *Eucalyptus Globulus*

Fifteen compounds were obtained and identified as beta-sitosterol, betulinic acid, stigmasterol, euscaphic acid, 2-hydroxybetulinic acid, macrocarpol B, macrocarpal A, oleanolic acid 3,4,3 -O- trimethylellagic acid, 3-O-methylellagic acid 4-O-(2''-O-acetyl) - alpha-L-rhamnopyranoside, 3-O-methylellagic acid, ellagic acid and gallic acid [15].

3.3. Chemical Constituents of the Wood of *Eucalyptus Globulus*

The main compound identified included sterols, sterol esters, fatty acid, steroid ketones, hydrocarbon and triglycerides. Minor compound such as fatty alcohol, mono- and diglycerides, waxes and tocopherols were also identified among the lipids from *E. globulus* wood. Sterols, sterol esters, fatty acids, steroid ketones, hydrocarbon and triglycerides were the major compound identified [16].

4. Steam Distillation Process of Eucalyptus Oil [17].

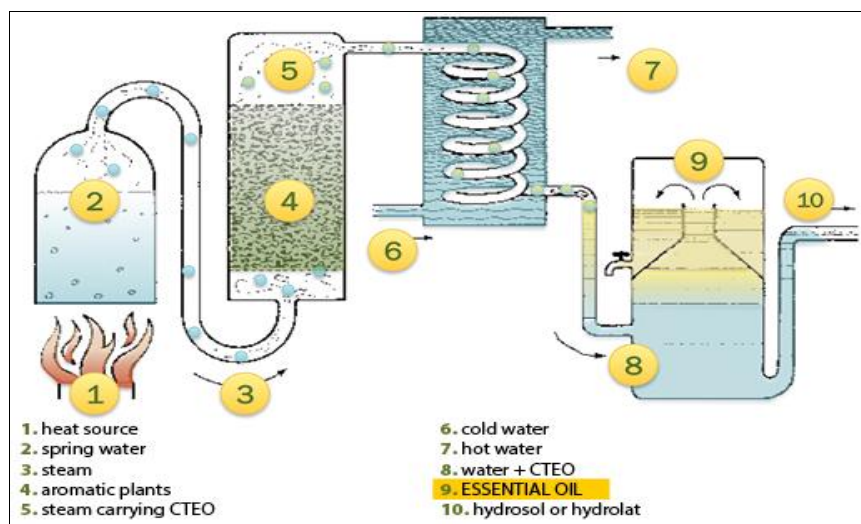


Fig 5: Steam distillation extraction Process

5. Therapeutics Application

Eucalyptus (Myrtaceae) is one of the world most importance and most widely planted genera. In Australia, this genus is the second largest genus, after *Acacia*, and contains about 750 species. UAs 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 [18].

5.1. Air Freshners

Most of eucalyptus oils are in aroma lamps, electric room diffusers, and spray mists. To make a simple mist spray, Dilute 50 to 100 drops or so of essential oils in 4 fluid ounce (120ml) of pure water. Spray to refresh and cleanse the air [19].

5.2. Allergy

Eucalyptus is used in many of allergies [19].

- **Bronchitis:** A nagging cough that lingers and causes difficulty in breathing is often symptomatic of bronchitis.
- **Congestion:** Congestion in the airways, lungs, sinus and chest makes breathing difficult and being sick even more miserable.
- **Sinus:** The cold that linger may not be just a cold. The congestion and headache may be signs of a sinus infection.
- **Asthma:** Eucalyptus has been shown to help ease breathing in asthma.

5.3. Antiseptic

The medicinal Eucalyptus oil is probably the most powerful antiseptic of its class, especially when it is old, as ozone is formed in it exposure to the air. It has decided disinfectant action, destroying the lower form of life [20].

5.4. Stimulant

Eucalyptus oil is used as a stimulant and antiseptic gargle. Locally applied, it impairs sensibility. It increase cardiac action [20].

5.6. Antimalarial

Its antiseptic confer some antimalarial action, though it cannot take place of Cinchona [21].

5.7. Anthelmintic action

For some years Eucalyptus- chloroform was employed as one of the remedies in the tropics for hookworm, Due the presence of phyto chemical constituents such as borneol, cineol, linalool, gernayl acetate, saffrol, antheol due to which it exhibit anthelmintic action of different intestinal worms [21].

5.8. UTI and RTI Infection

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 microbic diseases of the lungs and bronchitis [22].

5.9. Spasmodic action

In croup spasmodic throat troubles, the oil may be freely applied externally [22].

5.10. Irritant action and parasitic Infection

In large doses, it acts as an irritant to the kidneys, by which it is largely excreted, and as a marked nervous depressant ultimately respiration by its action on the medullary center. In veterinary practice. Eucalyptus oil is administered to hores in influenza, to dogs in distemper, to all animals in septicemia. It is also used for parasitic skin affections [22].

5.11. Anti-inflammatory

1, 8-cineole, major constituents present in violate oil of Eucalyptus airway inflammation in bronchial asthma and other steroid-sensitive disorders [23].

5.12. Antihistaminic

Hexane extract of leaves, ethanol extract of fruits & leaves of *Eucalyptus globulus* inhibited IgE dependent histamine release from RBL-2H3 cells [24].

5.13. Antiviral

Twelve euglobals from *Eucalyptus globules* & their twenty-six related compounds were examined for their inhibitory effects on Epstein-Barr virus activation by a short term *in vitro* assay. The results showed the most of the euglobals having monoterpene structures, & euglobal-III had strong inhibitory activity. Grandinol, homograndinols showed stronger inhibitory effects [25].

5.14. Antitumor

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 [26].

5.15. Antifungal

Treatment of human facial demodicidosis with freshly prepared camphor oil (*Eucalyptus globulus*) with or without glycerol dilutions gave complete cure with concentrations of 100%, 75%, and 50%. *Eucalyptus globulus* leaf extracts and oil showed antifungal property as they progressively inhibited the growth of *Malassezia furfur* on Sabouraud's destrose agar medium [27].

5.16. Antiplaque

Eucalytus globulus may be useful in inhibiting dental plaque formation [28].

5.17. Cytochrome p450 enzymes inhibitor

Eucalyptus oil (*Eucalyptus globulus*), is identified as inhibitor of six major cytochrome P450 enzyme with IC (50) values between 20 and 1000µg/MI [29].

5.18. Larvicidal

Eucalyptus globulus leaves were found to be potent against *Culex quinquefasciatus* and *Culex tritaeniorhynchus* (larvicidal activity) [30].

5.19. Nerve Blocker

Terpineol, volatile terpenoid alcohol of low toxicity, is widely used in the perfumery industry. It is an important chemical constituent of the essential oil of many plants with widespread applications in folk medicines and in aromatherapy. Terpineol, a relatively non-toxic, volatile monoterpene alcohol, is a measure component of the essential oil of *Eucalyptus globulus* (Eucalyptus), which is widely used in folk medicine and aromatherapy. The effects of terpineol on the compound action potential (CAP) of rat sciatic nerve was studied terpineol induced a dose-dependent blockade of the CAP [31].

5.20. Antiviral

Euglobal –G1, –G2 and –G3 strongly inhibited the Epstein-Barr virus activation. Euglobal –G1 –G5 isolated from leaves of *Eucalyptus grandis* exhibited significant inhibitory effects on Epstein-Barr virus (EBV) activation induced by the tumor promoter, 12-O-tetradecanoylphorbol-13-acetate (TPA) [32].

5.21. Antibacterial

A 50% EtOH extract of *Eucalyptus globulus* leaves yielded eight phloroglucinol-sesquiterpene-coupled constituents, including three novel compounds named macrocarpals, H, I and J. Some of these compounds possessed anti-bacterial activity against oral pathogenic microorganism with MIC values ranging from 0.20µg/ml to 6.25µg/ml. A 50% EtOH-soluble materials was extracted from the dried leaves of *E. globulus*. The extract showed appreciable antibacterial activity against *S. Mutans* Ingbritt & *P. gingivalis* ATCC 33277 (causes dental caries & periodontal disorders) using the broth dilution method (MICs were 12.5 & 6.25µg/mL, respectively) [33].

5.22. Antidiabetic

Eucalyptus globulus is used as traditional treatment for diabetes. In this study, incorporation of *Eucalyptus* in the diet (62.5g/kg) & drinking water (2.5g/L) reduced the hyperglycemia & associated weight loss of streptozotocin-treated mice. An aqueous extract of *Eucalyptus* (AEE) (0.5g/L) enhanced 2-deoxy-glucose transport by 50%, glucose oxidation by 60% & incorporation of glucose into glycogen by 90% in mouse abdominal muscle. In acute, 20 min incubations, 0.25-0.5g AEE/L evoked a stepwise 70-160% enhancement of insulin secretion from the clonal pancreatic beta-cell line (BRIN-BD11). These data indicate that *Eucalyptus globulus* represents an effective antihyperglycemic dietary adjunct for the treatment of diabetes and a potential source for discovery of new orally active agent for future therapy [34].

5.23. Anticancer

Phloroglucinol-monoterpene derivative, euglobal-G1 (EG-1), was obtained from the leaves of *Eucalyptus grandis* as an active constituent inhibited the promotion stages on two-stage carcinogenesis induced by both TPA-type & non TPA-type promoter (fumonisin B 1) and inhibited the pulmonary tumorigenesis induced by 4-NQO & glycerol. Therefore, EG-1 might be valuable as a chemo protective agent in chemical carcinogenesis [35].

5.24. Intestinal Fructose Absorption Inhibition

Eucalyptus globulus leaf extract inhibits intestinal fructose absorption, & suppresses adiposity due to dietary sucrose in rats [36].

5.25. Anti-Hyperglycemic

Eucalyptus tereticornis exhibited anti-hyperglycemic activities when fed simultaneously with glucose [37].

5.26. Hepatoprotective

Ursolic acid isolated from the leaves of *Eucalyptus* hybrid *E. tereticornis* showed a dose dependent (5-20 mg/kg) hepatoprotective activity (21-100%) in rats against thioacetamide, galactosamine and carbon tetrachloride induced hepatotoxicity in rats [38].

5.27. Myorelaxant

Essential oil of *Eucalyptus tereticornis* produces myorelaxant effects on guinea-pig isolated trachea, an effect that seems to

results from a complex interaction between its monoterpene constituents [39].

6. Conclusion

Eucalyptus globulus has been known since decades because of its rich ethnomedicinal and therapeutic importance. Various phytochemical isolated from the plant has been well accepted to possess various therapeutics effects. A variety of *Eucalyptus* species have also been widely studied for their various therapeutics activities, like Analgesic, Antiviral, Anti-Inflammatory, Antibacterial, Antidiabetic, Antioxidative, Antitumor, Antihistaminic, Anticancer, and hepatoprotective properties. In present review, we have made an attempt to congregate the description, phytochemical, therapeutics application and information on *Eucalyptus* species.

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