A review on therapeutics application of eucalyptus oil

Vipin Kesharwani, Shashank Gupta, Nikhil Kushwaha, Roohi Kesharwani and Dilip KM Patel

Abstract
Eucalyptus globulus a widely observed plant has a tremendous latent in term of medicinal uses. Eucalyptus globulus 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 leaves, steam, and root of the plant. They are various properties like anti-inflammatory, antibacterial, antiseptic, astringent, anti-diabetic, antioxidant, 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].

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae</th>
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<tbody>
<tr>
<td>Subkingdom</td>
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<td>Super division</td>
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<td>Myrtaceae</td>
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<td>Genus</td>
<td>Eucalyptus</td>
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<tr>
<td>Species</td>
<td><em>Eucalyptus globulus</em> Labill.</td>
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1.2 Major Species

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

<table>
<thead>
<tr>
<th>Major Species of Eucalyptus</th>
<th>Major Species of Eucalyptus</th>
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<tbody>
<tr>
<td>Eucalyptus amygdalina</td>
<td>Eucalyptus microtheca</td>
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<td>Eucalyptus australiana</td>
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<td>Eucalyptus boydiioides</td>
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<td>Eucalyptus gigantean</td>
<td>Eucalyptus regnans</td>
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<td>Eucalyptus globulus</td>
<td>Eucalyptus risdonni</td>
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<td>Eucalyptus gomphocephala</td>
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<td>Eucalyptus grandis</td>
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<td>Eucalyptus sideroxylon</td>
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<td>Eucalyptus largeflorens</td>
<td>Eucalyptus sieberiana</td>
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<td>Eucalyptus smithii</td>
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<td>Eucalyptus macrocarpa</td>
<td>Eucalyptus tereticornis</td>
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<td>Eucalyptus macrorhyncha</td>
<td>Eucalyptus tetrodonta</td>
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<td>Eucalyptus maculata</td>
<td>Eucalyptus umbra</td>
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<td>Eucalyptus marginata</td>
<td>Eucalyptus urophylla</td>
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<tr>
<td>Eucalyptus melanophloia</td>
<td>Eucalyptus virurnalis</td>
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<tr>
<td>Eucalyptus meliodora</td>
<td>Eucalyptus wandoo</td>
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</table>

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 eukalyptos 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 covere with a cup-like member (hence the name of the genus, derived from the Greek eukalyptos 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 whitis-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 single-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)

[Fig 1: Flower of (E.G)]
[Fig 2: fruit of (E.G)]
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-eucalyptol (72.71%), α-terpinene (2.54%), terpinene-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, euscapheic acid, 2α-hydroxybutelinic acid, macrocarbol B, macrocarpal A, oleanolic acid 3,4,3′-O-trimethyllelladic acid, 3-O-methyllellagic acid 4-O-(2″-O-acetyl) – alpha-L-rhamnopyranoside, 3-O-methyllellagic 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 digiyecerides, 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].

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 Fresheners
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 sings 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, geranyl acetate, saffrol, antheol due to which it exhibit anthelmintic action of different intestinal worms [21].

5.8. UTI and RTI Infection
An emulation 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 [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 monoterpeno structures, & euglobal-III had strong inhibitory activity. Grandinol, homograndinolos showed stronger inhibitory effects [25].

5.14. Antitumor
Antitumor-promoting activity of Euglobals Ia1, Ia2, Ib, Ic, Ila, 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, Ila, Ic, Ial, 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
*Eucalyptus 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/Ml [29].

5.18. Larvicidal
*Eucalyptus globulus* leaves were found to be potent against *Culex quinquefasciatus* and *Culex tritaeniorynchus* (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 monoterpenoid 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 Ingbrit & 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-treates 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
Phlorogucinol-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 carcino genesis 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 Eucalypt 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 monoterprenoid constituents [39].

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

7. Acknowledgment
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8. References
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