

Eucalyptus globulus: A New Perspective in Therapeutics

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ABSTRACT

The medicinal plants play a crucial role in world health and that is why they have been regarded as one of the primarily used agents since ages for the treatment and prevention of a number of diseases. *Eucalyptus globulus*, a plant from family myrtaceae, commonly known as blue gum, grows well in Nilgiris, Annamalai, Palni and Simla hills. *Eucalyptus globulus* is a rich source of phytochemical constituents which contain flavonoids, alkaloids, tannins and propanoids, which are present in the leaf, stem and root of the plant. Numerous studies have shown that *Eucalyptus globulus* exhibit various properties like anti-inflammatory, anticancer, antibacterial, antiseptic and astringent. The present review articles critically discusses about various phytochemicals associated with the plant alongwith numerous pharmacological properties exhibited by the plant.

Keywords: Herbal drugs, *Eucalyptus globulus*, Pharmacological.

INTRODUCTION

Medicinal plants and their products are in great demands and have gained wide importance in recent decades.¹ However, thorough and fractionate knowledge about the herbal drugs is mandatory in order to identify and select the appropriate plant for treating a specific disease.¹⁻² *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 south to Simla hills (4,000-7,000 ft.) in Himachal Pradesh and Shilong, in the east of India.³ Other places which have been considered suitable for its cultivation are Raniket, Kangra, Kullu and Chamba. *Eucalyptus globulus* is a large tree attaining height of 300 ft. or more, with clean straight bole under forest condition, but often tending to branch freely when grown in open.⁴ Leaves on juvenile shoot opposite, sessile, cordate-ovate, covered with bluish white bloom; adult leaves alteranate, lanceolate, 6-12 in long and 1-2 in broad. Stem of seedlings and coppice shoots appears quadrangular.³⁻⁴ Numerous phytochemicals have been found to be associated with the plant which include 1,8-cineole, α -gurjunene, globulol, β -

pinene, pipertone, borneol, bornylacetate, camphene, caproic acid, citral, eudesmol, fenchone, p-menthane, myrecene, myrtenol, α -terpineol, verbinone, asparagine, cysteine, glycine, and ornithine.⁵⁻⁶ *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.⁷⁻⁹ The present review article aims to discuss about the various phytochemicals present and pleiotropic pharmacological properties possessed by the plant.

Description of Plant

Eucalyptus globulus belongs to kingdom plantae, order myrtales, family myrtaceae, genus eucalyptus and species E. globulus with binomial name *Eucalyptus globulus* Labill. In addition, the plant possesses various vernacular names, i.e., Eucalyptus in bengali; blue-gum eucalyptus in english; eucalyptus in hindi; taliparna Sanskrit; and karpuramaram in tamil. Further, *Eucalyptus globulus* is an evergreen tree, 40-70 m tall with straight massive trunk 0.6-2 m in diameter with narrow, irregular crown of large branches and drooping

aromatic, camphoraceous foliage.¹⁰⁻¹¹ The roots appears to be deep and spreading with bark smoothish, mottled gray, brown, and greenish or bluish, peeling in long strips, becoming gray at base, rough and shaggy, thick, and finely furrowed; with inner bark light yellow within thin green layer. Moreover, the leaves are alternate, drooping on flattened yellowish petioles 1.5-4 cm long, narrowly lanceolate, 10-30 cm long, 2.5-5 cm wide, mostly curved, acuminate at tip, acute at base, entire, glabrous, thick, leathery, with fine straight veins and vein inside marlin, shiny dark green on both surfaces.¹²⁻¹³ Furthermore, the flowers (rarely 2-3), at leaf base, more than 5 cm across, the very numerous, white stamens 12 mm long. The buds appear top-shaped, 12-15 mm long, and 12-25 mm wide. Stamens are many, threadlike, white, anthers oblong opening in broad slits with round gland; pistil with inferior 3-5-celled ovary and long stout style. The capsules are single at leaf base, broadly top-shaped or rounded, 1-1.5 cm long, 2-2.5 cm wide, 4-angled, warty. The seeds are many, irregularly elliptical, 2-3 mm long, and dull black.³ The plant is mainly cultivated in Annamalai, Simla, Shillong, Raniket, Kangra, Kullu and Chamba. However, it is unsuitable for cultivation at altitudes below 4,000 ft. or at altitudes where heavy snowfall occurs.^{3,12}

Reported phytoconstituents

Wide-ranging studies on *Eucalyptus globulus* have been achieved which report the isolation of various phytoconstituents from the plant. The leaves and shoots of the plant have been reported to possess various volatile constituents like aromadendrene, γ -cadienene, 1,8-cineole, α -gurjunene, globulol, linalool oxide, eremophilene, β -pinene, pipertone, α -, β - and γ -terpinen-4-ol, and alloaromadendrene.⁵ Moreover, borneol, bornylacetate, camphene, caproic acid, citral, eudesmol, fenchone, isoamylalcohol, *p*-menthane, myrecene, myrtenol, trans-pinocarveol, sabinene, α -terpineol, α - and β -thujone, thymol, trans-verbinol, verbinone, asparagine, cysteine, glycine, glutamic acid, norvaline, ornithine, theonine have been found in fruits of the

plant.⁵⁻⁶ In addition, the flowers and honey of the plant have been noted to yield forming acid, dextrin and sucrose, whereas, eucalyptol is obtained from buds. Further, leaves have been known to yield carvone, caryophyllene, cinnamic acid, citral, citronellal, cuminaldehyde, eudesmyl acetate, γ -elemene, geranyl acetate, epi-globulol, S-guaiazulene ledol, d-myrtanal, α -pinene, cis-pinocarveol, α -pinocarvone, β -selinene, viridifloral, homoserine, chrysanthemine, chrysin, cyanin, cynaidin, delphindin, keracyanin, lycoricyanin, malvidin, peonin, peonidin, 8-demethylsideroxylin, hyperoside, quercetol, quercetin, rutin, caffeic, ferulic, gallic, gentisic and protocatechic acids.¹⁴⁻¹⁵

Moreover, constituent like *n*-tritriacontan-16,18-dione, a novel type of antioxidant, has been obtained from leaf-wax, bark and wood. Additionally, ellagitannin, 8-methoxy ellagic acid-2-rhamnoside, *p*-hydroxybenzaldehyde, phloroglucin derivatives, syringaldehyde, vanillin have been reported from the wood of the plant. Further, the lower boiling alcohols, aldehydes, ketones and acids, phenols have also been reported to be isolated from the plant. An usual hetroxylan composed of galactosyl, 4-O-methyl-glucuronosyl and xylosyl residues with molar ratio 1:3:30 have been isolated from the wood of *Eucalyptus globulus*.¹⁶ Also, four ellagic acid rhamnopyrosides were isolated from the stem bark which are, 3-O-methyl ellagic acid 3'-O- α -rhamnopyranoside; 3-O-nethylellagic acid 3'-O-3'-O-acetyl rhamnopyrosides; 3-O-nethylellagic acid 3'-O-2-O-acetyl rhamnopyrosides; and 3-O-methylellagic acid 3'-O-4'-O-acetyl rhamnopyrosides.¹⁷⁻¹⁸ Moreover, three triterpenoids have been isolated from the plant that includes methyl cis-*p*-methoxy cinnamoyl oxyoleanolate; methyl cis-*p*-methoxy cinnamoyl urosolate; and methyl 11 α -methoxy-3-acetoxyursolate [19]. A new steroidal lactone of withanolides A series has been isolated from the supercritical fluid extract of bark, which include (+)-6 α ,7 α -epoxy-5 α -hydroxy-1-oxo-2,24-dienolide as a major component and structurally similar steroidal lactone as the minor one.²⁰ Furthermore, cypellocarpin C; eucalyptone; and

heteroxylan have been isolated from the fruits of the plant.²¹⁻²³ The leaf wax has been noted to contain 4-hydroxytritricontan-16,18 di-one and 16-hydroxy-18-tritricontanone.²⁴ Moreover, a new group of compounds from the leaves, buds and calyces possessing wide range of biological activities have been isolated by Japanese researchers. The compounds have been isolated from the leaves and buds which are formulated as phloroglucinol based derivatives with an attached terpene moiety (a monoterpene or sesquiterpene), flavanoids and tannins. Besides, the plant has been reported to possess natural antioxidants that have also been isolated from the leaves of the plant, which include 1,8 oleanolic and masinic acid.^{3,25}

Pharmacological properties exhibited by plant

Tremendous amounts of works on *Eucalyptus globulus* reported it to possess diverse pharmacological and medicinal properties due to the presence of various phytoconstituents and volatile components. Various properties exhibited by the plant include antiperiodic, antiphlogistic, antiseptic, astringent, deodorant, anthelmintic, diaphoretic, expectorant, inhalant, insect repellent, rubefacient, sedative yet stimulant, suppurative, and vermifuge.²⁶⁻²⁸ In addition, the blue-gum eucalyptus is a folk remedy for abscess, arthritis, asthma, boils, bronchitis, burns, cancer, cold, cough, diabetes, diphtheria, dysentery, dyspepsia, fever, inflammation, malaria, miasma, sorethroat, spasms, tuberculosis, tumors, vaginitis, wounds, and worms.²⁹⁻³¹ The eucalyptus oil has been widely accepted as an antiseptic, the evidence of which has been established *in vitro* on many germs. Moreover, eucalyptus oil (0.05-0.2mL/day) has been reported to possess potent expectorant and mucolytic properties, which stimulates the bronchial epithelium. Like menthol, eucalyptus oil is believed to decongest the upper respiratory tract in case of common cold; the action being the stimulation of receptors normally stimulated by the incoming nasal air flow. However, at high doses, eucalyptus oil has been reported to

behave like a neurotoxic (LD=1.7Ml/Kg.rat.IP) agent. Moreover, the hydroalcoholic leaf extract of the plant showed potent antibacterial activity, particularly against cariogenic bacteria in the mouth.³²⁻³³ Further, the phloroglucin derivative isolated from leaves showed anti-inflammatory activity which was evidenced by the fact that when compared with indomethacin, the derivative showed better anti-inflammatory activity. Also, the oral administration of *Eucalyptus globulus* extract has been noted to reduce the alloxan-induced oxidative stresses, accounting for its antioxidant effects.³⁴

Despite the absence of clinical trials to demonstrate the indisputable therapeutical interest of eucalyptus oil, the product is the chief ingredient of many proprietary drugs because of its potent antiseptic and decongestant activity.³⁵ Hence, the dosage forms like syrups, lozenges, nasal drops, and inhalations have been proposed to treat the symptoms of ordinary respiratory disorders. Moreover, phytopharmaceuticals on eucalyptus leaves have been traditionally used to treat acute benign bronchial disease, and to relieve nasal congestion in the common cold.¹⁰ Furthermore, *Eucalyptus* has also been used for treating catarrh of upper respiratory and bronchitis. In addition, the tannin isolated from the plant has been shown to exert potent astringent effect on the inflamed mucous membranes of the throat, that further account for its therapeutic potential.^{32,36}

Other than possessing pharmacological properties, handsome ornamental shades have been reported to be owned by the plant. Moreover, the timber is used for carpentry, construction, fences, piles, platforms, plywood, poles, sheds, and tool handles. The essential oil from *Eucalyptus globulus* has been widely used in cough drops, antiseptic, rubefacient, and stimulant.^{30,37} Also, *Eucalyptus* hybrid 'Mysore' is a promising source of pinenes, which is used in synthetic camphor, pine oil, terpeneol, solvents, and cheap deodorants.³⁸ Further, the leaves of the plant have been shown to exhibit potent antibiotic activity, whose decoction is used for repelling insects and vermin.³⁰ The worldwide use of *Eucalyptus globulus* has

been evident by the fact that Africans use finely powdered bark as an insect dust, whereas Mexicans chew the leaves to strengthen the gums, and Portuguese bee farmers like to raise their bees near this eucalyptus.³⁹⁻⁴⁰

CONCLUSION

Eucalyptus globulus has been known since decades because of its rich ethnomedicinal and therapeutic importance. Various phytochemicals isolated from the plant has been well accepted to possess various pharmacological effects. The pleiotropic effects exhibited by the plant support the fact that the plant may be extensively used for the treatment and prevention of a number of pathological conditions. However, future studies are demanded to completely investigate other prime effects possessed by the plant in order to be named as a beneficial herbal supplement.

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