



Eucalyptus Genus: A Review

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ABSTRACT

Eucalyptus is a diverse genus of flowering trees (and a few shrubs) in the myrtle family, Myrtaceae. This review article is presented to compile all the updated information on its phytochemical and pharmacological Activities of *Eucalyptus* species which were performed by widely different methods. Literature indicates various *Eucalyptus* Species possesses analgesic, antifungal, antiinflammatory, antibacterial, antidiabetic, antioxidative properties. Literature also indicates various other effect of *Eucalyptus* species such as Antiviral, Antitumour, antihistaminic, anticancer cytochrome p450 inhibitor and hepatoprotective effect have also been reported by many Researcher. The present review articles critically discusses some *Eucalyptus* Species and about their Chemical constituents and Biological activities. This review indicate that *Eucalyptus* species have potential therapeutic effects.

KEY WORDS: *Eucalyptus*, Phytochemical, Pharmacological activities.

INTRODUCTION

A large genus of evergreen aromatic tress, rarely shrubs (mallees), indiginous to Australia, Tasmania, New Guinea and the neighbouring islands, where they constitute a large portion of the forest vegetation, giving it a characteristic appearance. Various species of *Eucalyptus* are cultivated, particularly in sub-tropical and warm temperate regions, on account of their economic value. About 100 species have been tried in India at different times and some of them are under cultivation¹.

Eucalyptus species (Family- Myrtaceae) are remarkable for their rapid growth and some of them, in their natural habitat, attain gigantic sizes and are among the tallest trees of the World. Most of the species are popularly called **GUM TREES** in Australia, although the exudation from them is not a gum, but an astringent, tanniferous substance called **KINO**.

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MAJOR SPECIES

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

Major Species of <i>Eucalyptus</i>	Major Species of <i>Eucalyptus</i>
<i>Eucalyptus amygdalina</i>	<i>Eucalyptus microtheca</i>
<i>Eucalyptus australiana</i>	<i>Eucalyptus nitens</i>
<i>Eucalyptus botryoides</i>	<i>Eucalyptus ovata</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 cladoalyx</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 gigantea</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 gunnii</i>	<i>Eucalyptus rostrata</i>
<i>Eucalyptus incrassate</i>	<i>Eucalyptus saligna</i>
<i>Eucalyptus kino</i>	<i>Eucalyptus sideroxylon</i>
<i>Eucalyptus largiflorens</i>	<i>Eucalyptus sieberiana</i>
<i>Eucalyptus lesouefii</i>	<i>Eucalyptus smithii</i>
<i>Eucalyptus macrocarpa</i>	<i>Eucalyptus tereticomis</i>
<i>Eucalyptus macrorhyncha</i>	<i>Eucalyptus tetradonta</i>
<i>Eucalyptus maculata</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>

TAXONOMIC CLASSIFICATION	
Kingdom	Plantae- Plants
Subkingdom	Tracheobionata-Vascular plants
Suuperdivision	Spermatophyta-Seed plants
Division	Magnolipphyta- Flowering plants
Class	Magnolipside- Dicotyledons
Subclass	Rosidae
Order	Myrtales
Family	Myrtaceae-Myrtle family
Genus	<i>Eucalyptus</i>

Chemical and biological investigations on *Eucalyptus* species.

Eucalyptus albens



Chemical constituents

Sideroxylonal C, a new phloroglucinol dimer, was isolated from the flowers of *Eucalyptus albens* through bioassay-guided fractionation.

Biological activity

Sideroxylonal C inhibited human plasminogen activator inhibitor type-1 at 4.7 microM without any significant effect on human tissue plasminogen activator ².

Eucalyptus amplifolia



Chemical constituents

Euglobal-Am-2, -IVb and -VII (acylphloroglucinol-monoterpenes) were isolated from this species.

Biological activity

Euglobal-Am-2 isolated from leaves of *Eucalyptus amplifolia* exhibited significant inhibitory effects on Epstein-Barr virus (EBV) activation induced by the tumor promoter, 12-O-tetradecanoyl phorbol-13-acetate (TPA)³.

Eucalyptus camaldulensis



Chemical constituents

Essential oil (Aromandendrene Myrtenal, Borneol, Camphene, Carvacrol Citronellal Citronellyl acetate, Cryptone- α -Terpenyl acetate)⁴. Flavonoids (Apigenin, Chrysin, Flavone, Luteolin, Eriodictyol, Hesperetin, Naringenin, Pinocembrin)⁵. Triterpenoids (Oleanolic Acid, Maslinic Acid, Camaldulic Acid, Camaldulenic Acid)⁶⁻¹⁰.

Biological activity

Antimicrobial

Eucalyptus camaldulensis, the bark had the antimicrobial property. Bark extract of *Eucalyptus camaldulensis*, showed inhibition zones of comparable magnitude with those of the standard antimicrobial agents. Therefore, the use of chewing sticks from these plants will be more beneficial if the bark is not peeled off, otherwise the antimicrobial property of the bark will not be fully exploited¹¹.

Anti-Nociceptive

Eucalyptus camaldulensis, possesses an anti-nociceptive effect against both acetic acid-induced writhing and hot plate-induced thermal stimulation¹².

Antioxidative

The extracts obtained by ethanol digestion and by supercritical fluid extraction (SFE; CO₂ with 15% ethanol) of leaves from *Eucalyptus camaldulensis* var. *brevirostris* trees showed the most promising antioxidative activities. Gallic and ellagic acid were found to be the prevailing antioxidants in the ethanolic extract. The main two compounds of the SFE extract with antioxidative activity revealed to be flavones. To a high degree of probability they were identified as 5-hydroxy-7,4'-dimethoxy flavone and 5-hydroxy-7,4'-dimethoxy-8-methyl flavone, respectively¹³.

Cytotoxic

Extracts obtained from *Eucalyptus camaldulensis* cytotoxic activity against human ECV-304 cells¹⁴.

Eucalyptus citriodora



Chemical constituents

Essential oil (Cineole, Citronellal, Citronellic Acid)¹⁵. Sterols (9 β -Sitosterol)¹⁶

Biological activity

Analgesic

Using acetic acid-induced writhes in mice and hot plate thermal stimulation in rats, it was shown that the essential oil of *Eucalyptus citriodora* induced analgesic effects in both models, suggesting peripheral and central actions.

Antifungal activity

The antibiotic effect of the active ingredients in Meijer medicated chest rub (*Eucalyptus* oil, camphor and menthol) as well as the inactive

ingredients (thymol, oil of turpentine, oil of nutmeg and oil of cedar leaf) were studied *in vitro* using the fungal pathogens responsible for onychomycosis, such as the dermatophytes *Trichophyton rubrum*, *Trichophyton mentagrophytes*, *Microsporum canis*, *Epidermophyton floccosum* and *Epidermophyton stockdale*. The zones of inhibition data revealed that camphor menthol thymol. and oil of *Eucalyptus citriodora* were the most efficacious components against the test organisms. The MIC (100) for mixtures of these four components in various carrier solvents revealed that formulations consisting of 5 mg/mL concentrations of each have a potential to be effective in controlling onychomycosis¹⁷. The volatile oil extracted from the leaves of *Eucalyptus citriodora* showed a wide spectrum of antifungal activity.

Anti-inflammatory

Essential oil from the *Eucalyptus citriodora* produced anti-inflammatory effects, as demonstrated by inhibition of rat paw edema induced by carrageenan and dextran, neutrophil migration into rat peritoneal cavities induced by carrageenan, and vascular permeability induced by carrageenan and histamine.

Bone Resorption Inhibition

Eucalyptus essential oil and monoterpenes are efficient inhibitors of bone resorption in the rat¹⁸.

Natural repellent

Ixodes ricinus can transmit several microorganisms, out of which *Borrelia burgdorferi* and tick-borne encephalitis (TBE) virus are the most important pathogens in humans. A lemon *Eucalyptus* extract (Citriodiol) has been shown to be a natural repellent against mosquitoes, stable flies, and midges¹⁹.

Eucalyptus cladocalyx



Chemical constituents

A formylated triterpene named cladocalol has been isolated from the leaves of *Eucalyptus cladocalyx*, together with ursulolactone acetate, ursolic acid, 3-beta-acetate-12, 20(29)-lupadien-28-oic acid, beta-sitosterol and the known flavonoid eucalyptine²⁰.

Biological activity

Cladocalol and its derivatives induce cytotoxic effect on the myeloid leukemia cell line HL-60.

Eucalyptus cypellocarpa



Chemical constituents

Three new phenol glycosides acylated with (+) -oleuropeic acid,

cypellocarpins A, B, and C, along with seven known compounds, were isolated from the dried leaves of *Eucalyptus cypellocarpa*. Three new acylated flavonol glycosides, cypellogins A, B and C, along with eight known phenolic compounds, were isolated from the dried leaves of *Eucalyptus cypellocarpa*²¹.

Biological activity

Above mentioned new compounds and a known related glucoside (chromene glucoside) showed potent *in vitro* antitumor-promoting activity in a short-term bioassay evaluating the inhibitory effect on Epstein-Barr virus early antigen activation induced by 12-O-tetradecanoyl phorbol 13-acetate (TPA). These compounds also suppressed an *in vivo* two-stage carcinogenesis induced with nitric oxide and TPA on mouse skin²².



Eucalyptus globules

Chemical constituents

Essential oil (1,8-Cineole, Carvone, Citral, Citronellal, Geranyl acetate, α -Pinene, α -Pinocarvone, β -Pinene)²³⁻²⁵. Hydrocarbons (4-Hydroxytrtriacontane-16,18-dione, 16-Hydroxy Btrtriacontanonen -Tritriacontane 16,18-dione)²⁶.

Biological activity

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 antibacterial activity against oral pathogenic microorganisms with MIC values ranging from 0.20 micrograms/mL to 6.25 micrograms/mL. A 50% EtOH-soluble material was extracted from the dried leaves of *E. globulus*. The extract showed appreciable antibacterial activity against *S. mutans* Ingbritt and *P. gingivalis* ATCC 33277 (causes dental caries and periodontal disorders) using the broth dilution method (MICs were 12.5 and 6.25 μ g/mL, respectively)²⁷.

Dried residue of methalonic extract of *Eucalyptus globulus* leaves show antimicrobial activity against *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Candida albicans* with minimum inhibitory concentration of 5.0, 10.0, 10.0, 1.25 mg/ml respectively²⁸.

Phloroglucinol-sesquiterpene coupled compounds, macrocarpals H, I, and J showed potent antibacterial activity and inhibitory effect of glucosyltransferase²⁹.

Ethanol extract of *Eucalyptus globulus* was active against the isolates inhibiting the growth of 59.5% isolates, out of 489 isolates of *Staphylococcus aureus*. All of these extracts were active against the reference strains of *Staphylococcus aureus* tested. *Saturia hortensis* L., *Teucrium polium* L³⁰.

Most concentrations of the extracts of the *Eucalyptus* showed a high antibacterial activity against *Pseudomonas aeruginosa*, and showed significant differences between susceptibility of *Pseudomonas aeruginosa* isolated from each tetracycline covered burn and non-tetracycline covered burn. Effects of some plant extracts and antibiotics on *Pseudomonas aeruginosa* isolated from various burn cases³¹.

Methanol-dichloromethane extract of *Eucalyptus globulus*, significantly inhibited the growth of six Gram-positive bacteria (*Staphylococcus aureus*, MRSA, *Bacillus cereus*, *Enterococcus faecalis*, *Alicyclobacillus acidoterrestris*, *Propionibacterium acnes*), and of a fungus (*Trichophyton mentagrophytes*). Cariogenic bacteria and periodontopathic bacteria are present in dental plaque as biofilms. Periodontopathic bacterial strains tested were killed completely by exposure for 30 s to 0.2% *Eucalyptus* oil. *Eucalyptus* oil tested inhibited the adhesion of *S. mutans*³².

The antibacterial activity of *Eucalyptus globulus* leaf extract was determined for 56 isolates of *Staphylococcus aureus*, 25 isolates of *Streptococcus pyogenes*, 12 isolates of *Streptococcus pneumoniae* and seven isolates of *Haemophilus influenzae* obtained from 200 clinical specimens of patients with respiratory tract disorders³³.

Antidiabetic

Eucalyptus globulus (*Eucalyptus*) is used as a traditional treatment for diabetes. In this study, incorporation of *Eucalyptus* in the diet (62.5 g/kg) and drinking water (2.5 g/L) reduced the hyperglycemia and associated weight loss of streptozotocin-treated mice. An aqueous extract of *Eucalyptus* (AEE) (0.5 g/L) enhanced 2-deoxyglucose transport by 50%, glucose oxidation by 60% and incorporation of glucose into glycogen by 90% in mouse abdominal muscle. In acute, 20 min incubations, 0.25-0.5 g 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(s) for future therapy³⁴.

Antiplatelet

Eucalyptus globulus may be useful in inhibiting dental plaque formation³⁵.

Antitumor

Antitumor-promoting activity of Euglobals Ia₁, Ia₂, Ib, Ic, IIa, IIb, IIc, III, IVa, IVb, and V and VIII 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, Ia2³⁶. *Eucalyptus globulus* oil inhibits the nuclear translocation of NF-kappaB induced by LPS in THP-1 cells³⁷.

Antiviral

Twelve euglobals from *Eucalyptus globulus* and 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 that most of the euglobals having monoterpene structures, and euglobal-III had strong inhibitory activity. Grandinol, homograndinols showed stronger inhibitory effects³⁸.

Eucalyptus oil showed antiviral activity against herpes simplex virus (herpes simplex virus-1 and -2). IC₅₀ of *Eucalyptus* oil was determined at 0.009% and 0.008% for HSV-1 and HSV-2, respectively³⁹.

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%⁴⁰. *Eucalyptus globulus* leaf extracts and oil showed antifungal property as they progressively inhibited the growth of *Malassezia furfur* on Sabouraud's destrose agar medium⁴¹.

Antihistaminic

Hexane extract of leaves, ethanol extract of fruits and leaves of *Eucalyptus globulus* inhibited IgE dependent histamine release from RBL-2H3 cells⁴².

Anti-inflammatory

1,8-cineole, major constituent present in volatile oil of *Eucalyptus globulus* is a strong inhibitor of cytokines, that might be suitable for long term treatment of airway inflammation in bronchial asthma and other steroid-sensitive disorders⁴³.

Using acetic acid-induced writhes in mice and hot plate thermal stimulation in rats, it was shown that the essential oil of *Eucalyptus globulus* induced analgesic effects in both models, suggesting peripheral and central actions. In addition, essential oil extracts from the *Eucalyptus globulus* produced anti-inflammatory effects, as demonstrated by inhibition of rat paw edema induced by carrageenan and dextran, neutrophil migration into rat peritoneal cavities induced

by carrageenan, and vascular permeability induced by carrageenan and histamine⁴⁴.

E. globulus oil has the anti-inflammatory effect on chronic bronchitis induced by lipopolysaccharide in rats and the inhibition effect on hypersecretion of airway mucins⁴⁵.

E. globulus extracts significantly inhibited the enhanced production of NO induced by LPS and IFN-gamma in a dose-dependent manner. It is well known that nitric oxide (NO) plays an important role in the pathogenesis of inflammatory diseases. *Eucalyptus globulus* Labill. have been used in traditional medicine in the treatment of bronchitis, asthma and other respiratory diseases⁴⁶.

Cutaneous application of *Eucalyptus globulus* essential oil, to mice suppressed the cellular inflammation induced by curdlan dose-dependently, as monitored by the MPO (myeloperoxidase) activity of peritoneal cavity and skin. This suggests that essential oils using in aromatherapy massage may suppresses the inflammatory symptoms related with neutrophil accumulation and edema. Cutaneous application of essential oils, can suppress the inflammatory symptoms with neutrophil accumulation and edema⁴⁷.

Antimalarial

Eucalyptus globulus is popularly used anti-malarial plants in Brazil⁴⁸.

Antioxidant

The methanol extracts of *Eucalyptus globulus* Labill showed efficiency in preventing the oxidation process.

Cytochrome p450 enzymes inhibitor

Eucalyptus oil (*Eucalyptus globulus*), is identified as inhibitor of the six major cytochrome P450 enzymes with IC(50) values between 20 and 1000 µg/MI⁴⁹.

Intestinal Fructose Absorption Inhibition

Eucalyptus globulus leaf extract inhibits intestinal fructose absorption, and suppresses adiposity due to dietary sucrose in rats⁵⁰.

Larvicidal

Eucalyptus globulus leaves were found to be potent against *Culex quinquefasciatus* and *Culex tritaeniorhynchus* (larvicidal activity)⁵¹.

Nerve Blocker

Terpineol, a 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 medicine and in aromatherapy. Terpineol, a relatively nontoxic, volatile

monoterpenoid alcohol, is a major 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 were studied. Terpineol induced a dose-dependent blockade of the CAP⁵².

Eucalyptus grandis

Chemical constituents

Volatile oil from *E. grandis* contains following cyclic ketones Flavesone, Leptospermone, Isoleptospermone, grandinol⁵³.

Five new euglobals possessing the phloroglucinol-monoterpene structure, euglobals G8-G12, together with a known euglobal-IIc were isolated from the hexane fraction of the methanol extract of the leaves of *Eucalyptus grandis*. Euglobal-G8 is an adduct of formyl-isovaleroyl-phloroglucinol and gamma-terpinene whereas -G9, -G10 and -G11 have the same phloroglucinol moiety fused with alpha-terpinene, while Euglobal-G12 has terpinolene fused with the same phloroglucinol moiety⁵⁴.

Percentage composition of the volatile oil is α -pinene-44.7%, camphene-0.8%, β -pinene-30.5%, limonene-5.6%, β -phellandrene-0.2%, 1,8-cineole-2.7%, γ -terpinene-0.3%, terpinolene-0.8%, α -fenchyl alcohol-0.6%, terpinen-4-ol-0.9%, α -terpineol-5.4%, allo-arom.

Biological activity

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 and non TPA-type promoter (fumonisin B 1) and inhibited the pulmonary tumorigenesis induced by 4-NQO and glycerol. Therefore, EG-1 might be valuable as a chemoprotective agent in chemical carcinogenesis.

Antiviral

Euglobal -G1, -G2, and -G3 strongly inhibited the Epstein-Barr virus activation⁵⁵. 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).

Eucalyptus macrocarpa

Chemical constituents

Six novel phloroglucinol dialdehyde diterpene derivatives (macrocarpals B-G), which have antibacterial activity, were isolated from leaves of *Eucalyptus macrocarpa*⁵⁶.



Biological activity

Four phloroglucinol derivatives, macrocarpals A, B, D, and G have been isolated from *Eucalyptus macrocarpa* and their inhibitory activity against porcine lens ALR2 (Aldose reductase) reported⁵⁷.

Eucalyptus occidentalis



Chemical constituents

A new flavonoid, 6,8-di-C-methylkaempferol 3,4'-dimethyl ether and three known compounds, 6,8-di-C-methylkaempferol 3-methyl ether, oleanolic acid, and 2 α ,3 β dihydroxyurs-12-en-28-oic acid, from aerial parts of *Eucalyptus occidentalis* collected in Algeria.

Biological activity

Flavonoids 6,8-di-C-methylkaempferol 3,4'-dimethyl ether and 6,8-di-C-methylkaempferol 3-methyl ether were used to study their biological activities on the human promyelocytic leukemia cell line, HL-60. Data showed that these compounds induce morphological changes and internucleosomal DNA fragmentation characteristic of apoptotic cell death, which is mediated by caspase-8/caspase-3 activation and cytochrome *c* release⁵⁸.

Eucalyptus radiata



Chemical constituents

The major component of the essential oil of *Eucalyptus radiata* Sieber ex DC. is 1,8-cineole (74.2%) followed by alpha-terpineol (11.6%) and limonene (4.5%)⁵⁹.

Biological activity

Volatile oil was found to be effective against 20 species of *Listeria monocytogenes*⁶⁰.

Eucalyptus robusta



Chemical constituents

Two new compounds, robustadiol A and B, isolated from the active fraction of the antimalarial extract of *Eucalyptus robusta* leaves⁶¹.

Biological activity

Decoction of the leaves and bark is used to treat fever and to wash skin diseases⁶².

The leaves of *Eucalyptus robusta* are used in China for the treatment of dysentery, malaria and bacterial diseases⁶³.

Eucalyptus viminalis



Chemical constituents

Terpenoid phenolaldehyde present in the leaves of *Eucalyptus viminalis* are euvimal-1, euvimal-2⁶⁴.

Biological activity

Antibacterial

Methanol-Dichloromethane extract of *Eucalyptus viminalis* leaves significantly inhibited the growth of six Gram-positive bacteria (*Staphylococcus aureus*, MRSA, *Bacillus cereus*, *Enterococcus faecalis*, *Alicyclobacillus acidoterrestris*, *Propionibacterium acnes*), and of a fungus (*Trichophyton mentagrophytes*), but they did not show strong antibacterial activity against Gram-negative bacteria (*Escherichia coli*, *Pseudomonas putida*).

Eucalyptus tereticornis



Chemical constituents

Essential oil (1,8-Cineole, Camphene, Carvone, Citral, Citronellal, Geranyl acetate, Limonene, Linalool oxide). Phloroglucinol monoterpene derivatives (Euglobal-T1, Euglobal IIc)⁶⁵. Triterpene esters (Tereticornate A and B)⁶⁶

Biological activity

Anti-Hyperglycemic

Eucalyptus tereticornis exhibited anti-hyperglycemic activities when fed simultaneously with glucose⁶⁷.

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 rats⁶⁸. Ursolic acid is the active material isolated from the leaves of the *Eucalyptus* hybrid *E. tereticornis*. It has shown a significant preventive effect in vitro against ethanol-induced toxicity in isolated rat hepatocytes.

Myorelaxant

Essential Oil of *Eucalyptus tereticornis* produces myorelaxant effects on guinea-pig isolated trachea, an effect that seems to result from a complex interaction between its monoterpene constituents⁶⁹.

CONCLUSION

The extensive survey of literature revealed that *Eucalyptus* species is an important source of many pharmacologically and medicinally important chemicals, such as Essential oils, terpenoids which have been used in aromatherapy. Various *Eucalyptus* species have also been widely studied for their various pharmacological activities like analgesic, antifungal, anti-inflammatory, antibacterial, antidiabetic, antioxidative properties. Various other effects of *Eucalyptus* species such as Antiviral, Antitumour, antihistaminic, anticancer cytochrome p450

inhibitor, hepatoprotective effect have also been studied. Although the results from this review are quite promising for the use of various eucalyptus species containing essential oils which are used in aromatherapy. The chemical components of essential oils, such as ketones, aldehydes, and esters, determine the specific effects of the essential oils. Essential oils may be administered by inhalation, bathing, or massage to decrease anxiety, pain, fatigue, and improve wound healing. Although aromatherapy is pleasant, inexpensive, and has little side effects (except for rare allergies), there is little evidence that it is effective in patients undergoing medical interventions.

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