



Received: 15th May-2012

Revised: 17th May-2012

Accepted: 21st May-2012

Research article

IN VITRO ASSESSMENT OF ANTIMICROBIAL ACTIVITY OF THE SELECTED ESSENTIAL OILS

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ABSTRACT : The present study evaluates the antimicrobial activity of three essential oils of *Eucalyptus globulus*, *Eugenia caryophyllata* and *Psoralea corylifolia*. The agar well diffusion method was used to assess the antimicrobial activity against five selected microorganisms *S. aureus* and *B. subtilis* (Gram-positive bacteria); *E. coli* and *P. aeruginosa* (Gram-negative bacteria) and *P. chrysogenum* (Fungus). The results revealed that the *E. globulus* was found to be most significant in comparison to the other oils. All the three oils have revealed higher antimicrobial activity against *S. aureus*.

Key Words: *Eucalyptus globulus*, *Eugenia caryophyllata*, *Psoralea corylifolia*, Antimicrobial activity, Agar-well diffusion method.

INTRODUCTION

Plants are the richest resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs (Hammer et al., 1999). The use of plants and plant products as medicines could be traced as far back as the beginning of human civilization. About 1500 plants are systematically used in indigenous system of medicine, like Ayurveda, Unani and Siddha. However, the ethnopharmacologists, botanists, microbiologists and natural-product chemists world over today, is constantly still in search of medicinal efficacy of plants and their phytochemicals, since the reported data so far available on plants are comparatively meager before the vast number of plant population. Phytomedicines derived from plants have shown great promise in the treatment of infectious diseases including viral infections (Cowan, 1999). The drugs which are already in use to treat infectious diseases is of concern because, drug safety remains an enormous global issue. The Myrtaceae family contains 133 genera and 3,800 species of trees and shrubs. One of important genera of Myrtaceae is Eucalyptus, which is a large genus of evergreen trees and shrubs containing about 700 species (Batish et al., 2008). The essential oils of Eucalyptus species possesses important biological activities including diaphoretic, disinfectant, antimalarial, antiseptic, analgesic, antiinflammatory, antibacterial (Cimanga et al., 2009), expectorant (Penfold and Willis, 1961) and antioxidant properties (Lee and Shibamoto, 2001). The essential oil extracted of clove *Eugenia caryophyllata* is used as a topical application to relieve pain and to promote healing and also finds use in the fragrance and flavoring industries. The main constituents of the essential oil are phenylpropanoids such as carvacrol, thymol, eugenol and cinnamaldehyde. The biological activity of *Eugenia caryophyllata* has been investigated on several microorganisms and parasites, including pathogenic bacteria, Herpes simplex and hepatitis C viruses. In addition to its antimicrobial, antioxidant, antifungal and antiviral activity, clove essential oil possesses antiinflammatory, cytotoxic, insect repellent and anaesthetic properties (Chaieb et al., 2008).

Psoralea corylifolia, commonly known as babchi, is a popular herb, which has since long been used in traditional Ayurvedic and Chinese medicine for its magical effects to cure various skin diseases. This plant is also pharmacologically studied for its chemoprotective, antioxidant, antimicrobial, and antiinflammatory properties. Dry fruit of leguminous plant *Psoralea corylifolia* Linn. (*Cullen corylifolium* Linn.) is one of the most popular Traditional Chinese Medicine and officially listed in Chinese Pharmacopoeia (Qiao et al., 2006). *P. corylifolia* is an annual herb growing throughout the plains of India. The plant is of immense biological importance, and it has been widely exploited since ages for its magical effect against several skin diseases, such as psoriasis, leukoderma, and leprosy (Sah et al., 2006).

The aim of the present study is to assess the antimicrobial activity of the three selected essential oils of *Eucalyptus globulus*, *Eugenia caryophyllata* and *Psoralea corylifolia* against the selected five microorganisms. The comparison of antimicrobial activities of the three essential oils was also carried out.

MATERIALS AND METHODS

Collection of Essential Oils

The selected essential oils of *Eucalyptus globulus*, *Eugenia caryophyllata* and *Psoralea corylifolia* were purchased from local market. Various concentrations (10, 20, 30, 40 and 50 %) of each oil were prepared in ethanol.

Microorganisms Used

The antimicrobial activities of essential oils were studied against microbial strains of *S. aureus* and *B. subtilis* (Gram-positive bacteria); *E. coli* and *P. aeruginosa* (Gram-negative bacteria) and *P. chrysogenum* (Fungus).

Antimicrobial Activity

The antimicrobial activity assay was carried out using agar well diffusion method according to Azoro (2002). Nutrient agar plates were swabbed with one day old broth cultures of selected microorganisms. Using the sterile cork borer, the wells (6 mm) were made into the each petri plate and the prepared concentrations of selected oils were poured/ transferred into the wells. The plates were incubated at 37°C for 24 h. Tetracycline and Griseofulvin antibiotics were used as the positive control against bacteria and fungal strains respectively.

RESULTS & DISCUSSION

The antimicrobial activity was investigated for each of the selected essential oils (*E. globulus*, *E. caryophyllata* and *P. corylifolia*). With the increasing concentration of each oil, the zone of inhibition was found to be increased. Among all the three selected oils, *E. globulus* was found to be most effective against all the tested microorganisms (Table 1 and Figure 1). All the results are evaluated with respect to the positive control used. The results of antimicrobial activity showed that *S. aureus*, *E. coli* and *P. chrysogenum* were sensitive to all the concentrations (10-50 %) of *E. globulus*. The 30% and 50% concentrations of *E. globulus* were significant against *B. subtilis* and *P. aeruginosa*. The results are found to be in accordance to Ghalem and Mohamed (2008) and Damjanovic-Vratinca et al. (2011). They have reported the antimicrobial activity of *E. globulus* against *S. aureus* and *E. coli*. The higher antimicrobial results of *E. globulus* may be due to the presence of antibacterial phytochemicals such as flavonoids, terpenes, phenolics and alkaloids etc (Egwaikhide et al., 2010). Eucalyptal (1,8-cineole) is the active ingredient of eucalyptus oil that is responsible for its various pharmacological activities (Salari et al., 2006).

Table 1. Zone of inhibition of three selected essential oils.

Name of Microorganisms	Zone of Inhibition (in mm)															
	Concentration of Essential Oils (%)															
	10			20			30			40			50			Control
	<i>E. globulus</i>	<i>E. caryophyllata</i>	<i>P. corylifolia</i>	<i>E. globulus</i>	<i>E. caryophyllata</i>	<i>P. corylifolia</i>	<i>E. globulus</i>	<i>E. caryophyllata</i>	<i>P. corylifolia</i>	<i>E. globulus</i>	<i>E. caryophyllata</i>	<i>P. corylifolia</i>	<i>E. globulus</i>	<i>E. caryophyllata</i>	<i>P. corylifolia</i>	
Gram Positive Bacteria																
<i>B. subtilis</i>	16	9	17	17	9.5	17	19	10	17	20	11	18	21	12	22	18
<i>S. aureus</i>	18	10	9	18	10	10	19	11	10	20	13	12	21	15	13	12
Gram Negative Bacteria																
<i>E. coli</i>	25	10	13	26	11	16	27	11	15	28	11	17	29	12	20	15
<i>P. aeruginosa</i>	16	9	10	18	9	13	19	9	15	19	10	18	22	10	22	21
Fungus																
<i>P. chrysogenum</i>	25	9	13	26	10	15	27	10	16	28	10	19	28	10	21	15

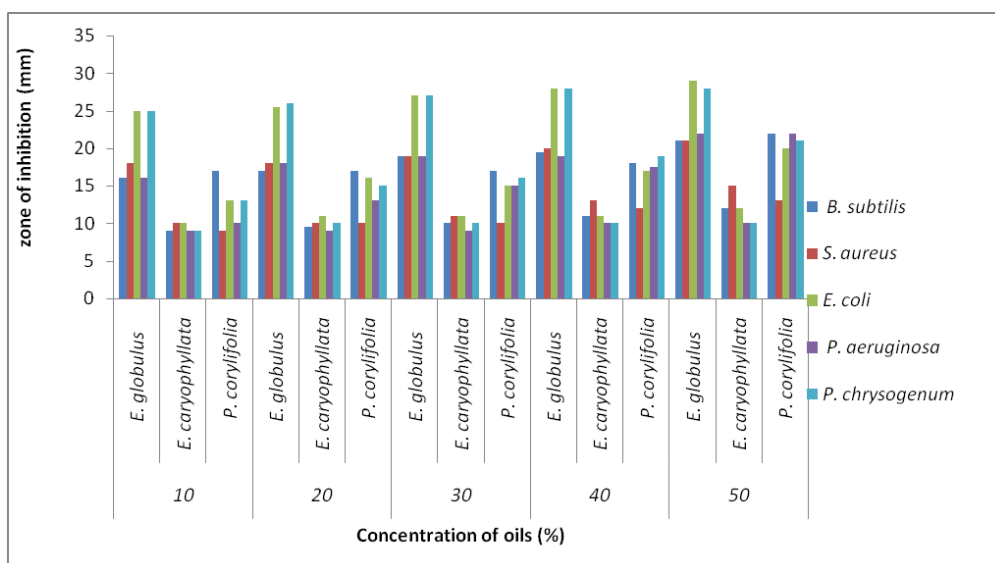


Figure 1. Zone of inhibition of three selected essential oils.

E. caryophyllata was found to be ineffective against all the selected microbial strains except *S. aureus*. The oil showed significant activity against *S. aureus* at 40% concentration. The antimicrobial activity of Eugenia was earlier reported by Larhsini (2001), Gameda et al. (2008) and Keskin and Toroglu (2011).

P. corylifolia had showed highest activity against *E. coli* and *P. chrysogenum*. The 40% and 50% concentrations of *P. corylifolia* were significant against both gram positive bacteria and *P. aeruginosa* respectively. Khatune et al. (2004) and Moon and Moon (2012) have reported significant antimicrobial activity of Psoralea. The seed and aerial parts of Psoralea showed best antibacterial activity amongst the 13 selected plants (Chanda et al., 2011).

From the present study, it can be concluded that the essential oils of *E. globulus*, *E. caryophyllata* and *P. corylifolia* shows antimicrobial activity. In comparison, *E. globulus* oil has the highest potential to inhibit the microbial growth than the other two oils. *P. corylifolia* is found to be more effective than the oil of *E. caryophyllata*.

Acknowledgment

We sincerely thanks to Dr. Vinod Bihari and Mr. A. Verma for their kind support during the present work.

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