Antimicrobial Activity of Oils and Extracts of
Cymbopogon citratus (Lemon Grass),
Eucalyptus citriodora and Eucalyptus camaldulensis

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The antimicrobial potentials of essential oils and extracts from the leaves of
Cymbopogon citratus (Lemon grass), Eucalyptus citriodora and Eucalyptus
camaldulensis were tested on Salmonella typhi, Staphylococcus aureus and
Escherichia coli. Both the water extract and freeze dried extract of these leaves
were used. Zone of inhibition measurement showed that Eucalyptus citriodora
oil was very effective against Salmonella typhi and found to suppress growth of
the organism after 24 h of incubation. Similar observation was made with a
combined extract of Eucalyptus citriodora oil and lemon grass oil. Lemon grass
oil was observed to possess high antimicrobial activity on all the three organisms
tested while Eucalyptus camaldulensis is very active against Staphylococcus
aureus. Both the freeze dried extracts and the viscous extracts possess slight
antimicrobial activity while in all cases, the aqueous extracts have no effects on
the organisms.

Key words: Antimicrobial, essential oils, aqueous extracts
INTRODUCTION

Nature has been a source of medicinal agents for thousands of years and since the beginning of man. In Nigeria, almost all plants are medicinal and the application of medicinal plants especially in traditional medicine is currently well acknowledged and established as a viable profession (Kafaru, 1994).

In the past, there have been reports on prevalence of infections caused by *Salmonella typhi*, *Staphylococcus aureus* and *Escherichia coli* and these organisms show resistant to most commonly used drugs. The consequence is that, newer drugs will have to be researched for, to enhance the treatment of people suffering from infections caused by these three microorganisms and one way of searching for new drugs is by studying locally used medicinal plants (Ehana et al., 1986, 1995).

Presently in the developing countries, synthetic drugs are not only expensive and inadequate for treatment of diseases but are also often with adulterations and side effects (Shariff, 2001). There is therefore the need to search for plants of medicinal value. Although the anti microbial and the antibacterial activities have been reported on the methanolic extract of these plants (Babayi et al., 2004; Mehrabani et al., 2005; Rogerio et al., 2004); there has been little or no documented scientific evidence on their water extracts on these organism.

The essential oils used in this study were extracted from two different Eucalyptus species (*Citriodora* and *camadulensis*) and *Cymbopogon citratus* (Lemon grass) plants, which are used traditionally for the treatment of malaria and typhoid fever. Concoction prepared from the combination of the leaves and grass of these plants or the boiling of the individual plant leaves have been used in the treatment of ailments like typhoid fever, stomach ache etc. (Udeh et al., 2001). These oils have applications in the soap, cosmetics and perfumery industries. The main objective of this study is to examine antimicrobial activities of water extracts and the essential (volatile) oils from the leaves of *Cymbopogon citratus*, *Eucalyptus citriodora* and *Eucalyptus camadulensis*.

MATERIALS AND METHODS

**Plant materials:** The Eucalyptus (*Eucalyptus citriodora* and *Eucalyptus camadulensis*) leaves were obtained from different trees of the Forestry Plantation in Samaru, Zaria while lemon grass was obtained from NARICT, Basawa, Zaria both in Kaduna State, Nigeria.

**Test organism:** The test microorganisms (*Salmonella typhi*, *Staphylococcus aureus* and *Escherichia coli*) were clinical isolates obtained from Department of Microbiology, Ahmadu Bello University, Zaria Nigeria. The three microorganisms were stock cultured using nutrient agar and incubated in the incubator at 37°C for subsequent use.

**Preparation of water extract and the essential oil:** Water extracts of the leaves were also prepared. A portion of the leaves was washed and dried in the oven at 100°C for 24 h. The dried leaves were then ground, soaked in water for 10 h and filtered using filter paper. The aqueous extract was frozen and then freeze dried to give the extract powder. The molten extract was obtained by boiling the leaves for 1 h. Another portion of the leaves was placed in distilled water and boiled for 1 h. The leaves were then filtered and the aqueous extract was evaporated on a heater to give the viscous extract.

The essential oils from plant samples were obtained from fresh leaves of these plants by simple distillation using a fabricated distillation apparatus designed and constructed by the National Research Institute for Chemical Technology (NARICT) Zaria, Nigeria, using the hydrodistillation technique. The oils were redistilled using simple distillation glass. This is to test the accuracy of the locally fabricated distillation set.

**Microbial tests of plants extract and oils:** The antimicrobial activity of both the essential oil and the extracts of lemon grass, *Eucalyptus citriodora* and *Eucalyptus camadulensis*, was carried out using the Punch hole diffusion technique described by Rogerio et al. (2004). Nutrient agar was used as the medium. 28 g L\(^{-1}\) of the agar was autoclaved along side with the petri dishes at 121°C for 15 min (Cheesbrough, 1984). The plates of diameter of 90 mm were poured and inoculated with the test microorganisms by streaking. A hole (3 mm) was punched in the center of the plate using micro-borers. Three drops of each extract and essential oil was dropped into the punched hole using Pasteur pipette. The plates were then incubated at 37°C for 24 h. The zones of inhibition were measured using a transparent meter rule across the hole at different dimensions. The oils of *Eucalyptus citriodora* and Lemon grass which contain the same citral compounds were combined in the same ratio to know their combining effect, whether synergistic additive or antagonistic.

One gram of the freeze dried extract was dissolved in 1 cm\(^3\) distilled water while 1 g of the viscous extract was...
dissolved in 0.5 cm³ distilled water and stirred until a homogenous solution was obtained. Three drops of each of these solutions were also put into the punched hole and the procedure was repeated for all the rest samples.

RESULTS AND DISCUSSION

The zones of inhibition representing the antimicrobial activity of the essential oils and their extract of the leaves of Eucalyptus citriodora and Eucalyptus camaldulensis and Lemon grass on Salmonella typhi, Staphylococcus aureus and Escherichia coli after 24 h of incubation are presented in Table 1-3. The zones of inhibition were measured in millimeter (mm) and compared to the diameter of the plates used which was 90 mm. From the results presented on the Table 1-3, it was observed that Eucalyptus citriodora possess the greatest antimicrobial activity in any state used on Salmonella typhi, Lemon grass possess highest activity the three test organisms while Eucalyptus camaldulensis possess the highest inhibitory effect on Staphylococcus aureus. This is in support with what was reported on the methanolic extract of these plants on these organism by Babayi et al. (2004). When Lemon grass oil and Eucalyptus citriodora (Lemon scent) were combined, they showed very high synergistic effect on the three microorganisms. These results are in accordance with what was reported by Udeh et al. (2001). They reported that Staphylococcus aureus showed indications of high susceptibility to the oil of Eucalyptus citriodora even at high dilutions of the crude oil so also Lemon grass (Cymbopogon citratus). It was also observed that some of the oils are highly inhibitory such that they inhibit growth absolutely of the microorganisms after 24 h of incubation. The extracts obtained from these plants possess a low or moderate inhibitory effect to growth of the test organisms. However, the aqueous extract of these plant leaves possess no inhibitory effect. This may be due to the fact that the active ingredients in this extract could not be extracted with water as the solvent. However, the methanolic extracts of these plants showed a very high antimicrobial sensitivity against some pathogenic microorganism (Babayi et al., 2004). Mehran et al. (2005), reported that essential oils of Cybopogon citratus and Eucalyptus citriodora showed 100% inhibition of mycelia growth and germination of spores of Didymella bryoniae.

Generally speaking, the oils of these plants are seen to possess amazing inhibitory effects on the three microorganisms. The combined lemon grass and Eucalyptus citriodora oils possess synergistic effect on all the three tests organisms. No marked demarcation between the viscous and powder extracts inhibitory effects on the organisms. The present study has demonstrated that the essential oils of Lemon grass, Eucalyptus citriodora and Eucalyptus camaldulensis have significant antimicrobial potentials.

REFERENCES


