

Brief Communications

Antibacterial activity of essential oils on microorganisms isolated from urinary tract infection

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Abstract

The antibacterial activity of essential oils extracted from medicinal plants (*Ocimum gratissimum*, L., *Cymbopogon citratus* (DC) Stapf., and *Salvia officinalis*, L.) was assessed on bacterial strains derived from 100 urine samples. Samples were taken from subjects diagnosed with urinary tract infection living in the community. Microorganisms were plated on Müller Hinton agar. Plant extracts were applied using a Steers replicator and petri dishes were incubated at 37°C for 24 hours. *Salvia officinalis*, L. showed enhanced inhibitory activity compared to the other two herbs, with 100% efficiency against *Klebsiella* and *Enterobacter* species, 96% against *Escherichia coli*, 83% against *Proteus mirabilis*, and 75% against *Morganella morganii*.

Historical records indicate that, as long as 2,600 years ago, the Chinese already developed drugs using a number of forms of phytotherapeutic agent elaboration. This was also the case with the Egyptians, Greeks and Romans.

In light of the recent emergence of bacteria which are resistant to multiple antimicrobial drugs, posing a challenge for the treatment of infections, the need to discover new antimicrobial substances for use in combating such microorganisms becomes patent.

The Brazilian savannah is very diverse and rich. It includes a number of plants that are used in natural medicine for treating tropical diseases, including bacterial infections.^{1,4} On the other hand, due to the lack of knowledge concerning the potential toxic activity and adequate usage, medicinal herbs are often used incorrectly, thereby not yielding the desired effect.

Species known to produce antiseptic essential oils include wild basil (*Ocimum gratissimum*, L.);⁷ lemon grass (*Cymbopogon citratus* (DC) Stapf);⁸ and sage (*Salvia officinalis* L.).

Cymbopogon citratus (DC) Stapf. essential oil includes mircene, neral, geranial, and other unidentified compounds² and is used for fighting colds, dysentery, headaches, and also as a tranquilizer and antispasmodic, besides its antimicrobial activity.⁸

Ocimum gratissimum L. is widespread in the tropics. It is used in popular medicine for treating upper respiratory tract infections, pneumonia, cough, fever, and conjunctivitis. The oil extracted from this plant contains the following compounds: 1,8 cineol, eugenol, methyl-eugenol, thymol, p-cimene, cisocimene, and cis-caryophyllene, and, in different concentrations inhibited the growth of *Staphylococcus aureus*, *Shigella flexneri*, *Salmonella enteritidis*,

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Table - Sensitivity of microorganism strains to essential oils extracted from *Ocimum gratissimum* L., *Salvia officinalis* L., and *Cymbopogon citratus* (DC) Stapf.

Microorganisms	Strains inhibited - N (%)		
	<i>Ocimum gratissimum</i> L.	<i>Salvia officinalis</i> L.	<i>Cymbopogon citratus</i> (DC) Stapf
<i>Escherichia coli</i> (N=79)	55 (69.6)	76 (96.2)	71 (89.9)
<i>Klebsiella pneumoniae</i> (N=7)	7 (100)	7 (100)	6 (85.7)
<i>Proteus mirabilis</i> (N=6)	2 (33.3)	5 (83.3)	1 (16.6)
<i>Morganella morganii</i> (N=4)	2 (50.0)	3 (75.0)	2 (50.0)
<i>Enterobacter aerogenes</i> (N=2)	1 (50.0)	2 (100.0)	1 (50.0)
<i>Klebsiella oxytoca</i> (N=1)	0 (0.0)	1 (100.0)	0 (0.0)
<i>Pseudomonas aeruginosa</i> (N=1)	0 (0.0)	0 (0.0)	0 (0.0)

Escherichia coli, *Klebsiella sp.*, *Proteus mirabilis*, and *Pseudomonas aeruginosa*.⁶

The essential oil extracted from *S. officinalis*, L., used as a medicinal herb, has antibacterial activity due to the presence of 1,8-cineol³ and of an antifungal substance.⁵

The present study was aimed at studying the antimicrobial activity of essential oils extracted from *Ocimum gratissimum* L., *Cymbopogon citratus* (DC) Stapf., and *Salvia officinalis* L. against enterobacteria and *Pseudomonas aeruginosa* isolated from urinary tract infections.

One hundred samples were collected from the middle portion of the urine of patients diagnosed with urinary tract infection in the municipality of Caçapava, southeastern Brazil. The samples collected were striated on DIFCO agar petri dishes and incubated at 37°C for 24h. The colonies isolated were identified by biochemical testing. The three herbs were picked between 10 a.m. and 3 p.m. from the Agrarian Science Department of the Universidade de Taubaté, state of São Paulo.

Essential oil extraction was performed using the hydrodistillation technique proposed by Craveiro et al² (1981). 100 g of leaves (herb) and 250 ml of water were placed in a 500 ml Kitassato. Upon heating on a Bunsen burner, a stream of vapor was generated and was collected using a 75 cm serpentine. The oil was then separated from the water with the aid of a 500 ml separation funnel.

One hundred ml of each strain were plated on Müller Hinton agar. The oils extracted were applied using a Steers replicator and petri dishes were incubated at 37° C for 24h. Reading was done by observing microbial growth inhibition at the sites where essential oils were applied.

Of the 100 samples analyzed, 79% were of *Escherichia coli*. Other enterobacteria were observed at levels below 8%. *Pseudomonas aeruginosa* accounted for 1% of samples.

The antimicrobial activity of the essential oil extracted from *Salvia officinalis* L. showed a mean 79% de inhibition (Table 1).

A comparison of the activity levels of the three herbs showed the greater efficiency of *Salvia officinalis* L. The different species analyzed were over 96% effective against *Escherichia coli*, 100% against *Klebsiella pneumoniae*, over 83% against *Proteus mirabilis*, 75% against *Morganella morganii*, 100% against *Enterobacter aerogenes*, and 100% against *Klebsiella oxytoca*. There was no antimicrobial activity on *Pseudomonas aeruginosa*.

Although less efficient than *Salvia officinalis* L., *O. gratissimum* L. and *C. citratus* (DC) Stapf. Showed antimicrobial activity on 16% of the strains analyzed, with the exception of *Klebsiella oxytoca* and *Pseudomonas aeruginosa*.

Escherichia coli was the most frequent etiological agent of urinary infection among the subjects analyzed.

The bactericidal activity of the medicinal herbs studied was satisfactory, especially that of *Salvia officinalis* L. An adequate toxicological study must be carried out so as to verify the possibility of using these herbs for fighting microorganisms.

A single strain of *Pseudomonas aeruginosa* was resistant to the three oils analyzed. This species is of great importance in hospital infections, and it deserved a wider ranging investigation, including a larger number of strains.

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