Ain Shams University
Women's College
for Arts, Science and Education

Antimicrobial Activities of Some Egyptian Cultivated and Naturally Grown Plants

A Thesis
Submitted to Botany Department,
Women's College, Ain Shams University
For
The Degree of Ph. D. in Science (Microbiology)

BY

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2011

I praise almighty
ALLAH

for giving me strength, passions, courage and guidance agency to achieve this work, despite all difficulties

DEDICATION

To the sole of my parents

Without them this work would

never have been started.

To my husband

Without him this work will never

have been done.

To my children

For them this work has been done.

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This is the time for a last and personal word. This the time to say

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ABSTRACT

A total of twenty nine plant species distributed among twenty families were investigated in an *in vitro* preliminary screening test using G +ve bacteria (*Staphylococcus aureus*, *Micrococcus luteus* & *Bacillus cereus*), G -ve bacteria (*Klebssila pneumoniae*, *Escherichia coli*, *Pseudomonas aeruginosa* & *Salmonella typhi*), yeasts (*Candida albicans* & *Saccharomyses cerevisiae*) and filamentous fungi (*Aspergillus niger* & *Aspergillus flavus*). The antimicrobial properties of the different plant extracts against the studied pathogens were evaluated using agar well diffusion method. The results were expressed in terms of the diameter of inhibition zones in mm. Results revealed that all plant species exhibited antimicrobial potency against all tested microbial strains with different inhibition zone diameters depending on the bacterial species and type of the extract. The plants that exhibited antimicrobial activity to a certain degree were *Lawsonia inermis*, *Azadirechta indica*, *Salvia officinalis*, *Thymus vulgaris* & *Syzygium aromaticum*, while the most potent plants which possess the highest degree of activity against all the studied strains (bacteria, yeasts & fungi) were *Salvia officinalis* & *Syzygium aromaticum*. The broad spectrum of activity was recorded for the diethyl ether extract of *Syzygium aromaticum*, which have the potential to control the growth of all the antibiotic sensitive and resistant strains under investigation. Clove plant was considered to be the most potent of all investigated plant species.

The minimum inhibitory concentrations (MIC) of the diethyl ether clove extract against the antibiotic sensitive strains varied between 0.05 and 500 µg/ml. The lowest MIC (0.05 µg/ml) and higher inhibition zones were recorded for *Micrococcus luteus*, *Salmonella typhi* & *Aspergillus niger* (the most sensitive strains), while the higher MIC (500 µg/ml) and lower inhibition zone was recorded for *Escherichia coli* (the most resistant strain). A good reduction in the

MICs of clove extract and the antibiotic (ciprofloxacin) was obtained when used in combination against the resistant strain *Staphylococcus aureus* indicating the presence of synergistic effect of the two combined agents.

A separation of the active constituents of clove diethyl ether extract, indicating the presence of three different compounds. The antimicrobial activity of each separated compound was detected against the sensitive *Staphylococcus aureus* and compared with the activity of the total crude extract. The gas chromatogram of the clove diethyl ether extract shows the presence of eugenol and eugenol acetate, as the main constituents.

The modes of action of the crude clove diethyl ether extract against *S. aureus* (ATCC 25923) were investigated by estimating protein profile, the DNA content also by morphological examination of the treated cells using scanning electron microscopy (SEM).

The cytotoxicity of crude clove diethyl ether extract against two common human cancer cell lines namely, breast cancer (MCF-7) and colon cancer (HCT-116) was investigated.

Key Words : Antimicrobial activity, Medicinal plants, Antibiotic resistance, Synergistic effect, Phytoextract, Clove (*Syzygium aromaticum*), anticancer activity.

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