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Research Article

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Antimicrobial potential of *Brassicaceae* family against clinical isolates

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ABSTRACT

Antimicrobial properties of various extracts from plants have recently been of great interest in both research and food industry, because of their possible use as natural additives which emerged from a growing tendency to replace synthetic antimicrobial agents with natural ones. In the present study, all extracts of Brassica oleracea (Broccoli, Cauliflower, Cabbage, Brussels Sprouts and Red Cabbage), Raphanus sativus (radish) and Brassica rapa (Bok Choy) showed significant antimicrobial activity against selected strains of pathogen. Ethanol extract showed highest antimicrobial activity than methanol, chloroform and diethyl ether extracts. Chloroform showed least antimicrobial activity. The extracts of Brassica rapa from all the four solvents showed a significant antimicrobial activity against all the pathogen. The chloroform extract of Cauliflower showed highest zone of inhibition against E.coli with a zone of 34mm. Owing to the antibacterial activities exhibited by the leaf extracts investigated in this study, some of them could be considered a natural herbal source that can be used in food and pharmaceutical industries.

Key words: *Antimicrobial, Brassica oleracea, Brassica rapa, Raphanus sativus.*

INTRODUCTION

Many infectious diseases are known to be treated with herbal remedies throughout the history of mankind. Even today, plant materials continue to play a major role in primary health care as therapeutic remedies in many developing countries[1]. The screening of plant extracts has been of great interest to scientist for the discovery of new drugs effective in the treatment of several diseases[2]. A number of reports concerning the antibacteria screening of plant extracts of medicinal plants have appeared in the literatures[3, 4].

Brassicaceae such as York cabbage, Brussels sprouts, broccoli and white cabbage are rich in polyphenols, flavonoids, and glucosinolates and their hydrolysis products have proved to have antibacterial, antioxidant and anticancer properties[5, 6], investigated antibacterial activity against food borne pathogen using extract of petroleum ether, chloroform, ethyl acetate, acetone, methanol and aqueous of broccoli and determined the Minimum inhibitory concentration (MIC) values to be approximately 10 - 320 µg ml-1.

The pathogens are becoming resistant against antibiotics due to the indiscriminate use of modern antibiotics[7, 8, 9]. Therefore, it is important to find out safer and more effective natural or synthetic antibacterial drug molecules. Synthetic drugs are costlier and have said to posse's side effects, thus natural plants can be considered as a vital source for anti-microbial agents [10]. Therefore, the demand for new and effective anti-microbial agents with broad-spectrum of activity from natural sources is increasing day-by-day [11]. Hence, the purpose of our present investigation was to evaluate the antibacterial activity of some plants for the discovery of potential antibacterial agents that might be used for the management of bacterial infectious diseases. On the basis of these results and because of the popular use of the different species of Brassica as an antibacterial and anticancer agent, the present work was undertaken to evaluate in vitro antimicrobial activity of different extracts of Brassica species.

MATERIALS AND METHODS

Sample collection:

Mature leaves samples belonging to Brassicaceae family, namely *Brassica oleracea* (Broccoli, Cauliflower, Cabbage, Brussels Sprouts and Red Cabbage), *Raphanus sativus* (radish) and *Brassica rapa* (Bok Choy) were collected from Lalbagh Botanical Garden, Bangalore and from local market and brought to the laboratory in sterile zip lock bags for further investigation.

Solvent Extraction:

The leaves were dried at room temperature, ground into uniform powder and taken in four sterile glass beakers each containing 50ml of ethanol, Methanol, Chloroform and diethyl ether. The beakers were kept in rotary shaker at 100rpm for 2 days to enhance proper dissolution of the bioactive compounds in the samples. Each sample solution was filtered with Whatmann filter paper 1 at room temperature. Each filtrate was then evaporated in a rotary evaporator at 45ºC until the extracts became concentrated. The extracts were stored at 4 ºC in a refrigerator until required for further analyses[12].

Microorganisms tested:

The pure culture of the microorganisms such as *Staphylococcus aureus* (2127), *Escherichia coli* (2685) *and Pseudomonas aeruginosa* (5029) were used which obtained from NCL, Pune. These pure cultures were sub cultured and maintained on Nutrient agar and Trypicate soy agar medium plates and stored at 4^0C until needed.

Antimicrobial Activity:

The antimicrobial activities of the Phytochemical leaf extracts were determined by the Kirby-Bauer agar diffusion method according to NCCLS standards[13]. 0.1ml of 24 hrs broth culture of each bacterium was inoculated onto MHA plates by spread plate technique in sterile conditions. The wells were made by sterile cork borer and 50µl of concentrated leave extracts were added in to each well[14]. After 24 hours of incubation the zone of inhibition was determined for each extract samples. The experiment was carried out in duplicates and the average zone of inhibition was calculated. Solvents were used as controls to check any inhibition zones.

RESULTS

Antimicrobial assay was carried out with different solvent extracts against some of the pathogenic microorganisms like *Staphylococcus aureus, Escherichia coli and Pseudomonas aeruginosa*. The different solvents used for the extraction were methanol, ethanol, chloroform and diethylether. The ethanolic extract of all the samples showed a zone of inhibition against all the three pathogenic microorganisms.

The methanolic extract of leaves from cauliflower showed maximum zone of inhibition against *E.coli* (Figure-1). Ethanolic extract of Bok choy showed highest zone of inhibition against *S.aureus* (Figure-2). *E.coli* was maximally inhibited in growth by chloroform extract of cauliflower (Figure-3). The diethyl ether extract of cauliflower leaves had a maximal zone of inhibition against *P.aeruginosa* (Figure-4).

The chloroform extract of cauliflower had a maximum zone of inhibition with a diameter of 34mm among all the samples extracted using chloroform or solvents like diethyl ether, methanol and ethanol. The leaf extract of Bok choy from all the four solvents showed inhibition against all the microorganisms, thus suggesting that Bok choy can be used as an antimicrobial agent against these microorganisms irrespective of the solvent used for elution of the active compounds.

Fig.1: Antimicrobial activity of Methanolic extract of leaf samples

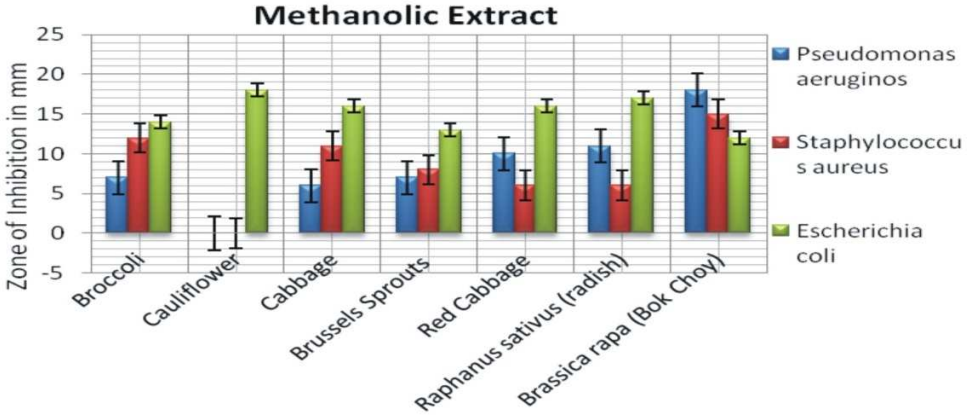


Fig.2: Antimicrobial activity of Ethanolic extract of leaf samples

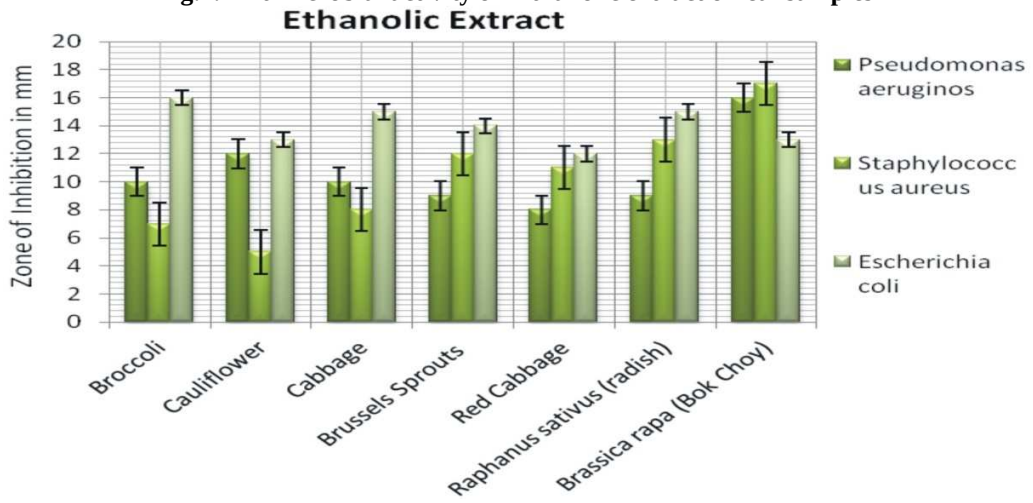


Fig.3: Antimicrobial activity of Chloroform extract of leaf samples

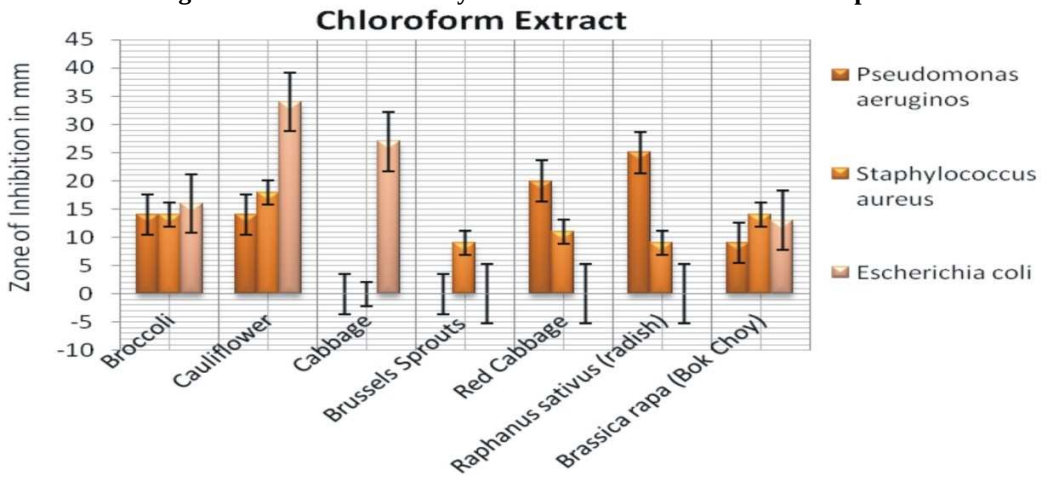
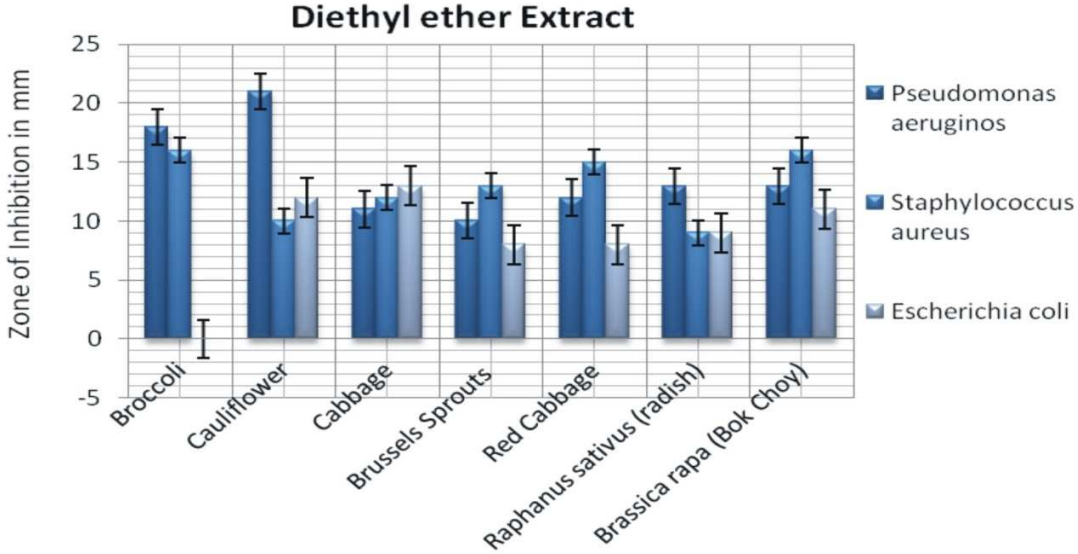


Fig.4: Antimicrobial activity of Diethylether extract of leaf samples



DISCUSSION

In the present investigation antimicrobial activity of different solvent extract of *Brassicaceae* leaves was evaluated using agar well diffusion method against pathogenic bacteria like *Staphylococcus aureus*

(2127), *Escherichia coli* (2685) *and Pseudomonas aeruginosa* (5029) similarly[15] carried out antimicrobial activity against *Aspergillus* and *Cladosporium* species and found that among most of the solvents, the acetone extracts showed higher sensitivity against *Aspergillus flavus* and *Aspergillus niger when compared to Aspergillus fumigatus* and *Cladosporium* species.

[16]carried out *in vitro* evaluation of antibacterial activity of aqueous & organic extract of leaves of *Brassica oleracea* plant, on some vegetative microorganisms like *Candida albicans, Staphylococcus spp., Salmonella spp., Klebsiella spp., Bacillus spp.* and yeast, having different strain. The result obtained by using extract of leaves having different concentration against different test bacteria, showed that the leaves of *Brassica oleracea* possesses an antibacterial activity against microorganisms similar to the findings of the present study where in the leaves of *Brassica oleracea* (Broccoli, Cauliflower, Cabbage, Brussels Sprouts and Red Cabbage), *Raphanus sativus* (radish) and *Brassica rapa* (Bok Choy) showed inhibition against the food borne pathogenic microorganisms, thus suggesting that the leaves of these plants can play a major role in providing antimicrobial agents against such organisms.

The ethanol extracts of all the plant parts were found to be highly effective whereas the petroleum ether, methanol and ethyl acetate extracts of root, stem and leaves of *B. campestris* respectively exhibited a good antibacterial activity against all bacterial strains i.e. *Staphylococcus aureus, Bacillus cereus, Pseudomonas aeruginosa, Escherichia coli* and *Staphylococcus epidermidis* with the diameters of growth inhibition area in the range of 05 – 25 mm as par the findings of [17] similarly in the present investigation chloroform extract of leaf samples proved to have a greater impact of inhibition when compared to the extract obtained from different solvents and the diameter of zone of inhibition ranged from 5-34mm. Thus suggesting that the leaves of the *Brassicaceae* family can be a source of naturally available food possessing antimicrobial activity.

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