ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

IN VITRO ANTIMICROBIAL POTENTIAL OF *CORIANDRUM SATIVUM*AGAINST PATHOGENIC MICROORGANISMS

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Manuscript Info

Manuscript History:

Received: 10 November 2013
Final Accepted: 15 December 2013
Published Online: January 2014

Key words:
Coriandrum sativum, secondary metabolites, phytochemical screening, *in vitro* agar well diffusion assay.

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Abstract

*Coriandrum sativum*is known to be an important medicinal herb from ancient period in India. It has been reported to possess numerous secondary metabolites of pharmacological significance. The present work was framed out to undertake the phytochemical screening and to explore the antibacterial and antifungal potential of this herb in acetone and methanol extracts by *in vitro* agar well diffusion assay. The phytochemical screening of extracts of *Coriandrum sativum* showed thepresence of alkaloids, glycosides, flavonoids and amino acids however, reducing sugars were absent in both extracts. Acetone extract was found to exhibit better inhibitory effectagainst bacteria and fungi than methanolic extract. However,none of the extracts were effective against *K. pneumoniae*and *S. cerevisiae*.

Introduction

Antibiotic resistance has become an alarming problem worldwide and this has resulted in an immense clinical problem for the treatment of infectious diseases. The resistance against the existing drugs has risen due to indiscriminate use of commercial antimicrobial drugs commonly used for the treatment of infectious diseases. This has led to the search for new, safe and effective antimicrobial agents from alternative natural resources like plant products. Antimicrobial compounds with plant sources have plentiful therapeutic potentials; not only theyare effective in the treatment of infectious diseases, but also reduce a large number of side effects that are often linked with antimicrobial compounds (Sakharkar, P. R., and Patil, A. T. 1998).Isolation of effective antimicrobial compounds has been made from various plants, showing a considerable inhibitory effect on a variety of pathogenic microorganisms.

Spices are crucial components of Indian cuisines since ancient times. These are consumed in minute amounts to impart flavour, taste and aroma in food preparation to improve their palatability. Spices are also used for stabilizing several food items from deterioration (Kizil, S. andSogut, T. 2003). Spices are also considered as a rich source of bioactive antimicrobial compounds (Lia, P. K. and Roy, J. 2004) Coriander (*Coriandrum sativum* L.), a culinary plant from the family Apiaceae, is a herb, which is considered both as a medicinal herb and a spice and has been shown to have many medicinal properties. It is extensively cultivated in India, Russia, central Europe, Asia and Middle East. The dried fruits are widely employed as a condiment, especially for flavouring sauces, meat products, bakery and confectionery items (Ravi, R. et al., 2007).Coriander seed oil is one of the 20 major essential oils in the world marketand it is known to exert antimicrobial activity (Burdock, G. A. and Carabin, I. G. 2009) however, its mechanism of action is still a matter of debate. The seeds are primarily responsible for the medicinal use and have been used as a drug for indigestion, against worms; rheumatism and pain in the joints (Wichtl, M. W. 1994). In the folk medicine, the seeds of coriander are also used as an aromatic, carminative, stomachic, antispasmodic and against gastrointestinal complaints such as dyspepsia, flatulence and gastralgia. The seeds are also used as an ingredient in the laxative preparations to prevent stomach griping (Nadakarni, A. K. 1976).

The present study was framed out to undertake the preliminary phytochemical analysis and *invitro* antimicrobial activity of *Coriandrum sativum* extracts against some major contagious pathogens.

Materials and methods:

Collection of Plant material:

The seeds of Coriander were purchased from the local market of Solan, Himachal Pradesh, India and their identity was confirmed through literature available in the Department of Botany in Shoolini University. The seeds were washed with distilled water and dried in an oven at 40^{o}C for 24 hrs. The dried seeds were grinded into powdered form by the help of grinding machine.

Collection of bacterial strains:

The bacterial strains, *Staphylococcus aureus* (MTCC-737), *Streptococcus thermophillus* (MTCC-5461), *Bacillus subtilis* (MTCC-121), *Proteus vulgaris* (MTCC- 426), *Pseudomonas aeuroginosa* (MTCC-429), *E. coli* (MTCC-1303), *Serratia marcescens* (SRM) (MTCC-8708), *Klebsiella pneumoniae* (MTCC-109), Methicillin-resistant *Staph. aureus*(MTCC-84), *Salmonella typhimurium* (MTCC-1254), *Staphylococcus epidermis* (MCC-10623), *Lactobacillus acidophilus*(MTCC-447), *Micrococcus luteus* (MTCC-1538), *Vibrio cholera* (MTCC-3906), *Candida albicans* (MTCC-227) and*Saccharomyces cerevisiae* (MTCC-170) were obtained from MTCC, IMTECH, and Chandigarh, India.The microorganisms were sub cultured on the specific media recommended for different microorganisms such as Brain heart infusion agar (*S. mutans*), Lactobacillus MRS agar (*L. acidophilus*), Malt yeast agar (*C.albicans* and *S. cerevisiae*) and Nutrient agar for rest of the bacteria and incubated aerobically at 37°C. The media were obtained from Himedia. Each of the bacteria was reactivated prior to susceptibility testing by transferring them into a separate test tube containing broth and incubated overnight at 37°C.

Preparation of methanol and acetone extracts

Twenty grams of dried coriander seed powder was mixed with 100 ml of 96% methanol and 100ml of acetone for 20 min and blended in sterilized blender for 3 min. Extract was filtered by Whattmann filter paper No. 1 and then re-filtered through membrane filter (Axiva) of 0.45 µm. The extract was further concentrated in a rotary evaporator at 50°C and stored thereafter at 4°C until further use.

Phytochemical screening of extracts:

The phytochemical screening of methanol and acetone extracts of *Coriandrum sativum* was performed using standard procedures (Trease, G. E., Evans, W. C. 1989). The qualitative biochemical tests like test for alkaloids, glycosides, flavonoids, test for reducing sugars and amino acids were carried out for both the extracts.

Antimicrobial Susceptibility Assay:

In vitro antimicrobial activities of all extracts were determined by standard agar well diffusion assay (Perez, C. et al. 1990). Petridishes (size 100 mm diameter) containing 18 ml of cool and molten Mueller Hinton Agar(MHA) (Himedia) (at 40°C) were seeded with 100 µl inoculum of bacterial/fungal strain (inoculum size was adjusted so as to deliver a final inoculum of approximately 1.0 x 10^{8} CFU/ml). Wells of 6 mm diameter were cut into solidified agar media with the help of sterilized cork borer.An aliquot of 100 µl of each extract was poured in the respective well and the plates were incubated at 37°C overnight. Organic solvents, in which extracts were prepared, were usedas a negative control while ciprofloxacin and amphotericin B (10µg/ml) was used as a positive control. The experiment was performed in triplicate under strict aseptic conditions. Theantimicrobial activity for each of the extract evaluated was expressed in terms of the average of the diameter of zone of inhibition (in mm) produced by the respective extract at the end of incubation period.

Results:

Phytochemical screening:

Phytochemical screening of extracts showed the presence of alkaloids, glycosides, flavonoids and amino acids. However, both the extracts showed the absence of reducing sugars.

Antimicrobial Susceptibility Assay:

The results of antimicrobial efficacy of methanol and acetone extracts of *Coriandrum sativum*are listed in Table 1.

Table 1. The antimicrobial activity of methanol and acetone extract of *Coriandrum sativum*. The results are the means of the independent triplicates.

Name of organism	Zone of inhibition against methanol extract (in mm)	Zone of inhibition against acetone extract (in mm)	Ciprofloxacin/ Amphotericin B
S. aureus	15±0.6	19±0.4	24±0.2
S. thermophillus	14±0.4	18±0.7	28±0.4
B. subtilis	15±0.3	16±0.4	25±0.3
P. vulgaris	12±0.9	19±0.6	30±0.2
P. aeruginosa	13±1	13±0.3	27±0.0
E. coli	15±0.5	17±0.5	31±0.7
S. marcescens	14±0.4	15±0.8	30±0.3
K. pneumoniae	NA	NA	29±0.5
S. epidermitis	12±0.6	16±0.4	24±0.2
MRSA	11±0.5	13±0.0	23±0.4
L. acidophilus	9±0.8	13±0.4	26±0.6
S. typhimurium	12±0.4	14±0.3	29±0.3
C. albicans	13±0.7	16±0.5	14±0.2
M. luteus	11±0.8	14±0.3	23±0.2
S. cerevisiae	NA	NA	12±0.4
V. cholera	10±0.8	13±0.2	15±0.7

NA: No activity

Discussion and conclusion:

The present scenario of antibiotics is very threatening with significant emergence of resistance among bacterial pathogens against the existing antibiotics. Coriander is a pharmaceutical plant with proven therapeutic potential like for e.g., essential oils of this plant has already been reported to possess highly effective antimicrobial properties (Cantore, P. 2004).The present findings reveal that *Coriandrum sativum*and other plants could be the major source in search of secondary metabolites with greater efficacy against resistant bacterial pathogens. Antimicrobial characteristics of the herbs are due to the presence of various chemical compounds including volatile oils, alkaloids, tannins and lipids that are present in their tissues. Keeping these points in view, the present study was focused to perform the phytochemical screening and to investigate the antimicrobial efficacy of Coriander by using different extracts. The phytochemical screening of methanol and acetone extracts of *Coriandrum sativum* revealed the presence of some promisingalkaloids, glycosides, flavonoids and amino acids however, reducing sugars were absent in both. Coriander is also reported to possess potent antimicrobial activity, thereby proving its efficacy as a medicinal herb,which is in line with other researches confirming medicinal effects of this plant (Kim, Y. D. et al., 2001 and Ceska, O. et al., 1988).The acetone extract of Coriander was found to show more inhibitory effect against bacteria and fungi than methanolic extract. However, none of them were found to be effective against *K. pneumonia*and *S. cerevisiae*. Also gram positive organisms were found to be more vulnerable to both the extracts than gram negative organisms. The study concludes that coriander as antimicrobial additives in food may be useful for the avoidance of some contagious infections. Further, comprehensive phytochemical study for identification and elucidation of bioactive constituents in the plant is expected to serve as a lead in the development of some novel antimicrobial compounds.

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