

ANTIMICROBIAL ACTIVITY AND PHYTOCHEMICAL STUDY OF MEDICINAL PLANT *ALPINIA GALANGA*

BEULA RANI KR¹, SUNDAR SK², MURUGAN M^{3*}

¹Department of Chemistry, Satyam College of Engineering & Technology, Satyam Nagar Aralvaimozhi, Kanyakumari - 629 301, Tamil Nadu, India. ²Department of Microbiology, M.R. Govt. Arts College, Mannargudi, Tiruvarur - 64 1 014, Tamil Nadu, India.

³Department of Biomedical Engineering, Centre for Biological Science, Noorul Islam Centre for Higher Education, Kumaracoil, Kanyakumari - 629 180, Tamil Nadu, India. Email: muruganbt@gmail.com

Received: 05 March 2016, Revised and Accepted: 19 March 2016

ABSTRACT

Objective: The study was undertaken to evaluate the antimicrobial activity and phytochemical constituents of the medicinal plant *Alpinia galanga*.

Methods: The plant samples were collected from the places of Mandaikadu, Kanyakumari District, Tamil Nadu, India. Plant extracts were prepared from the dried leaf powder using different solvents include acetone, chloroform, diethyl ether, ethanol, and distilled water. Initially, antimicrobial activities of the plant extracts were tested by agar well diffusion method against four bacterial, viz., *Escherichia coli*, *Klebsiella pneumonia*, *Bacillus cereus*, and *Staphylococcus aureus* and two fungal pathogens, viz., *Aspergillus niger* and *Penicillium chrysogenum*. Further, the plant extracts were screened for phytochemical constituents by standard protocols.

Results: In this study, the entire bacterial pathogens have inhibited by acetone, chloroform, diethyl ether, and ethanol extracts. In phytochemical screening tests, the plant extracts showed positive results for carbohydrates, amino acid, chloride, alkaloids, flavonoids, phenols, and terpenoids.

Conclusion: This study reveals the continuation of antimicrobial components in the medicinal plant *A. galanga*.

Keywords: *Alpinia galanga*, Phytochemical, Antimicrobial activity and plant extracts.

INTRODUCTION

For past few decades compounds from natural sources have been gaining importance because of the vast chemical diversity that they offer. This had led to phenomenal increase in the demand for herbal medicines in the last two decades and or need has been felt for ensuring the quality, safety, and efficacy of herbal drugs [1]. The plants are used for medicine over thousands of years constitute the most obvious choice for examining the current search for therapeutically effective new drugs such as anticancer drugs [2], antimicrobial drugs [3], and antihepatotoxic compounds [4]. Drugs from the plants are easily available, less expensive, safe, and efficient and rarely have side effects [5].

About 80% of the world's population depends on herbal medicines, and the World Health Organization has reported that around 21,000 plants have been used for medicinal purpose in the world [6]. The use of plants materials as a medicine has increased in recent years in spite of the advances made in the field of chemotherapy. Furthermore, there is the improved use of plants in modern countries for galenical preparations and herbal medicines [7].

The medicinal value of these plants lies in some chemical substances that produce a definite physiological action on the human body. The most important of these bioactive constituents of plants are alkaloids, tannins, flavonoids, and phenolic components [8]. This study was aimed to study the antimicrobial activity and phytochemical constituents of the medicinal plant *Alpinia galanga*. It is commonly known as "Greater galangal" belonged to *Zingiberaceae* family, Rhizomes and flowers were used for edible item by the traditional local peoples [9]. They are majorly cultivated in South East Asia, distributed in Himalaya and Southern region of Western Ghats in India. The plant parts are used for cough, indigestion, dysentery and food poisoning, fresh juice of its rhizomes used for the treatment of ringworm and seeds are used for colic diarrhea and vomiting [9,10].

METHODS

Plant sample

Leaves of the medicinal plant *A. galanga* were collected from the place of Mandaikadu, Kanyakumari District, Tamil Nadu. The collected leaves were washed with distilled water and allowed to shade dry at room temperature. The dried leaves were cut into small pieces and powdered with mixer grinder.

Preparation of extracts

About of 5 g of powder was used for the preparation of plant extracts using 100 ml of various solvents, viz., acetone, chloroform, diethyl ether, ethanol, and distilled water; they were achieved by Soxhlet apparatus. The extracts were allowed to condensed, weighed and used for further studies.

Antimicrobial activity

Antimicrobial activity of the plant extracts was performed by agar well diffusion method against four bacterial and two fungal pathogens. Bacterial pathogens include *Escherichia coli*, *Klebsiella pneumonia*, *Bacillus cereus*, and *Staphylococcus aureus*, and fungal pathogens include *Aspergillus niger* and *Penicillium chrysogenum*. The fresh bacterial culture of 0.1 ml was spread on nutrient agar plate and the fungal culture was on potato dextrose agar. Wells of 6 mm in diameter were punched off into medium with a sterile cork borer and filled with 50 µl of plant extracts in aseptic condition. All the plates were kept in a refrigerator to allow pre-diffusion of extract for 30 minutes. Further, the bacterial plates were incubated at 37°C for 24 hrs and fungal plates were incubated at 28-30°C for 72 hrs. The antimicrobial activities were evaluated by measuring the zone of inhibition.

Phytochemical test

Phytochemical test was performed for qualitative analysis of the phytochemical constituents. The test, includes carbohydrates, amino acid, protein, vitamin C, chloride, alkaloids, flavonoids, phenols, tannins,

Table 1: Phytochemical screening of *A. galanga* (L) extracts

S. No.	Parameters	Acetone	Chloroform	Diethyl ether	Ethanol	Aqueous
1	Carbohydrates	+	+	-	+	-
2	Amino acid	-	-	-	+	+
3	Protein	-	-	-	-	-
4	Vitamin C	-	-	-	-	-
5	Chloride	-	+	-	-	+
6	Alkaloids	-	+	+	-	-
7	Flavonoids	+	+	-	+	+
8	Phenols	-	-	-	+	-
9	Tannins	-	-	-	-	-
10	Steroids	-	-	-	-	-
11	Terpenoids	+	-	+	+	+
12	Saponin	-	-	-	-	-

+: Presence of compound, -: Absence of compound. *A. galanga*: *Alpinia galanga*

steroids, terpenoids, and saponin, was performed by followed standard protocols [11].

Fourier transform infrared (FTIR) study

The plant powder was assayed by FTIR spectrophotometer. Attenuated total reflectance (ATR) model (Bruker Alpha T) was used, the spectrum 500-4000 nm was recorded using ATR technique beach measurement, and the peak values were computationally analyzed by IRPAL software.

RESULT

The acetone extract shows inhibitory activity against *E. coli* (13 mm), *K. pneumonia* (10 mm), *B. cereus* (11 mm), and *S. aureus* (9 mm); chloroform extract against *E. coli* (10 mm), *K. pneumonia* (9 mm), *B. cereus* (8 mm) and *S. aureus* (10 mm); diethyl ether extract against *E. coli* (8 mm), *K. pneumonia* (10 mm), *B. cereus* (11 mm), and *S. aureus* (8 mm); ethanol extract against *E. coli* (10 mm), *K. pneumonia* (10 mm), *B. cereus* (9 mm), *S. aureus* (12 mm) and *P. chrysogenum* (8 mm) (Fig. 1). In this study, the entire bacterial pathogens were inhibited by acetone, chloroform, diethyl ether, and ethanol extracts. It does not show any inhibitions on fungal pathogens except ethanol extract on *P. chrysogenum*. Among these extracts, acetone and ethanol extracts were highly inhibited the growth of *E. coli*, *K. pneumoniae*, and *S. aureus* than other extracts. The aqueous extracts show any inhibition activities against the tested organisms.

Phytochemical study

Screenings of phytochemical constituents were qualitatively tested. In this study, acetone extract showed positive for carbohydrates, flavonoids and terpenoids; chloroform extract showed positive for carbohydrates, chloride, alkaloids and flavonoids; diethyl ether extract showed positive for alkaloids and terpenoids; ethanol extract showed positive for carbohydrates, amino acid, flavonoids, phenols and terpenoids; and aqueous extract showed positive for amino acid, chloride, flavonoids and terpenoids (Table 1). Overall the plant extracts contained carbohydrates, amino acid, chloride, alkaloids, flavonoids, phenols, and terpenoids.

FTIR study

FTIR study of the plant powder showed 12 peaks between 500 and 4000 nm. Among these, 5 peaks were high, viz., 878.40, 1043.80, 1086.12, 2975.21 and 3340.65 (Fig. 2). The appropriate classes of the functional group were predicted using IRPAL software. The majority of the functional groups were amines, phosphates, sulfate, alkyl halides, ethers, esters, carboxylic acids, alkanes, and phenols.

DISCUSSION

Acetone, chloroform, diethyl ether, and ethanol extracts were exhibited inhibitory activities against the entire bacterial pathogen includes *E. coli*, *K. pneumonia*, *B. cereus*, and *S. aureus*. Furthermore, it was observed that the above extracts do not inhibit fungal pathogens except *Penicillium chrysogenum* which was inhibited by diethyl ether

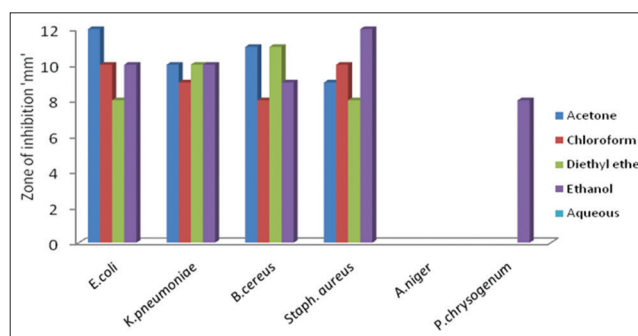


Fig. 1: Antimicrobial activity of *Alpinia galanga* (L) extracts

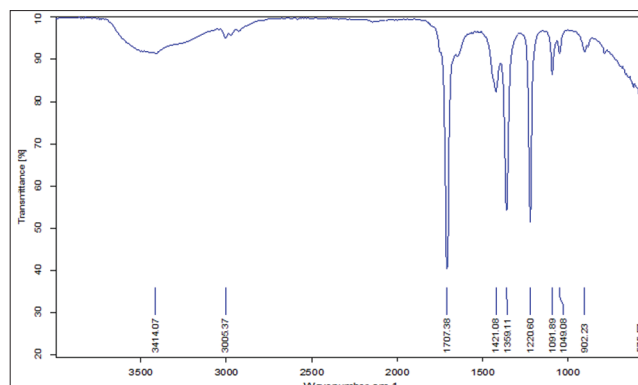


Fig. 2: Fourier transform infrared chromatogram of *Alpinia galanga* (L.)

and ethanol extracts. Rao *et al.* have evaluated antibacterial activity of acetone, methanol and diethyl ether extracts of *A. galanga*. The methanol extracts have shown best inhibition activity toward *Bacillus subtilis*, *Enterobacter aerogene*, *Enterobacter cloacae*, *Enterococcus faecalis*, *E. coli*, *K. pneumoniae*, *Pseudomonas aeruginosa*, *Salmonella typhimurium*, *S. aureus*, and *Streptococcus epidermis* [12]. In this study, it was observed that acetone, chloroform, diethyl ether, and ethanol extracts of *A. galanga* also showed good antibacterial activities.

The phytochemical constituents present the plant material was qualitatively analyzed. In this study, the leaf of *A. galanga* contained carbohydrates, amino acid, chloride, alkaloids, flavonoids, phenols, and terpenoids. They have many properties such as antioxidants and antimicrobial which respond with other organisms by inhibiting bacterial or fungal growth. Flavonoids show anti-allergic, anti-inflammatory, antimicrobial, and anticancer activity [13]. Phenolic compounds have antioxidative, antidiabetic, anticarcinogenic, antimicrobial, anti-allergic, antimutagenic, and anti-inflammatory [14].

Plant-derived natural products, such as alkaloids, flavonoids, phenol, and saponin, have served defence mechanism against invasion by many microorganisms, insects and other herbivores [15], and they have received considerable attention in recent years due to their diverse pharmacological properties. There has been a lot of interest in the investigation of natural materials as sources of new antibacterial agents and plants are one of the bases for modern medicine to attain new principles [16,17].

CONCLUSION

The leaf extracts of *A. galanga* showed good antibacterial activities against the tested organisms. Furthermore, reveals the continuation of antimicrobial components. These results represent a potent antibacterial system for the development of new drugs. *A. galanga* can be used for preservation of foods, as it possesses distinctive flavor as well as antimicrobial activity.

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