Antibacterial activity of Costus speciosus rhizome extract on some pathogenic bacteria

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Introduction

The genus Costus Linn is an important medicinal plant belonging to the family Zingiberaceae. Costus comprises 175 species which are distributed in the humid tropics of both hemispheres (Anonymous, 1950). *C. speciosus* occurs throughout the foot hills of Himalayas from Himachal Pradesh to Assam, Vindhya Satpura hills in Central India, Eastern Ghats of Andra Pradesh and Western Ghats of Maharashtra, Karnataka, Tamil Nadu and Kerala upto an altitude of 1220 ft (Sarin et al., 1979). It thrives well on rich moist soil in shady localities under mixed deciduous forests of South India (Nagendra Prasad, 1982).

The *C. speciosus* is known by the name ‘Kemuka’ in Ayurvedic medicine. In Hindi and Bengali it is known as ‘Keu’, ‘Chengalva Koshta’ in Telegu and Kannada, ‘Kottam’ or ‘Koshtam’ in Tamil and ‘Penava’ or ‘Pushkarmula’ in Marathi (Satyavati, 1976).

Kanikkars are one of the most primitive hill tribes of South India. They occupy the slopes of Western Ghats in Tamil Nadu and Kerala. They use this plant as food and medicine (Janaki Ammal and Nagendra Prasad, 1984). Recently it gained importance in the drug industry as a natural source of diosegenin, a precursor in the synthesis of steroidal hormones (Sarin et al., 1974). The rhizomes are generally consumed in the form of decoction. The tribal’s use this

Abstract

*C. speciosus* among the Kanikkars brought a number of new uses of this plant by the tribes in their therapeutic practices. *C. speciosus* rhizome extract was evaluated for antibacterial activity against pathogenic strains of Gram positive (*Staphylococcus aureus*, *Staphylococcus epidermidis*) and Gram negative (*Escherchia coli*, *Pseudomonas aeruginosa*, *Salmonella typhimurium*) bacteria. Rhizome extract was found to be most active and its activity was compared to the standard antibiotic Gentamycin. Simple phytochemical analysis of total phenol, ortho-dihydric phenols and the alkaloid diosegenin were estimated in rhizome at the vegetative and fruiting stage by using spectroscopy to assess the disease resistance phenomenon. The use of the rhizome extract as a potential bio- bacterialcide in prevention and treatment of bacterial infection has been suggested.

Keywords: *Costus speciosus*, *Escherchia coli*, *Pseudomonas aeruginosa*, *Salmonella typhimurium* and Ethanobotanical

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plant internally and externally for common ailments like head-ache, fever, cough, cut and wounds, scabies, antidote for snake bite, jaundice and arthritis.

The development of bacterial resistance to presently available antibiotic has necessitated the search for new antibacterial agents. The Gram positive bacteria such as *Staphylococcus aureus* are mainly responsible for post operative wound infections, toxic syndrome and food poisoning. The gram negative bacterium such as *E.coli* is present in human intestine and cause lower urinary tract infection, cololecystis or septicemia. The Gram positive and Gram negative bacterial growth can be inhibited by antibiotics, either by blocking the protein synthesis or peptidoglycan synthesis in bacterial cell wall. In the present study, the effect of water extract of the *Costus speciosus* rhizome on pathogenic bacterial strains by zone of inhibition assay and the effect were compared with the standard antibiotic, Gentamycin.

**Materials and Methods**

Fresh rhizomes were collected from the Mothiramalai Kanni settlement of Kanyakumari (8°4’N, 77°34’E) district, Tamilnadu, India. The rhizomes were ground finally in a mortar and pestle by adding little water and made into paste and dissolved in water and made into 1% solution. The Gram positive and Gram negative (clinical isolate) bacteria used as test organism were obtained from Kamini Biotechnology lab, Nagercoil (8°11’N, 77°29’E), Tamilnadu, India. Cultures of bacteria were grown on nutrient broth (Hi media, Mumbai) at 4°C. The extract were dissolved in ethylene glycol and filtered through membrane filter (0.47 m) and it’s used for antibacterial activity using disc diffusion method. A concentration of 30µg / disc was chosen. Sterile 6 mm diameter filter paper disc were impregnated with 30µg of sample and placed on the sterile media spreaded with 0.1 ml of test bacteria. The plates were incubated at 37°C for 12 hours. The experiments were carried out in triplicate. The results were recorded by measuring the zone of growth inhibition around the disc. For comparison, standard antibiotic gentamycin inhibiting bacterial cell wall biosynthesis was included in the assay.

The phenolic compounds are mainly responsible for the disease resistance property. In order to ascertain this the simple phytochemical analysis, the phenols were estimated by employing Folin Denis reagent (Bray and Thrope, 1954), Ortho - dihydric phenols were estimated by using Arnon reagent (Johnson and Schaal, 1957) and diosgenin was extracted with hexane by using Soxlet apparatus and estimated by spectro- scopy method (Rishi *et al.*, 1976) both vegetative and fruiting stage.

**Results**

The antibacterial activity showing zone of inhibition in millimeter and as percentage (calculated by taking gentamycin as positive control with 100 percent inhibition) for Gram positive and Gram negative bacteria were calculated. The rhizome extract was tested for antibacterial activity in *in vitro* systems.

Antibacterial activity of aqueous extract of *C. speciosus* rhizome was found be maximum for *Staphylococcus aureus* (15.5mm) and minimum activity for *Staphylococcus epidermis* (12.7mm) of Gram positive organism. Crude aqueous extract of *Costus speciosus* rhizome showed maximum antibacterial activity for *Salmonella typhimurium* (18mm), moderate activity for *Pseudomonas aeruginosa* (15.4mm) and minimum activity was observed in *E.coli* (8.3mm) (Table - 1).

The extract was most active against both Gram positive and Gram negative strains of bacteria when compared with standard gentamycin (100%).
At the vegetative stage the total phenol content was 2933 µg / g on fresh weight basis and ortho-dihydric phenol was 1773 µg /g. In the fruiting stage the total phenol content was 1350 µg / gm and ortho-dihydric phenol was 600 µg /g. The diosgenin content was 1058 µg / gm and 1068 µg / gm in vegetative and fruiting stage respectively (Table – 2).

**Discussion**

In the present study shows that the Gram positive bacteria have more than 70% activity in both the strains and more than 55% activity in the Gram negative strains.

The result clearly indicates that presence of more amount of total phenol and orthodihydric phenols in the vegetative stage may be responsible for the disease resistance property.

Moreover the high antibacterial activity of rhizome extract of *C.speciosus* is may be due to the presence of diosgenin, an alkaloid which is the precursor for the synthesis of steroidal hormone. Furthermore since it is a steroidal compound, which will be naturally having the antibacterial activity. Hence the rhizome could be used to treat the bacterial disease.

Another interesting factor observed in the study is that in the natural population ( in the natural locality) and in the cultivated farms of *C.speciosus* there was no incident of any bacterial, fungal, viral and pest diseases in the plant organs. It showed that the plant is having
disease resistances in the plant organs. The disease resistance may be due to the presence of phenolics and alkaloid substances.

The results are encouraging that the rhizome aqueous extract of *Costus speciosus* could be used as a bio-bacterialcide and herbal medicine as that of *Zingeber officinale*. Furthermore, the plant could be explored biotechnologically to exploit as a potential biomedicine.

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**References**


