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Research Article

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Antimicrobial activity of *Polycarpaea corymbosa* Lam. (Caryophyllaceae) against human pathogens

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ABSTRACT

Polycarpaea corymbosa are widely used traditional medicinal plant to treat various ailments. The antimicrobial potential of Polycarpaea corymbosa against human pathogenic microorganisms (fifteen bacteria and six fungus) ware investigated. Antimicrobial activity of various plants extracts was compared with commercially available antibiotics. The antimicrobial potential of the above plant extracts was seen against the test organism using disc diffusion method. The phytochemical prospection of the dried aerial and root extracts showed the presence of different classes of secondary metabolites, as phenols, flavonoid, alkaloids and tannins that have demonstrated antimicrobial action. Acetone and methanolic extracts showed considerably good antibacterial activity against all bacteria and fungi. This study shed the light on the ability of extracts from the plant to combat pathogens which will help as natural antimicrobial agents as well as can be used in pharmaceutical and food preservation systems.

Keywords: *Polycarpaea corymbosa* ,Antimicrobial activity, disc diffusion method, phytochemical.

INTRODUCTION

Medicinal plants have been prescribed and used with a strong belief in their ability to cure diseases for centuries [1]. Over the past 20 years, there has been a lot of interest in the investigation of natural materials as sources of new antibacterial agents [2,3] insecticidal, acaricidal and cytotoxic activity [4]. Plants used in traditional medicine contain wide range of substances to treat chronic as well as acute diseases. The substances that can either inhibit the growth of microorganisms or kill them are commonly considered for developing new drugs for treatment of various infectious diseases [5]. Many plant species are considered as potential resource for treating diabetes and various diseases in skin, liver, digestive and the urinary system [6]. Herbal medicine in the developing countries has evolved as an alternative solution to health problems as a cheap source [5-7]. Therefore, medicinal plants are intensely screened and tested for a wide range of applications including pharmacology, pharmaceutical botany, medical and clinical microbiology, phytopathology and food preservation [8].

Research on plants used as remedies in traditional folk medicine can lead to identification of several biologically active molecules from the 250,000 documented higher plant species [9]. The success achieved using medicinal plants and herbal formulations therapeutically based on ethnomedicinal and traditional use against a number of bacterial infections, raises optimism about the future of phytoantibiotics. Based on the indigenous and local knowledge, plants represent a rewarding untapped source with a significant potential for developing antimicrobial agents [10]. Herbs can be very effective in programs for resolving urinary tract infections and typhoid fever [11]. Thus, herbal treatment would promise a greater viable solution for effective treatment of diseases caused by bacteria [12, 13].

Polycarpaea corymbosa Lam. is a herb of annual or perennial, small shrubs with taproots slender to stout, stems erect, branched, terete, leaves opposite, sometimes appearing whorled belonging to the family Caryophyllaceae.

Flavonoids and phenolic compounds widely distributed in plants have been reported to exert multiple biological effects, including antioxidant, anti-inflammatory, anticarcinogenic, etc. Leaves, flower heads of *P.corymbosa* are used in reducing fever; anti-inflammatory and as a poultice for boils and other swellings; antidote for snakebite, leaves were reported to posses potent antioxidant property and are used for treatments of jaundice, demulcent and astringent in Indian folk medicine**.** The whole parts of *P.corymbosa* are used in Indian traditional medicinal system in inflammatory swellings and in treatment of ulcer, jaundice [14]. Hence the present work is carried out to evaluate the effect of various aerial and root extracts of *P.corymbosa* for the antimicrobial activity using various microbes.

EXPERIMENTAL SECTION

Plant collection

The Plant material of *Polycarpaea corymbosa* Lam. used for investigation was collected from Chennimalai, Erode (Dist.), Tamilnadu, India. The plant was authenticated Botanical survey of India, Coimbatore. The voucher specimen of the plant was deposited at the college for further reference.

Preparation of the extract

Plant materials (aerial and root) were washed with distilled water and shade dried. The dried samples were manually ground to a fine powder. The coarsely powdered parts were Soxhlet extracted with methanol for 8 h. The filtrate was evaporated to dryness under reduced pressure using rotary vaccum evaporator. The extracts were lyophilized until further use.

Preliminary phytochemical screening

The freshly prepared crude methanolic extract of *P.corymbosa* was qualitatively tested for the presence of phytochemical constituents by standard methods [15].

Microbial test suspensions:

Test organisms used in this study are six Gram-positive bacteria, nine Gram-negative bacteria and six fungus. The microorganisms were maintained on slants of nutrient agar (NA) at 4˚C. The inoculums were incubated overnight in nutrient broth at 37˚C to produce dense microbial suspension.

Growth and Maintenance of Test Microorganism for Antimicrobial Studies:

Bacterial cultures of *Streptococcus faecalis, S.pyogenes, Euterococcus faccalis, Bacillus subtilis, B.thuringiensis, Strephylococcus aureus, Serratia marcescence, Klebsiella pneumonia, Proteus vulgaris, Salmonella paratyphi, S. paratyphi A, S. paratyphi B, Pseudomonas aeuroginosa* and *Escherichia coli* and fungus cultures of *Paecilomyces lilacinus, Mucur spp, Azospirillum lipofererum, Verticillum lecanii, Candida albicans* and *Penicillium* spp.) were obtained from the PSG medical hospital, Coimbatore, India, were used for antimicrobial test organisms. The bacteria were maintained on nutrient broth (NB) at 37°C and fungus were maintained on Potato dextrose agar (PDA) at 28˚C.

Preparation of Inoculum:

Stock cultures were maintained at 4˚C on nutrient agar slants. Active cultures for experiments were prepared by transferring a loopful of culture to 10 mL of nutrient broth and incubated at 37˚C for 24 hours for bacterial proliferation**.**

Anti-bacterial Activity:

The antibacterial assay of aqueous and methanolic extracts was performed by Bauer *et al.* (1996) [16]. The Nutrient Agar media was poured into the petridishes and were streaked with the test organism. For the agar disc diffusion method, the disc (0.5 cm)) was saturated with 100 mg/ml of the extract was then placed on the upper layer of the seeded agar plate. The plates were incubated overnight at 37°C. Antibacterial activity was determined by measuring the diameter of the zone of inhibition (mm) surrounding bacterial growth. A reading of more than 6mm indicated growth inhibition. All the assays were done in triplicate and the results were given in mean ± SD. For each bacterial strain, Amphicilline positive controls were used.

Antifungal Activity:

The antifungal activity was tested by disc diffusion method [17]. The potato dextrose agar plates were inoculated with each fungal culture (10 days old) by point inoculation. The filter paper discs (5 mm in diameter) impregnated with 100 mg/ ml concentrations of the extracts were placed on test organism-seeded plates. Tetracycline was used as positive control. The activity was determined after 72 h of incubation at 28˚C. The diameters of the inhibition zones were measured in mm.

RESULTS

The preliminary phytochemical analysis represented in Table 1 showed the presence of bioactive compounds like alkaloids, tannins, phenols, flavonoid, steroids and glycosides. The petroleum ether, chloroform, acetone and methanol extracts obtained from the aerial and the root of *P.corymbosa* were microbiologically evaluated.

Table 1: Phytochemical screening results of *Polycarpaea corymbosa.*

Secondary Metabolites	Petroleum ether		Chloroform		Acetone		Methanol	
	Aerial part	Root	Aerial part	Root	Aerial part	Root	Aerial part	Root
Alkaloid	+	+	++	++	++	++	++	++
Flavonoid	+	+	++	+	++	+	++	+
Phenol	+	-	-	-	++	+++	++	+++
Tannin	-	-	-	-	+++	+	+++	++
Glycoside	-	-	-	++	+++	++	+++	++
Saponin	-	+	++	++	++	++	+++	++
Resin	-	-	+	+++	+	++	+	++
Steroids	-	-	+	+	++	+++	++	+++

Figure 1: Antimicrobial activity of Aerial extract of *P.corymbosa* against different bacterial strains.

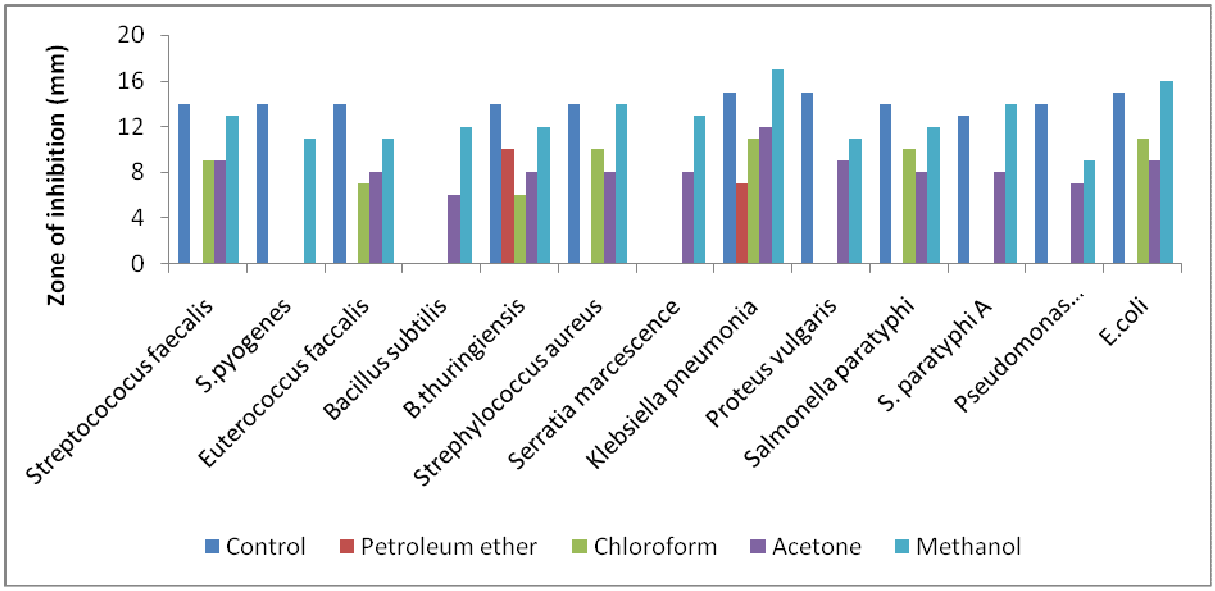
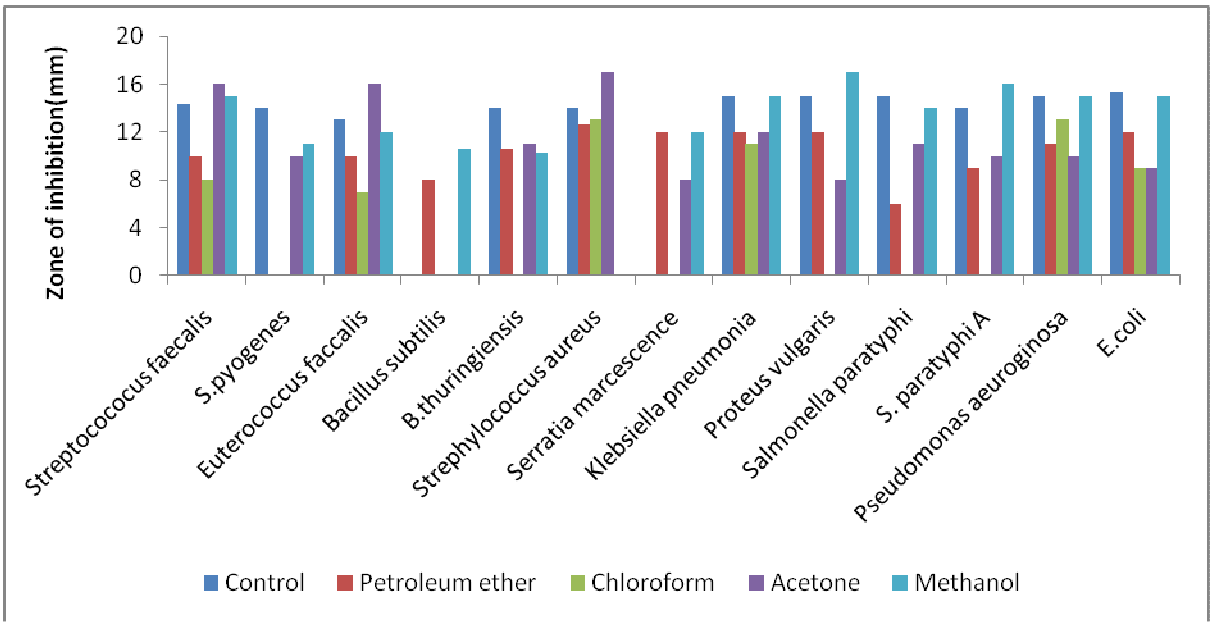


Figure 2: Antimicrobial activity of Root extract of *P.corymbosa* against different bacterial strains.



All the extracts of the plant showed antimicrobial activity against all the Gram-positive and Gram-negative bacteria are determined by disc diffusion techniques. The antimicrobial assay showed that Chloroform, acetone and methanol extracts of *P.corymbosa* (aerial and root) exhibited *in-vitro* antibacterial activity against Gram-positive and Gram-negative bacteria, whereas significant activity was not observed with petroleum ether extract. The largest inhibition zone was observed from methanol aerial and root extracts again *Klebsiella pneumonia* and *Proteus vulgaris* resp. (Fig.1 and 2). The aerial petroleum ether extract showed least antibacterial activity when compared to other extracts.

With pathogenic fungi when tetracycline was used as the standard for all the extracts of *P.*corymbosa was effective against *Penicillium spp., Verticillum lecanii* and *Paecilomyces lilacinus* , among which *Paecilomyces lilacinus* showed better results in methanolic root extract with a zone of inhibition as 20 mm (Fig.3 and 4).

Figure 3: Antifungal activity of *P.corymbosa* aerial extract against fungal species tested by disc diffusion assay.

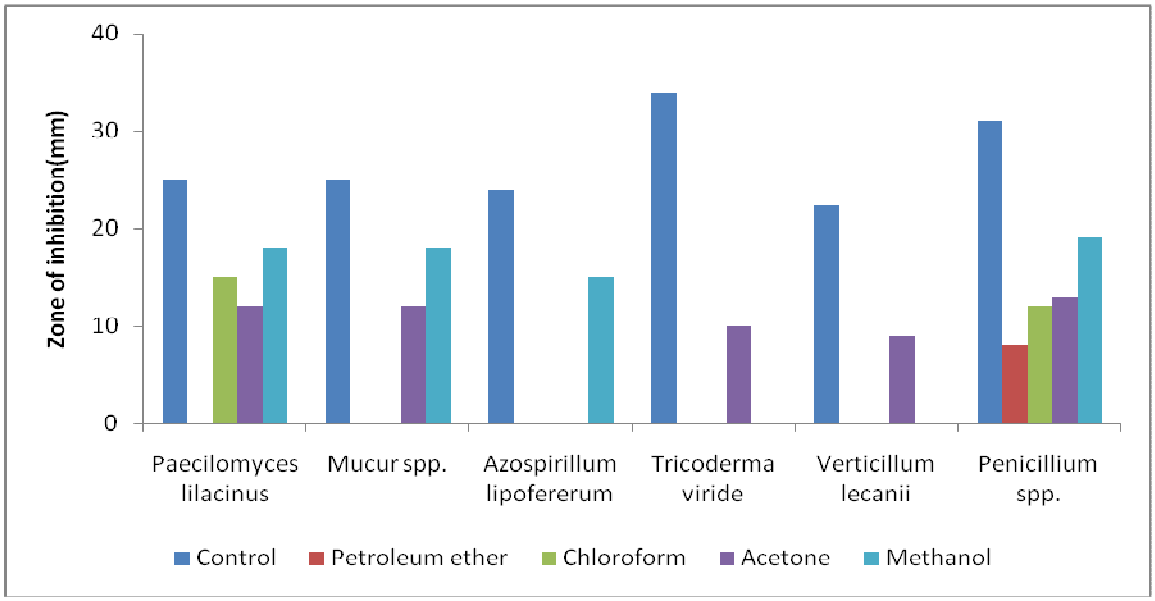
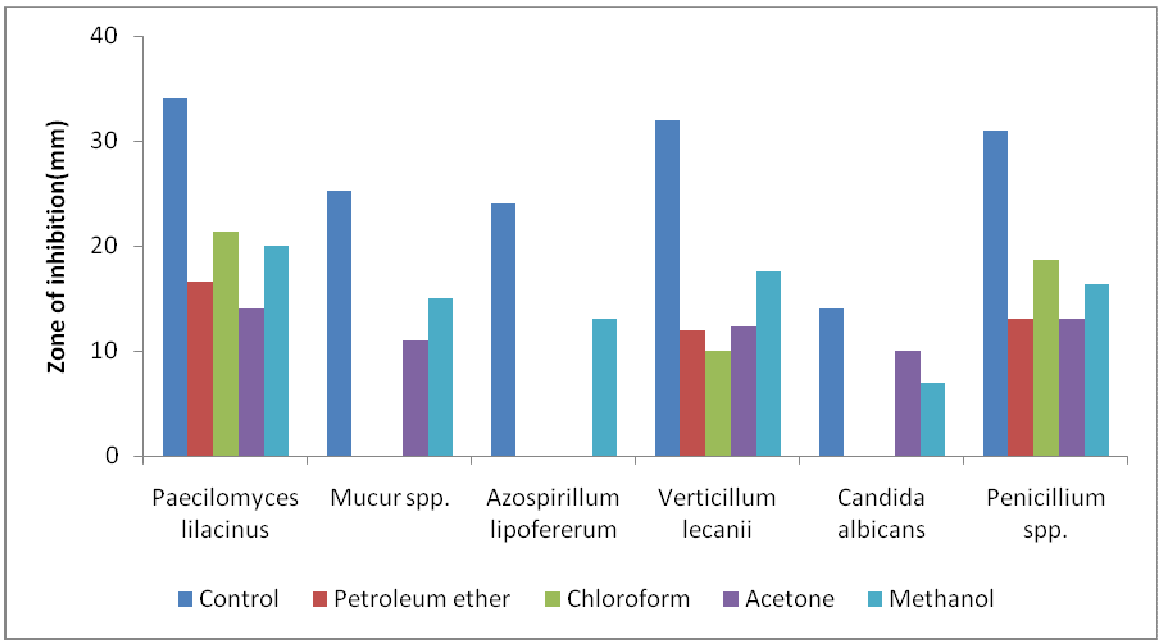


Figure 4: Antifungal activity of *P.corymbosa* root extract against fungal species tested by disc diffusion assay.



DISSCUSSION

Plants are important source of potentially useful structures for the development of new chemotherapeutic agents. The first step towards this goal is the *in vitro* antibacterial activity assay [18]. Many reports are available on the

antiviral, antibacterial, antifungal, anthelmintic, antimolluscal and anti-inflammatory properties of plants [19-25]. Some of these observations have helped in identifying the active principle responsible for such activities and in the developing drugs for the therapeutic use in human beings. Considering these, *P.corymbosa* were screened *in vitro* for antibacterial activity against fifteen human pathogenic bacteria and six fungus known to cause diseases in humans. On the basis of zone of inhibition, the result of the present investigation revealed that among the fifteen bacteria and six fungus screened, methanol extract of *P.corymbosa* (aerial and root) showed significant antibacterial activity. Further investigation on isolate the active principle for the activity by successive solvent extraction revealed that methanol is the most suitable solvent for the extraction of antibacterial principle from *P.corymbosa*.

Maximum antifungal activity was shown by root extract, but it was active only against *Paecilomyces lilacinus* (21 mm) and *Penicillium* spp. (18 mm) (Fig 4), while aerial extract showed activity against all six members investigated (Fig 3). On the contrary all the aerial and root extracts of *P.corymbosa* exhibited better activity on the bacteria except *Proteus mirabilis* and *Salmonella paratyphi B*, a Gram-negative bacterium. It was further reported that the inhibitory activity of all extracts of aerial and root of *P.corymbosa* is not Gram positive and Gram negative. It may be explained that the ingredients present in the extracts both qualitatively and quantitatively are adequately present to act upon the cell membrane of the bacteria of Gram positive and Gram negative types [26]. It may also be explained that the activity of antibiotics in plant extracts against bacterial growth may be due to their mechanism of action, chemical structure or spectrum of activity.

The acquired results confirm and supplement present findings about antibacterial and antifungal characteristics of *P.corymbosa* plant from Caryophyllaceae family. Methanol aerial extract of *P.corymbosa* showed antifungal activity against five fungal strains and petroleum ether extracts showed activity against only one fungus. Based on the response of *P.corymbosa* extracts to the inhibition of the growth of the colonies of bacteria and fungi, it came to know that the methanol extracts of aerial and root parts of this species are highly effective to cure infectious diseases caused by bacteria and fungi. In addition, it confirms the traditional medicinal use of this species for the treatment of certain ailments.

CONCLUSION

A scientific and systematic investigation with regard to the various biological activities of this plant is lacking. Results of the present work indicate that the plant species assayed possess antimicrobial properties. This explains the use of these plants in folk medicine for the treatment of various diseases whose symptoms might involve bacterial and fungal infections and underline the importance of the ethnobotanical approach for the selection of plants in the discovery of new bioactive compounds. Further phytochemical research is needed to identify the active principles responsible for the antifungal effects of some of these medicinal plants.

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