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COMPARISON OF ANTIMICROBIAL EFFICACY OF VARIOUS EXTRACTS OF *CARICA PAPAYA* LEAF AND DIFFERENT ANTIBIOTICS AGAINST SELECTED HUMAN PATHOGENS

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ABSTRACT

In the current study, the synergistic antimicrobial efficacy of *Carica papaya* plant extracts in combination with antibiotics has been assessed on selected pathogens using different solvent extracts. Papaya leaves were extracted by using Soxhlet apparatus method and three kinds of solvents: petroleum ether, chloroform, ethylacetate. Papaya leaf extracts were tested against human pathogenic microbes. Bacteria such as *Escherichia coli, Staphylococcus aureus* and fungi such as *Aspergillus niger* and *Candida albicans* by agar well diffusion method. All the leaf extracts of *Carica papaya* Linn. exhibited greater activity towards bacteria and fungi. The extract demonstrated higher activities against all the bacteria with the highest activity (ethyl acetate extract of 12 mm and 14 mm zone of inhibition) demonstrated against *Escherichia coli* and fungi with (petroleum ether extract of 9 mm and 12 mm zone of inhibition) demonstrated against *Candida albicans*. Synthetic discs with the antibiotics Chloramphenicol, Tetramycin, Ampicillin, and Gentamycin respectively were used for comparison All the tested human pathogens were highly sensitive to Gentamycin with the zone of inhibition above 20 mm. Further study is necessary to detect and evaluate the actual constituents responsible for the antibacterial activity of the valuable medicinal plant investigated, for its successful utility.

Keywords : Antibacterial activity; *Carica papaya*; Human pathogens; Bio active compounds; Solvent extracts.

Introduction

The world's major threat to human health and account for almost 50000 deaths every day (Ahmad and Beg, 2001). Emergence of resistant strains of pathogenic microorganism has also continued to pose a major health concern about the efficacy of several drugs, most importantly antibiotics in *Carica papaya* Linn belongs to the family Caricaceae is commonly known as papaya in English, Papita in Hindi and Erandakarkati in Sanskrit. Leaves being an important part of several traditional formulations are undertaken for standardization for various parameters like moisture content, extractive values, ash values, swelling index, etc (Yogiraj *et al*., 2014). Its fruits, leaves and flowers are edible. Its roots can be used as medicine for renal and urinary bladder problem, and its seeds have anthelmintic activity (Doughari *et al*., 2007). Infectious diseases are current use (Timothy and Idu, 2011). The search for newer sources of antibiotics is a global challenge pre-occupying research institutions, pharmaceutical companies, and academia, since many infectious agents are becoming resistant to synthetic drugs (Doughari *et al*., 2007).The search for newer sources of antibiotics is a global challenge pre-occupying research institutions, pharmaceutical companies, and academia, since many infectious agents are becoming resistant to synthetic drugs (Latha and Kannabiran, 2006). The local use of natural plants as primary health remedies, due to their pharmacological properties, is quite common in Asia, Latin America, and Africa (Bibitha *et al.,* 2002). Sofowora (1982) and Balandrin *et al.* (1985) defined medicinal plants as a plant in which one or more organs contain substances that can be used for therapeutic purposes or which it precursors for the manufacturing of drugs are useful for disease therapy. Since medicinal plants do not nearly save people from feeling pain but permit them to emerge unscathed, they deserve investigation. Each part of papaya tree possesses economic value when it is grown on a commercial scale (Krishna *et al.,* 2008). Even though the active components are normally extracted from all parts of the plant, the concentration of these components vary from structure to structure. The present study is a comparative analysis of anti-microbial activity of various extracts of *Carica papaya*with some known antibiotics against selected human pathogens.

Materials and Methods

Fresh and healthy *Carica papaya*plants were collected from various locations of Thiruvananthapuram District. Leaves were washed and shade dried for two weeks and extracts with solvents such as petroleum ether chloroform, ethyl acetate were prepared. The extracts obtained from the respective solvents were stored for further use (Bruneton, 1995). Antimicrobial activity the selected micro-organisms were cultured on nutrient agar. The extracts were tested for their anti-microbial activity using disc diffusion method.

Synthetic discs with the antibiotics Chloramphenicol, Tetramycin, Ampicillin, and Gentamycin respectively were used for comparison. A total of four human pathogens *Staphylococcus aureus, Escherichia coli, Aspergillus niger* and *Candida albicans* were used as test organism. The agar plates were inoculated with test organisms, sterile and dried disc with plant extracts and synthetic discs such as Chloramphenicol, Tetramycin, Ampicillin, and Gentamycin were placed on the agar surface. The inoculated plates were incubated at 37^0C overnight and the inhibition zone was recorded (Bauer *et al.,* 1966). Sterile plain disc (5 mm) without plant extract was used as control. The inhibitory zone around test paper discs indicates the absence of bacterial growth and that was recorded as positive test and the absence of zone as negative test.

Results and Discussion

Antibiotics are the main therapeutic agents used against bacterial infections. But the higher level of genetic variability among bacteria enables them in developing antibiotic resistance rapidly. Development of novel as well as higher potent antibiotics is necessary all the time (Selvamony *et al.,* 2020). The extracts of *Carica papaya* with various extracts and different antibiotics against selected human pathogens solvents showed a wide variation in the anti-bacterial activity among the selected pathogens studied (Table 1 and Figure 1).

Antibacterial activity of papaya leaf obtained with petroleum ether exhibited higher zone of inhibition compared to other solvent extracts, the zone formation was 12 mm and 14 mm at different concentration against *Escherichia coli* (Table 1 and plate1). Ethyl acetate exhibited lower zone of inhibition compared to other solvent extract., the zone formation was 11 mm and 12 mm at different concentration against *Escherichia coli. S. aureus* not showing zone of inhibition.

Antifungal activity of papaya leaf obtained with ethyl acetate exhibited higher zone of inhibition compared to other solvent extracts, the zone formation was 9 mm and 12 mm at different concentration against *Candida albicans.* (Table 1 and plate 1). Petroleum ether exhibited lower zone of inhibition compared to other solvent extract. The zone formation was 9 mm and 11 mm at different concentration against *Candida albicans.* Chloroform extraction not showing zone of inhibition in both organism. *S. Aspergillus niger* in petroleum ether extraction exhibited higher zone of inhibition and chloroform and ethyl acetate not showing zone of inhibition. four antibiotics Chloramphenicol, Tetracycline, Ampicillin, and Gentamycin were tested against four bacterial and fungal strains. *Staphylococcus aureus, Escherichia coli,* and fungal strains *Aspergillus niger* and *Candida albicans* to determine the sensitivity towards antibiotics. Results of the present study reveals that the chloramphenicol inhibited the growth of bacterial strains such as *Staphylococcus aureus* with zone of inhibition above 15mm. *Escherichia coli* showed resistance against Chloramphenicol. Tetracycline inhibited the growth of bacterial and fungal strains such as with the zone of inhibition above (22 mm). *Staphylococcus aureus* and *Candida albicans* was sensitive to Ampicillin, whereas all other bacterial strains showed resistance against Ampicillin. Gentamycin also showed antibacterial activity against all the tested human pathogens with the zone of inhibition above (15 mm).

The comparative study of sensitivity of different human pathogens towards plant extracts *of Carica papaya, Staphylococcus aureus* was insensitive to all extract but sensitive to all antibiotics. *Escherichia coli* was sensitive towards all extracts obtained from *Carica papaya*. At the same time *Escherichia coli* showed resistance towards synthetic antibiotics, Chloramphenicol and Ampicillin. *Aspergillus niger* was insensitive towards petroleum ether and ethyl acetate extract of *Carica papaya,* but sensitive towards all other plant extracts. *Aspergillus niger* was insensitive towards the antibiotics Chloramphenicol and Ampicillin. *Candida albicans* was found to be sensitive towards all extracts of *Carica papaya* except chloroform extract. *Candida albicans* was sensitive to all antibiotics.

Carica papaya is a plant that has been reported to possess medicinal properties. The activity of extracts against test organisms provides scientific basis for the local usage of these plants in the treatment of various ailments. The fact that the extracts were active against both gram–positive and gram- negative tested may indicate a broad spectrum of activity. This broad spectrum of activities may be significant in developing therapeutic substances that will be active against multidrug–resistant organisms (Ayannfemi *et al*., 2015). Papaya was found to be resistant to Chloramphenicol, Tetramycin, Ampicillin, and Gentamycin. The results of this study are in agreement with the study conducted by Thomas T. Yoshikawa on drug resistant strains prevalent in hospital environment. Ocloo *et al*. (2012) studied the efficacies of crude extracts of *C. papaya* seeds against *Staphylococcus aureus*, *Escherichia coli* and *Shigella flexneri* using disc diffusion method. The crude organic (acetone, methanol) extracts inhibited the growth of all three organisms. These results strongly support our study.

All the leaf extracts of *Carica papaya* Linn. exhibited greater activity towards bacteria and fungi. From the entire experiment it can be concluded that papaya leaves have antibacterial activity. Papaya leaves have natural antibacterial compounds and can be applied for various disease. The extract demonstrated higher activities against all the bacteria with the highest activity (ethyl acetate extract of 12 mm and 14 mm zone of inhibition) demonstrated against *Escherichia coli* and fungi with (petroleum ether extract of 9 mm and 12 mm zone of inhibition) demonstrated against *Candida albicans*. All the tested human pathogens were highly sensitive to Gentamycin with the zone of inhibition above 20 mm. Further study is necessary to detect and evaluate the actual constituents responsible for the antibacterial activity of the valuable medicinal plant investigated, for its successful utility.

Table 1: Different antibiotics against human pathogen

Antibiotics	Zone of inhibition			
	S. aureus	***E. coli***	***A. niger***	***C. albicans***
Chloramphenicol	15	0	0	18
Tetramycin	29	27	25	23
Ampicillin	11	0	0	10
Gentamycin	21	27	16	20

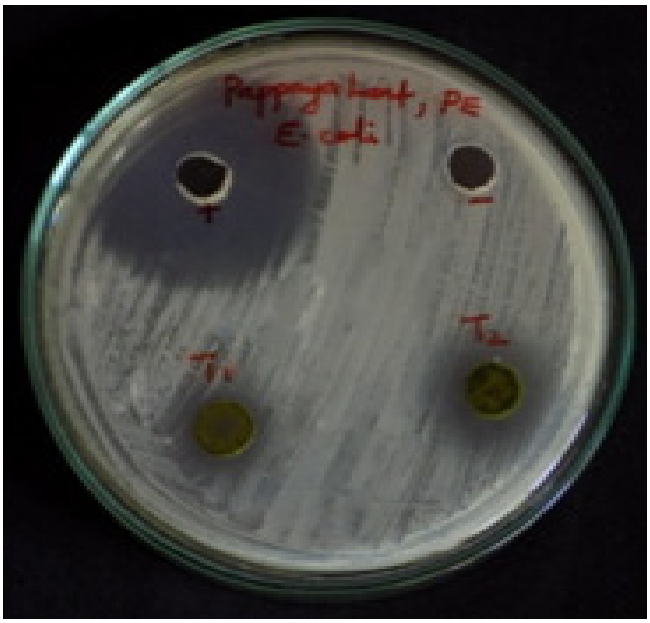

Plate 1: Petroleum etherextract of *E.coli*

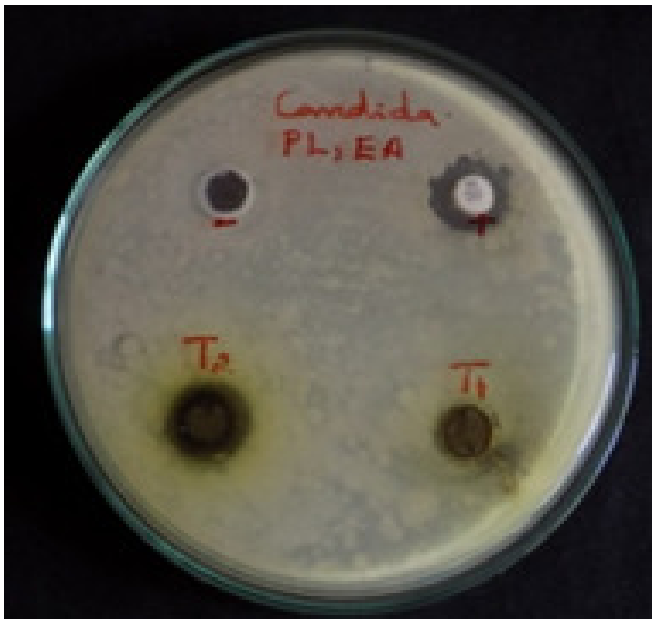

Plate 3: Ethyl acetate extract of *C. albicans*

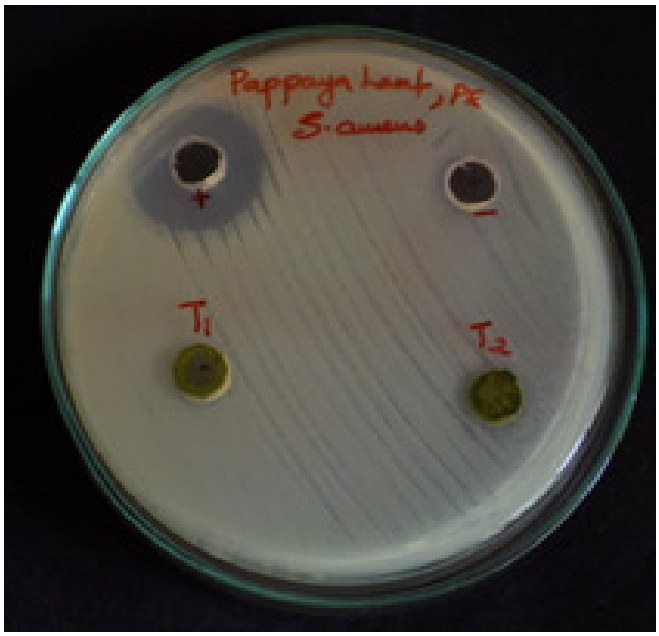

Plate 2: Petroleum ether extract of *S. aureus*

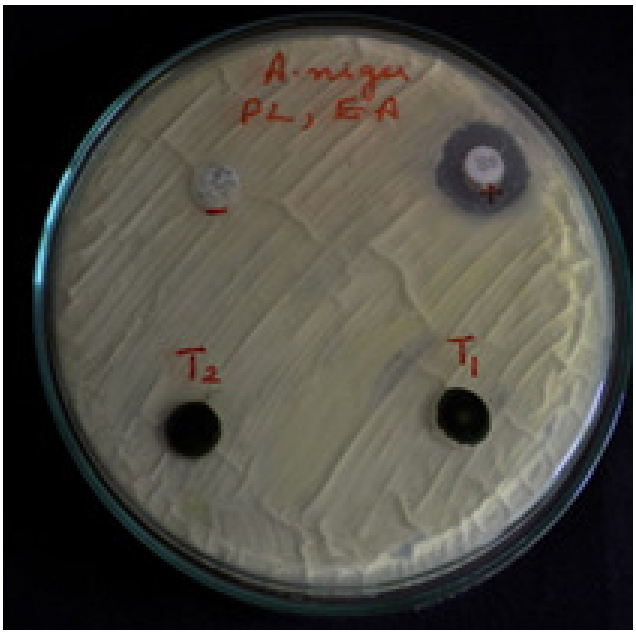

Plate 4: Ethyl acetate extract of *A. niger*

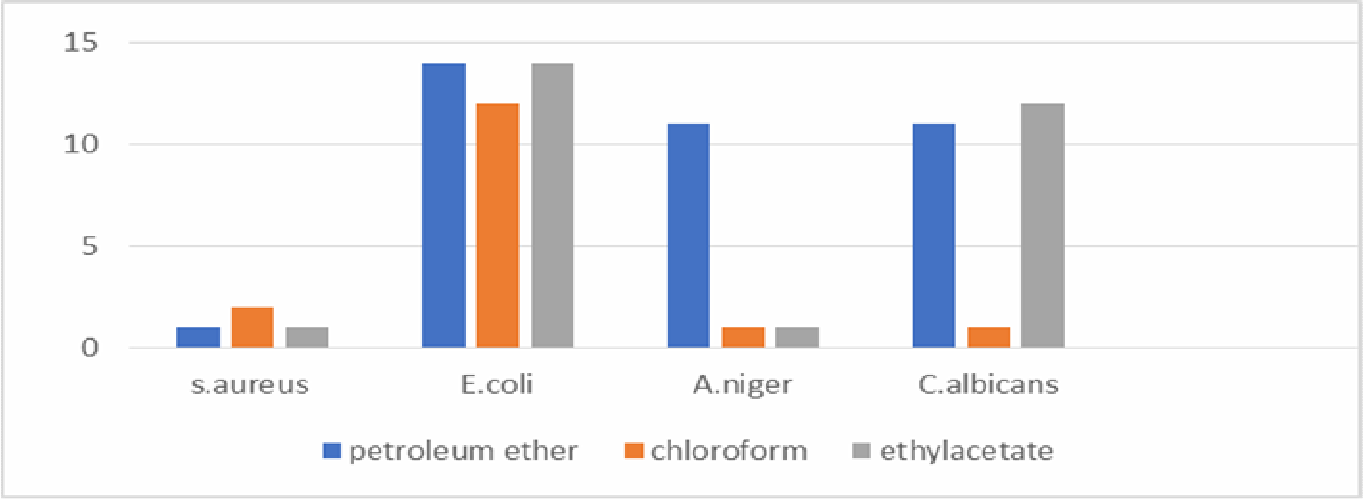

Fig. 1: Comparison of antibacterial and antifungal activity of different solvent extract

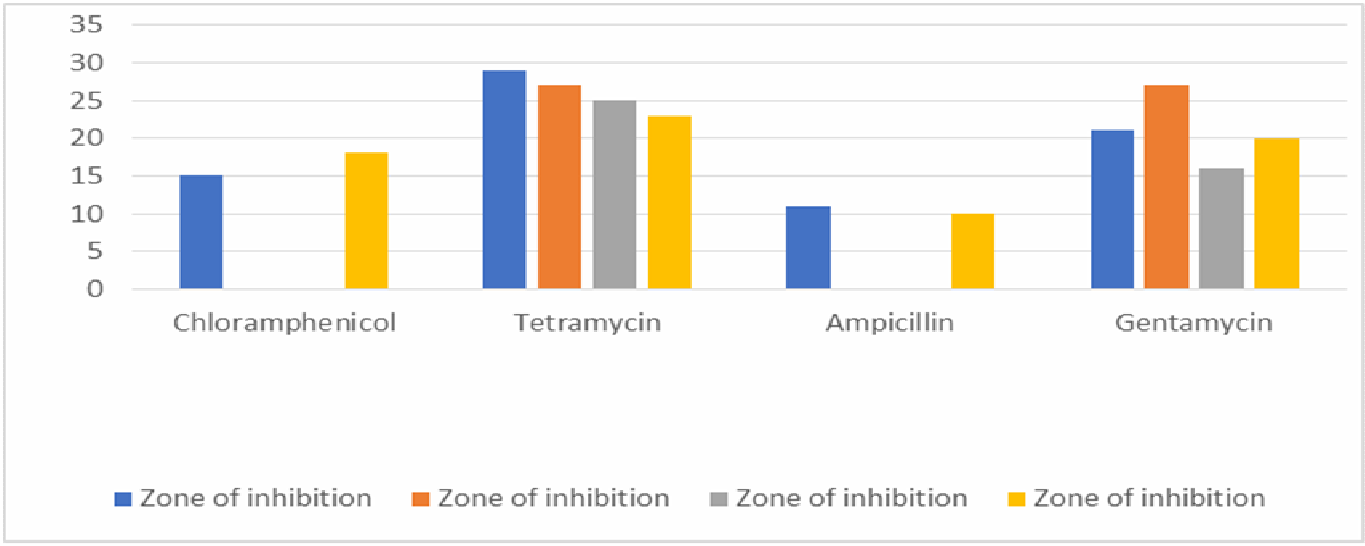

Fig. 2: Different antibiotics against human pathogen

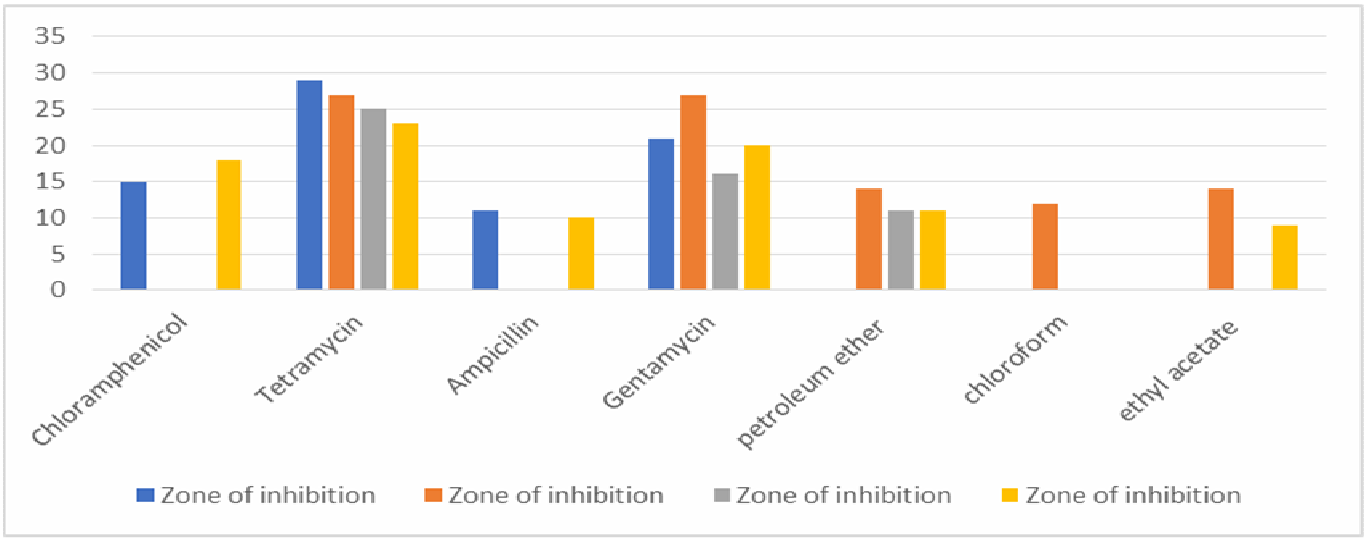

Fig. 3 : Comparison of antimicrobial study of *Carica papaya* and antibiotics

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