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Assessing the antibacterial activity of resin derived from the bark of *Artocarpus heterophyllus* Lam.

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Abstract

A wide variety of bioactive substances, such as alkaloids, phenolics, terpenoids, and flavonoids, are present in resin and are thought to be involved in its antibacterial qualities. Due to its therapeutic qualities, the resin of *Artocarpus heterophyllus*, better known as jackfruit, has long been employed in a variety of traditional remedies. The resin's possible antibacterial action is one of its noteworthy features. In this work, we examine the antibacterial activity of *A. heterophyllus* resin against a range of microorganisms and consider possible uses for it in the treatment of microbial illnesses. After gathering the resin from the bark of the plant, 200 mL of 100% ethanol were used to extract it overnight. The crude extract yield was gathered after the extract was filtered via Whatman No. 1 filter paper. The study's findings indicate that the resin extract exhibited a 100% concentration-dependent inhibitory zone against MRSA, *S. aureus, E. faecalis, and S. mutans*, but no inhibition against *P. aeruginosa*. At concentrations of 25% and 50%, there was very little inhibition. The phytochemical content of the resin, which includes substances like flavonoids, alkaloids, and tannins, may be responsible for its efficacy. The resin is of interest for possible pharmacological and medical uses since these bioactive compounds are known to hinder the growth and proliferation of bacteria.

Keywords: *Artocarpus heterophyllus*, Bioactive Compounds, Antimicrobial Activity.

Introduction

The genus Artocarpus includes a vast range of plants, many of which have been traditionally used for their therapeutic properties. One such plant that has attracted attention is jackfruit, or *A. heterophyllus*, because of potential antibacterial properties. The resin that was taken from this tree's trunk has drawn particular interest because it has been shown to be useful in combating a range of bacteria. An introduction to *A. heterophyllus*, its historical uses, and the significance of investigating the resin's antibacterial properties [1]. Though they are native to South and Southeast Asia, large tropical trees like *A. heterophyllus* are now grown all over the world for their wonderful fruit. The jackfruit's large size (it can weigh up to 80 pounds) and its sweet, aromatic, and nutritious flesh make it a major food source valued in many countries. However, jackfruit has a long history of use in traditional folk medicine, making it more than just a delicious fruit [2].

Traditional medical systems have employed various elements of *A. heterophyllus*, including the leaves, seeds, and latex, to cure a range of ailments. These traditional usages have

sparked scientific interest in the plant and its components, especially the resin extracted from the trunk. The resin is harvested by making cuts in the trunk of the tree and collecting the fluid that oozes out. It has been used topically to accelerate wound healing, as an adhesive, and in traditional therapies for a variety of skin conditions [3]. One of the most crucial research topics is *A. heterophyllus*'s possible antibacterial qualities. Since bacterial, fungal, and other pathogen-based infections constitute a serious concern for global health, the development of novel antimicrobial medicines is imperative. The need for alternative treatments and the rise in antibiotic resistance have brought attention to natural products such as the resin of *A. heterophyllus* [4]. The antibacterial activity of the resin is particularly noteworthy due to its proven effectiveness against a wide variety of microorganisms.

Studies have revealed that the resin contains antibacterial, antifungal, and antiviral properties. The potential for broad-spectrum activity makes it a fascinating subject for research in the development of novel antibacterial drugs [5]. The resin's antibacterial effect is a result of its chemical composition. Among the bioactive components it contains include flavonoids, tannins, alkaloids, and phenolic compounds. These chemicals have been shown in numerous investigations to possess antibacterial activities. The exact mechanisms of action by which these compounds stop the development and spread of microbes are still being investigated [6]. Research on the antibacterial properties of *A. heterophyllus* resin has applications in both traditional and modern medicine. Its antibacterial qualities can be better understood and applied to standard medical procedures and treatments. This could offer a strong empirical foundation for the resin's continued use in traditional therapeutic methods [7].

The identification of the antibacterial properties of the resin could have a significant influence on the development of new drugs and treatments in the field of contemporary medicine. The quest for novel antimicrobial drugs in the medical domain is an ongoing undertaking, and natural materials such as the resin derived from *A. heterophyllus* present an exciting avenue for drug discovery [8]. Furthermore, the potential antibacterial properties of the resin may be useful to the food and pharmaceutical industries. In food preservation, natural antimicrobial agents are of interest because they can extend the shelf life of perishable items. They can be used as preservatives in a range of medicinal compositions [9]. The purpose of this issue is to examine the antibacterial activity of the resin that was isolated from the jackfruit, *A. heterophyllus*, and to consider possible uses for it. The goals are to determine the resin's main bioactive ingredients, measure how well it works against different microbes, and analyze the resin's applicability in conventional medicine, contemporary healthcare, and industrial sectors including pharmaceuticals and food preservation.

Materials & Methods

Extraction

Using a sterile scalper, a wound was made in the plant's bark to extract resin. After collecting the resin, 200 mL of 100% ethanol were used to extract it further overnight. Crude extract was then obtained by evaporating the extracted material.

Antimicrobial Assay - Zone of Inhibition (ZOI)

Methicillin-resistant *Staphylococcus aureus* (MRSA), *Pseudomonas aeruginosa* (PA), *Streptococcus mutans* (SM), *Enterococcus faecalis* (EF), and *Staphylococcus aureus* (SA) were the test organisms used in the investigation. Three different dosages of the crude extract (20 mg, 10 mg, and 5 mg) were made. Test organism fresh broth suspensions were calibrated to 0.5 McFarland Standards. Mueller-Hinton agar plates were used to create lawn cultures, and sterile agar cutters were used to cut the wells. Each test substance was added in increments of 20 mg, 10 mg, and 5 mg to the corresponding wells. After 24 hours of incubation at 37°C, the zones of inhibition on the plates were measured and noted.

Results and Discussion

At 100% concentration, the resin extract demonstrated an inhibitory zone against MRSA, *S. aureus*, *E. faecalis*, and *S. mutans*; no inhibition was observed against *P. aeruginosa*. The concentrations of 25% and 50% showed the least amount of inhibition (**Fig. 1 and 2**). Further investigation into the mechanisms of action of jackfruit resin is warranted since its distinct flavonoid profile may have a substantial impact on its antibacterial activity (Panche et al., 2016).

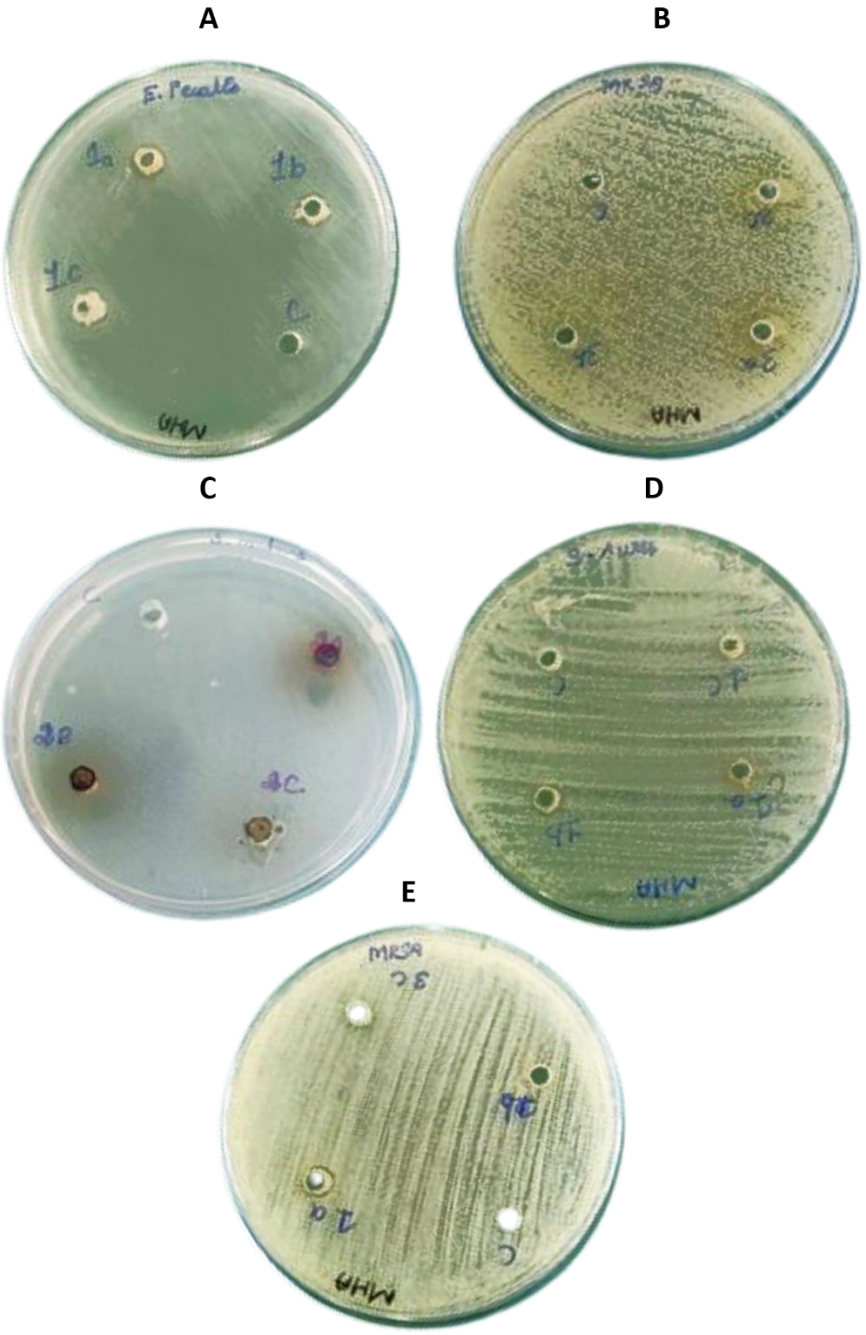

Figure 1. The Petric dishes showing antimicrobial activity of the resin extract as zone of inhibition

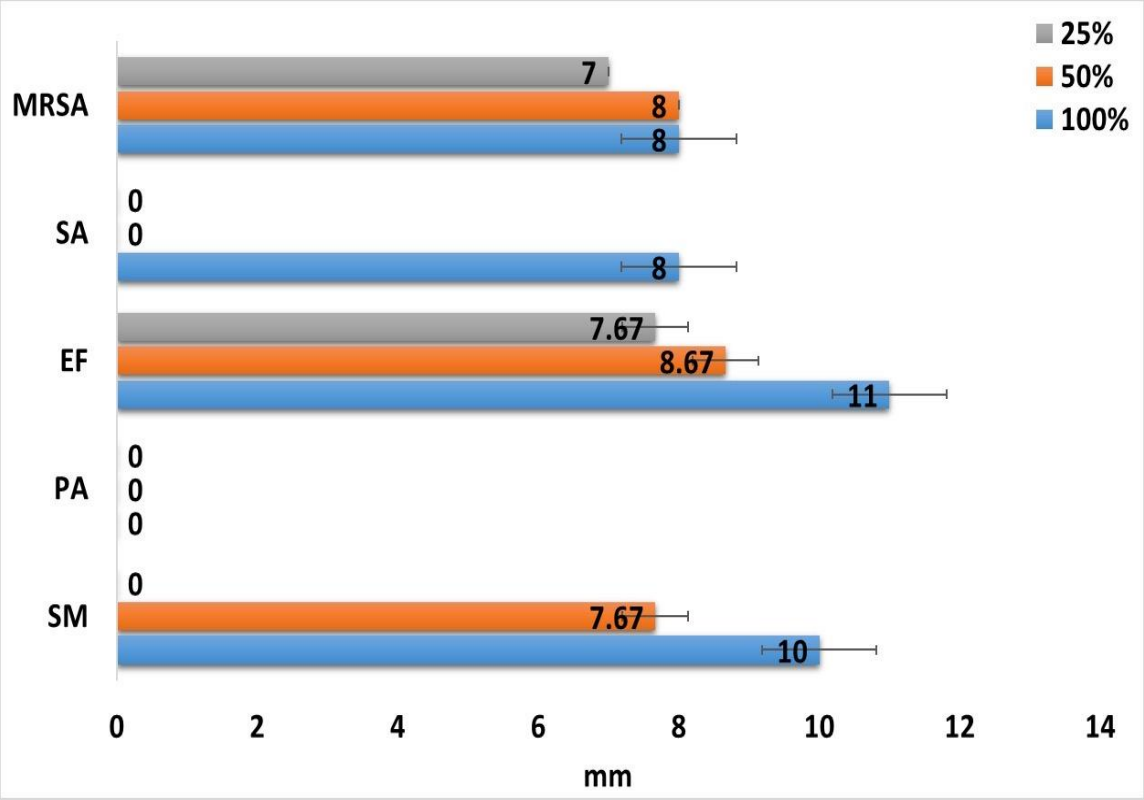

Fig. 2. The bar graph showing the antimicrobial activity of the resin extract in three different concentrations as zone of inhibition (mm).

Alkaloids, a different resin component, have also been connected to antibacterial properties. Several investigations have demonstrated that these nitrogenous substances prevent the growth of fungus and bacteria. Understanding the particular alkaloids found in jackfruit resin and how they impact different microbes is essential to understanding its antimicrobial efficacy [10]. Tannins, a well-known substance for their ability to precipitate proteins, are most likely responsible for the resin's antibacterial qualities. Tannins bind to microbial proteins and cause structural damage to cells, blocking essential cellular functions. It is essential to thoroughly investigate the phytochemical profile of jackfruit resin since the kind and number of tannins it contains can affect how effective it is against specific microbes [11].

An orchid called *Vanilla planifolia* that exhibits the presence of vital anti-microbial chemicals, indicating that it is a strong, promising dental biomaterial that has a favorable and advantageous impact on the oral microenvironment [12]. While the antibacterial activity of jackfruit resin is intriguing and opens up possibilities for pharmaceutical uses, other areas still require research. The yield of bioactive chemicals from the resin must be increased by optimizing the extraction process in order to fully exploit its medicinal potential. Moreover, thorough toxicity investigations are required to ensure the security of its application in

therapeutic contexts [13]. By providing a compelling subject for comparison with other resinous compounds, the antibacterial activity of *A. heterophyllus* resin sheds light on the special qualities and possible uses of this natural product. One noteworthy analogy is with the resins of *Boswellia serrata*, or frankincense, and *Commiphora wightii* [14]. Jackfruit is the source of *A. heterophyllus* resin, which exhibits broad-spectrum antibacterial action against a variety of bacteria and fungus. Its efficacy is attributed to the phytochemical content of it, which includes tannins, alkaloids, and flavonoids. Boswellic acids, on the other hand, are responsible for the well-known anti-inflammatory and anti-arthritic qualities of *B. serrata* resin. Although Boswellia serrata has demonstrated some antibacterial activity, *A. heterophyllus* resin has been investigated in this area more thoroughly [15]. In contrast, Ayurvedic medicine has long utilized *C. wightii* resin due to its antibacterial and anti-inflammatory qualities. Guggulsterones, which have been linked to cholesterol-lowering properties, are present in the resin. Although *A. heterophyllus* and *C. wightii* resins are both antibacterial, their individual bioactive ingredients and modes of action may be different [16]. Because of its varied phytochemical makeup, *A. heterophyllus* resin appears to have a unique antibacterial profile in comparison. For example, jackfruit resin's flavonoids may help break down microbial cell membranes, setting it apart from resins like *B. serrata*, which are dependent on boswellic acids to function [17].

Ocimum sanctum L. (Tulsi) plant extract illustrates antimicrobial efficacy against anaerobic oral microbes. *O. sanctum* L. (tulsi) shown effective antibacterial activity against anaerobic oral microorganisms, suggesting that it could be a useful and common addition for the management of periodontal diseases [18]. It is important to remember that the antibacterial activity of resins varies depending on the particular strains of microorganisms examined, concentration, and extraction techniques. The efficacy of *A. heterophyllus* resin against various bacteria suggests its potential for diverse uses [19]. Although resins from *B. serrata* and *C. wightii* are widely used in traditional medicine, *A. heterophyllus* resin has the potential to be used in novel ways, particularly in the fight against microbial diseases. The comparative analysis highlights the necessity of additional investigation to clarify the precise mechanisms of action, enhance extraction techniques, and investigate synergy with currently available antimicrobial drugs [20]. Copper nanoparticles supplemented with *Vernonia amygdalina* have strong antibacterial activity against oral pathogens [21].

The broad-spectrum effects and varied phytochemical makeup of *A. heterophyllus* resin make it stand out for its antibacterial activities. Similarities with resins such as *C. wightii* and *B. serrata* draw attention to the distinctive qualities of each and emphasize the need for focused

research to fully realize their therapeutic potential. These comparative studies add to our understanding of natural products and their uses in medicine and healthcare as the area develops [22]. Nevertheless, ginger (*Zingiber officinale*)-derived copper nanoparticles demonstrated a maximal inhibitory zone against oral infections [23]. When the nanoparticle is made from tulsi and turmeric, it also has antifungal properties at the same time [24]. It was also discovered that the coconut oil inhibited *Candida albicans* [25].

Conclusion

A. heterophyllus resin extract's antibacterial activity highlights the plant's potential as a natural antimicrobial agent. Optimizing extraction methods to increase the yields of bioactive compounds should be the main emphasis of future research.

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