

Antimicrobial Activity of Whole Plant Extract of *Ipomoea Palmata* (L.)

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Abstract—Novel therapeutic compounds derived from traditional medicinal flora must be identified and validated immediately because to the growing worldwide concern about antibiotic resistance. In this work, the agar diffusion method was used to investigate the antibacterial activity of several solvent extracts of *Ipomoea palmata* against *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*. Among all the examined species, *Ipomoea palmata*'s 50% ethanolic extract showed the strongest antibacterial activity. Using the agar diffusion technique, several solvent extracts of *Ipomoea palmata* were evaluated for antibacterial activity against *Escherichia coli* (90 µg/ml), *Staphylococcus aureus* (68 µg/ml), and *Pseudomonas aeruginosa* (102 µg/ml), and they shown significant action. Out of all the examined species, *Ipomoea palmata*'s 50% ethanolic extract showed the strongest antibacterial activity. Gentamicin, a common antibacterial drug, was used to compare the outcomes.

Index Terms—*Ipomoea palmata*, whole plant, antibacterial activity, agar diffusion method etc.

I. INTRODUCTION

The effectiveness of traditional pharmacological treatments has been severely hampered by the frequency of multidrug-resistant bacteria, especially those included in the ESKAPEE group. Because phytochemicals have multitarget antimicrobial actions that may affect vital bacterial cellular functions, this crisis has forced a paradigm shift toward natural products. In particular, *Ipomoea palmata* produces secondary metabolites in response to environmental stress, which provide as a sustained source of bioactive substances that might get beyond plasmid-mediated resistance mechanisms (Thara & Kasirajan, 2026). Even though these botanical resources have a wide range of pharmacological potential, current research often has methodological flaws that make it difficult

to use laboratory results in clinical settings (Eloff, 2019). In order to help standardise natural antimicrobial treatments, this work attempts to methodically assess the antibacterial properties of *Ipomoea palmata* methanolic extracts. To ascertain these extracts' minimal inhibitory concentration and wider range of action, their effectiveness will be evaluated against a varied panel of clinical isolates (Panda et al., 2016; Soruba & Sathiya, 2024). Additionally, these crude extracts will undergo phytochemical profiling in order to identify the precise bioactive components that are in charge of the observed bactericidal or bacteriostatic events. This study bridges the gap between traditional ethnomedicinal knowledge and evidence-based pharmaceutical development by using rigorous microbiological testing and standardised extraction techniques (Mathur et al., 2013). The experimental design uses both disc diffusion and micro-dilution methods to measure inhibitory effectiveness against both Gram-positive and Gram-negative pathogenic pathogens in order to provide a thorough efficacy profile. According to Khare et al. (2021) and Konaté et al. (2012), this rigorous analytical methodology guarantees that the discovered compounds may be confirmed as viable options for alleviating the current microbial resistance threat.

Although *Ipomoea palmata*, a member of the Convolvulaceae family, has long been used for its many therapeutic uses, more empirical research is needed to confirm its unique phytochemical profile and mode of action against bacterial strains that are resistant to several drugs. Preliminary phytochemical screening is required to identify groups of secondary metabolites that are known to interfere with bacterial quorum sensing and signal transduction pathways, such as alkaloids, flavonoids, and phenols. According

to Bushra et al. (2025) and Suganya et al. (2022), these bioactive components provide a varied chemical basis for the development of alternative therapeutic agents that might effectively combat the survival strategies of infections resistant to multiple drugs. Such phytochemical variety has a crucial role in disrupting the formation of microbial cell walls and the permeability of membranes, possibly providing a strong means of overcoming existing resistance patterns. Additionally, as biofilm-associated illnesses often show increased resistance to traditional antibiotics, the synergistic potential of these metabolites to prevent biofilm formation in clinical isolates is still an important field for research (Khan et al., 2025). This work aims to connect certain secondary metabolites with the observed inhibitory zones against pathogenic bacterial growth by methodically cataloguing these phytochemical elements using sophisticated chromatographic methods. Methanol is used as the main solvent in the extraction process because it efficiently separates polar and moderately polar substances, such as terpenoids and polyphenols, which are often associated with strong antimicrobial bioactivity. The crude formulations will be put through well-agar diffusion tests after solvent extraction in order to identify the different zones of inhibition against certain bacterial and fungus strains. The potency of these extracts will then be measured using the minimum inhibitory concentration values, which will provide crucial information on their effectiveness against certain pathogens like *Staphylococcus aureus* and *Escherichia coli* (Onen, 2025). Furthermore, figuring out the minimal bactericidal concentrations will make it clear if the botanical preparations really kill bacteria or only stop them from growing (Voukeng et al., 2016).

II. METHODS AND MATERIAL

Plant material and procedure for making of plant extracts:

A taxonomist from Yeshwant Mahavidyalaya, Nanded-431602, Maharashtra, recognised and validated the plant *Ipomoea palmate*, which was collected from the Bhokar region, Dist. Nanded, Maharashtra. The whole *Ipomoea palmate* plant was harvested and let to dry in the shade. The dried stem bark was ground into a fine powder using a

combination grinder. Using the Soxhlet apparatus and a range of solvents, including 50% ethanol, chloroform, and petroleum ether, the plant's fine powder was extracted. The filtered extract was then concentrated and stored in a refrigerator for usage in a range of biological processes.

Test microorganisms:

The culture collection facility at S. R. T. M. University in Nanded, Maharashtra, provided the test microorganisms (*Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*) utilised in this investigation. The gathered bacterial cultures were incubated for 24 hours at 37°C after being periodically subcultured in nutrient broth.

Antimicrobial activity:

Ipomoea palmate solvent extracts were tested for antibacterial activity using the disc agar diffusion technique. Agar media are covered with a subcultured bacterial suspension prepared in nutrient broth. The antibacterial activity of the chosen plant was tested using a variety of concentrated extracts on a sterile paper disc (Bhandari et al., 2021). After the sample was added, the plates were left for an hour to allow the extract to spread. Following a 24-hour incubation period at 37°C in an incubator, the inhibitory zone was measured in millimetres (mm). For comparison, gentamycin was employed as a reference.

III. RESULTS AND DISCUSSION

Table 1 summarises the entire plant extract's antibacterial activity. In this work, the agar diffusion method was used to investigate the antibacterial activity of several solvent extracts of *Ipomoea palmate* against *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*. Among all the examined species, *Ipomoea palmate*'s 50% ethanolic extract showed the strongest antibacterial activity. Using the agar diffusion technique, several solvent extracts of *Ipomoea palmate* were evaluated for antibacterial activity against *Escherichia coli* (90 µg/ml), *Staphylococcus aureus* (68 µg/ml), and *Pseudomonas aeruginosa* (102 µg/ml), and they shown significant action. *Ipomoea palmate*'s chloroform extract shown antibacterial efficacy against *Pseudomonas aeruginosa* (210 µg/ml), *Staphylococcus aureus* (130 µg/ml), and *Escherichia coli* (178 µg/ml). *Ipomoea palmate*'s

petroleum ether extract shown antibacterial efficacy against *Pseudomonas aeruginosa* (239 µg/ml), *Staphylococcus aureus* (162 µg/ml), and *Escherichia coli* (240 µg/ml).

Because of its varied secondary metabolite profile, *Ipomoea palmata*, a species often used in ethnomedicine, is a viable target for such pharmacological study (Angelini, 2024; El-Saadony et al., 2025). In order to address the urgent demand for alternative antibacterial scaffolds in clinical medicine, this work assesses the phytochemical constituents' broad-spectrum inhibitory ability against key drug-resistant infections (Woo et al., 2023).

In order to address the urgent need for substitutes for traditional drugs that have been ineffective due to increasing microbial resistance, this study aims to assess the effectiveness of these bioactive components against clinically relevant infections (Chassagne et al., 2021; Dagne et al., 2025). In order to ascertain how *I. palmata*'s secondary metabolites, such as flavonoids and alkaloids, interact with microbial membranes and protein synthesis pathways to produce bactericidal effects, the research particularly investigates the phytochemical makeup of the plant.

The goal of the study is to provide a mechanistic foundation for the plant's therapeutic potential in the fight against strains that are resistant to many drugs by examining these molecular interactions (Arip et al., 2022; Kumaran et al., 2023). Additionally, the methodical extraction and characterisation of these phytochemicals may make it easier to find new anti-infectives with distinct, different modes of action. Important preclinical information on the extract's ability to neutralise drug-resistant organisms is provided by the experimental confirmation of these characteristics, which is evaluated by thorough in vitro and in vivo screening (Kriti, 2025). In the continuous endeavour to lessen the risks to public health presented by high-priority, multi-drug-resistant bacteria, our results add to the increasing amount of information that supports the use of plant-derived chemicals as practical substitutes (Jadimurthy et al., 2023; Subramani et al., 2017).

The approach used in this work quantifies the inhibitory capacity of *I. palmata* against particular clinical isolates by identifying zones of inhibition using standardised agar well diffusion experiments

(Khan et al., 2025). The extract's effectiveness against ESKAPE infections, which are often associated with serious clinical consequences, was then evaluated using the minimal inhibitory concentration values (Schultz et al., 2020). This methodical methodology not only measures the extract's ability to limit growth but also makes it easier to comprehend how it can affect the integrity of membranes and enzymatic processes in resistant bacterial populations (Shah, 2024). Finding these bioactive reservoirs is also a crucial tactic in combating the worldwide rise in hospital-acquired illnesses brought on by bacteria that evade conventional treatment measures (Bhatia et al., 2021; Khameneh et al., 2021).

This research explores the potential of *Ipomoea palmata* as a source of new bioactive chemicals capable of suppressing clinically important bacterial strains in light of the growing worldwide issue of antibiotic resistance. A leaf extract of *I. palmata* has been shown in earlier studies to inhibit *Staphylococcus aureus* and to contain a number of phenolic acids and flavonoids, which supports more study into the plant's antibacterial potential (Mira et al., 2025). Evidence from leaf preparations, however, does not demonstrate whether extracts from the whole plant have comparable efficacy or how different bacterial strains are affected by them.

IV. CONCLUSION

The transition from traditional ethnobotanical applications to rigorous contemporary clinical validation is made possible by the paradigm shift toward evidence-based phytomedicine. A multimodal strategy to combating infectious pathogens is provided by using these natural metabolites into treatment techniques, often by concurrently reducing microbial virulence and compromising membrane integrity. This gap may be filled by evaluating the whole plant extract, which will provide the groundwork for identifying active ingredients and determining their possible significance for next antimicrobial studies.

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Table 1. Antimicrobial activity of whole plant extract of *Ipomoea palmate*

Sr. No.	Microorganisms	Minimum inhibitory concentration (MIC) Whole plant extract of <i>Ipomoea palmate</i> in (µg/ml)			
		50 % Ethanol extracts	Chloroform extracts	Petroleum ether extracts	Gentamicin
1	<i>Escherichia coli</i>	90	178	240	45
2	<i>Staphylococcus aureus</i>	68	130	162	49
3	<i>Pseudomonas aeruginosa</i>	102	210	239	39