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A SYSTEMATIC REVIEW ON THE ANTIMICROBIAL ACTIVITY OF *PIPER BETEL* LINN. LEAVES

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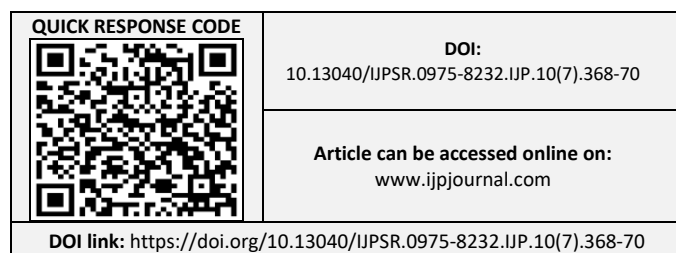
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ABSTRACT: *Piper betel* Linn (PBL) is a well-known medicinal plant used in traditional medicine for various ailments. The leaves of *P. betel* Linn have been reported to exhibit broad-spectrum antimicrobial activity against various pathogenic microorganisms. The major active compounds responsible for the antimicrobial activity of *P. betel* Linn are phenolics, alkaloids, terpenoids, and flavonoids. This review article summarizes the current knowledge on the antimicrobial activity of *P. betel* Linn leaf extracts against bacteria, fungi, viruses, and parasites. The article also discusses the major active compounds responsible for the antimicrobial activity of *P. betel* Linn and their mechanism of action. Further, the potential use of *P. betel* Linn as a natural antimicrobial agent to combat antimicrobial resistance (AMR) is discussed. The review highlights the need for further studies to evaluate the efficacy and safety of *P. betel* Linn extracts as a potential antimicrobial agent.

INTRODUCTION: Antimicrobial resistance (AMR) is a global public health threat that has led to the emergence of multidrug-resistant (MDR) microorganisms. Developing new antimicrobial agents is crucial to combat AMR and protect public health. Medicinal plants have been used for centuries in traditional medicine to treat various ailments, including infectious diseases. The leaves of *P. betel* Linn, a member of the Piperaceae family, have been used in traditional medicine for their antimicrobial, anti-inflammatory, and analgesic properties. *P. betel* Linn is a climbing vine widely distributed in Southeast Asia, India, and China.

The leaves of *P. betel* Linn contain various bioactive compounds, including phenolics, alkaloids, terpenoids, and flavonoids, which have been reported to exhibit antimicrobial activity against various pathogenic microorganisms.

Antibacterial Activity: *P. betel* Linn leaf extracts have been reported to exhibit antibacterial activity against various pathogenic bacteria, including *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi*, and *Pseudomonas aeruginosa*. The antibacterial activity of *P. betel* Linn is attributed to its phenolic and alkaloid content. The phenolic compounds present in *P. betel* Linn, such as eugenol and hydroxychavicol, have been reported to exhibit antibacterial activity by inhibiting bacterial growth and biofilm formation. The alkaloids present in *P. betel* Linn, such as piperine and pellitorine, have been reported to exhibit antibacterial activity by disrupting bacterial cell membrane and inhibiting bacterial growth.



Antifungal Activity: *P. betel* Linn leaf extracts have also exhibited antifungal activity against various pathogenic fungi, including *Candida albicans*, *Aspergillus niger*, and *Trichophyton mentagrophytes*. The antifungal activity of *P. betel* Linn is attributed to its phenolic and flavonoid content. The phenolic compounds present in PBL, such as eugenol and hydroxychavicol, have been reported to exhibit antifungal activity by inhibiting fungal growth and biofilm formation. The flavonoids in PBL, such as quinazoline and quercetin, have also been reported to exhibit antifungal activity by disrupting fungal cell membranes and inhibiting fungal growth.

Antiviral Activity: *P. betel* Linn leaf extracts have been reported to exhibit antiviral activity against various viruses, including herpes simplex virus (HSV), human immunodeficiency virus (HIV), and influenza virus. The antiviral activity of *P. betel* Linn is attributed to its phenolic and flavonoid content. The phenolic compounds present in *P. betel* BL, such as eugenol and hydroxychavicol, have been reported to exhibit antiviral activity by inhibiting viral replication and entry into host cells. The flavonoids in *P. betel* BL, such as quercetin and catechin, have also been reported to exhibit antiviral activity by inhibiting viral replication and entry into host cells.

Antiparasitic Activity: *P. betel* Linn leaf extracts have also been reported to exhibit antiparasitic activity against various parasites, including *Plasmodium falciparum*, *Trypanosoma cruzi*, and *Leishmania donovani*. The antiparasitic activity of *P. betel* Linn is attributed to its alkaloid and terpenoid content. The alkaloids present in *P. betel* BL, such as piperine and pellitorine, have been reported to exhibit antiparasitic activity by disrupting the parasite cell membrane and inhibiting parasite growth. The terpenoids in *P. betel* BL, such as β -caryophyllene and α -humulene, have also been reported to exhibit antiparasitic activity by disrupting parasite cell membranes and inhibiting parasite growth.

Mechanism of Action: The antimicrobial activity of *P. betel* Linn is attributed to the presence of various bioactive compounds, including phenolics, alkaloids, terpenoids, and flavonoids. These compounds have been reported to exhibit

antimicrobial activity by disrupting microbial cell membranes, inhibiting microbial growth, and inhibiting biofilm formation. The phenolic compounds present in PbBL, such as eugenol and hydroxychavicol, have been reported to exhibit antimicrobial activity by disrupting microbial cell membranes and inhibiting microbial growth. The alkaloids present in *P. betel* BL, such as piperine and pellitorine, have been reported to exhibit antimicrobial activity by disrupting microbial cell membranes and inhibiting microbial growth. The terpenoids present in *P. betel* BL, such as β -caryophyllene and α -humulene, have also exhibited antimicrobial activity by disrupting microbial cell membranes and inhibiting microbial growth.

Antimicrobial Resistance: Antimicrobial resistance (AMR) is a global public health threat that has led to the emergence of multidrug-resistant (MDR) microorganisms. Developing new antimicrobial agents is crucial to combat AMR and protect public health. *P. betel* Linn has been proposed as a potential natural antimicrobial agent to combat AMR due to its broad-spectrum antimicrobial activity and low toxicity. However, further studies are needed to evaluate the efficacy and safety of *P. betel* Linn extracts as a potential antimicrobial agent.

CONCLUSION: *P. betel* Linn is a well-known medicinal plant used in traditional medicine for various ailments. The leaves of *P. betel* Linn have been reported to exhibit broad-spectrum antimicrobial activity against various pathogenic microorganisms. The major active compounds responsible for the antimicrobial activity of *P. betel* Linn are phenolics, alkaloids, terpenoids, and flavonoids. The antimicrobial activity of *P. betel* Linn is attributed to the disruption of microbial cell membrane, inhibition of microbial growth, and inhibition of biofilm formation. In addition to its antimicrobial activity, *P. betel* Linn has also been reported to exhibit antiviral and antiparasitic activity.

The antimicrobial activity of *P. betel* Linn suggests its potential use as a natural antimicrobial agent to combat AMR. However, further studies are needed to evaluate the efficacy and safety of *P. betel* Linn extracts as a potential antimicrobial agent. Moreover, the development of standardized

protocols for extracting and characterizing active compounds from *P. betel* BL leaves is essential to ensure the reproducibility of results. In conclusion, the antimicrobial activity of *P. betel* Linn leaves highlights its potential use as a natural antimicrobial agent. Further studies are needed to evaluate its efficacy and safety and to develop standardized protocols for extracting and characterizing active compounds. Using *P. betel* Linn leaves combined with conventional antimicrobial agents may also provide a synergistic effect and reduce the emergence of AMR.

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