

POTENTIAL ANTIBACTERIAL EFFECT OF THE ESSENTIAL OIL FROM *Psidium cattleianum* SABINE (MYRTACEAE)

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ABSTRACT

Although significant advances have been made in the discovery of plant-derived antimicrobials, research investigating the pharmacological properties of regional products remains scarce, particularly regarding the antibacterial potential of *Psidium cattleianum*. Considering the ethnopharmacological use of this plant species for the treatment of respiratory tract diseases, and given that bacteria, along with viruses, constitute the etiological agents of many respiratory pathologies, this study aimed to investigate the antibacterial activity of the essential oil extracted from the aerial parts of this medicinal species. Microdilution broth tests were performed following Clinical and Laboratory Standards Institute (CLSI) recommendations, with modifications, against Gram-positive and Gram-negative microorganisms of four American Type Culture Collection (ATCC) standard strains. The results demonstrated that the essential oil from *Psidium cattleianum* exhibits potential antibacterial activity. While one *Escherichia coli* strain showed resistance, the oil exhibited weak antibacterial activity against *Pseudomonas aeruginosa* and moderate activity against *Staphylococcus aureus* and *S. epidermidis* strains. Although preliminary, this research may open perspectives for the development of effective phytotherapeutics for infectious disease treatment.

Keywords: Antibacterial activity; Essential oil; Myrtaceae; Biotechnology.

INTRODUCTION

One of the major advances in drug therapy has been the use of antimicrobials, both in outpatient settings and hospitals, significantly reducing the incidence of many infectious diseases. However, serious side effects of many of these substances and the emergence of multidrug-resistant microorganisms have driven research not only focused on the development of new antimicrobial agents but also on elucidating resistance mechanisms (ALVARENDA et al., 2015; CATTOIR; DAUREL, 2010; SAMY; GOPALAKRISHNAKONE, 2010).

The development of new antimicrobial agents has not kept pace with the speed at which microorganisms acquire resistance to available drugs. Knowledge of emerging bacterial resistance patterns has strongly impacted therapy, prompting

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changes in antimicrobial choice, dosage, and combination strategies. Antimicrobial resistance is associated with gene expression that encodes various biochemical mechanisms or target site modifications, ultimately leading to drug inactivation or inhibition. Resistance can be natural, acquired (mutations), or transferable (recombination processes) (BARROS; MACHADO; SPRINZ, 2001; TAVARES, 2019).

In this context, the development of new antimicrobial agents can benefit from research on natural products. Natural products are known for high structural diversity, biochemical specificity, and other molecular properties that make them favorable as lead compounds for new drug development (MARIATH et al., 2020).

The antibacterial activity of extracts and essential oils from medicinal plants has been widely observed in the literature. For example, *Vitex negundo* extract exhibited bactericidal effects against various pathogenic bacteria (KAMRUZZAMAN; BARI; FARUQUE, 2013). Essential oils from *Euphorbia macrorrhiza* showed strong inhibitory effects on *Staphylococcus aureus* (LIN et al., 2012). Chatterjee, Bhattacharjee, and Chandra (2011) reported antibacterial activity of a fraction isolated from *Vangueria spinosa* leaf extract against *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*. Essential oils from *Eucalyptus camaldulensis* and *Mentha spicata* acted against *Streptococcus mutans* and *S. pyogenes*, significantly interfering with biofilm formation (RASOOLI; SHAYEGH; ASTANEH, 2009).

Despite these advances in plant-derived antimicrobial discovery, research investigating the pharmacological properties of regional products remains scarce, particularly concerning the antibacterial potential of *Justicia pectoralis*. Considering its ethnopharmacological use for respiratory tract diseases (FONSECA, 2009; LINHARES, 2012), investigating its potential antimicrobial effect is essential, as bacteria, along with viruses, are major etiological agents of respiratory pathologies. Furthermore, exploring medicinal plants for treating infections caused by various microorganisms can support promising developments in pharmacological treatments for infectious diseases.

This study specifically aimed to evaluate the antibacterial activity of essential oil extracted from the aerial parts of *Psidium cattleianum*, commonly known as red guava,

against Gram-positive and Gram-negative ATCC standard strains, since various *Psidium* species have been studied worldwide, demonstrating diverse biological activities and highly interesting chemical constituents (CORRÊA, 2013; CORRÊA; ALCÂNTARA, 2012; VERDAM, 2009). The main objective was to provide insights for the development of bioproducts with antibiofilm potential.

METHODOLOGY

The plant material used for microbiological assays was obtained from collections at Parque da Serra dos Pireneus, Pirenópolis, Goiás, Brazil. The material was identified by Prof. Dr. Josana de Castro Peixoto and deposited in the herbarium of Universidade Estadual de Goiás. Essential oil extraction was performed in the Chemistry Laboratory of Universidade Evangélica de Goiás according to the Brazilian Pharmacopoeia standard methodology. The essential oil obtained from the aerial parts of *Psidium cattleianum* was subjected to antibacterial activity tests. Microdilution broth assays were conducted following CLSI recommendations, with modifications, for antimicrobial susceptibility testing of aerobic bacteria (CLSI M7-A6, 2010). Plate readings were performed using resazurin (7-hydroxy-3H-phenoxazin-3-one-10-oxide) as a visual indicator of bacterial viability (SARKER; NAHAR; KUMARASAMY, 2007) and as a redox colorimetric indicator (SALVAT; ANTONNACCI; FORTUNATO, 2001). All assays were conducted in triplicate within a laminar flow chamber to prevent contamination.

RESULTS

The results for the viability test, used as a control for the microbiological assay technique with chloramphenicol, are highlighted in Table 1.

Tabela 1. Concentração Mínima Inibitória - CMI ($\mu\text{g mL}^{-1}$) do antitibiótico cloranfenicol frente a bactérias Gram-positivas e Gram-negativas das cepas ATCC testadas.

BACTÉRIAS TESTADAS	Cloranfenicol ($\mu\text{g mL}^{-1}$)
<i>Staphylococcus aureus</i> ATCC 25923	2
<i>Staphylococcus epidermidis</i> ATCC 12228	2

<i>Escherichia coli</i> ATCC 25312	2
<i>Pseudomonas aeruginosa</i> ATCC 27853	2

CONCLUSION

It can be concluded that the essential oil from the leaves of *Psidium cattleianum* has antibacterial potential, despite the low susceptibility of one *Escherichia coli* strain and the weak activity against *Pseudomonas aeruginosa*. The oil showed moderate activity against *Staphylococcus aureus* and *S. epidermidis*. Further studies are suggested using different concentrations, extract forms, and a broader spectrum of microorganisms, as well as toxicological studies to ensure safe use.

Although preliminary, this work may open perspectives for the development of an effective and low-cost phytotherapeutic product, which could be used in the treatment of infectious diseases as an alternative to synthetic antibiotics, with potential applications in biofilm testing.

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