

EVALUATION OF THE ANTIBIOTIC ACTIVITY OF METHANOLIC AND HEXANIC EXTRACTS OF IPÊ-ROXO (HANDROANTUS IMPETIGINOSUS) ON DIFFERENT BACTERIA

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ABSTRACT

Antimicrobial resistance is currently increasing, and based on this, as well as on the characteristics of Ipê-roxo (*Handroanthus impetiginosus*), popularly known for its medicinal properties, the present study aimed to evaluate the antibiotic activity of hexane and methanol extracts of the plant against bacteria. In the study, in vitro tests were performed using the microdilution technique to determine the Minimum Inhibitory Concentration (MIC) of the extracts, followed by in vivo analyses in larvae. The results indicated that the methanol and hexane extracts were effective against Gram-positive bacteria such as *Streptococcus agalactiae* and *Staphylococcus aureus*, but ineffective against Gram-negative bacteria such as *Escherichia coli* and *Klebsiella pneumoniae*. In vivo tests confirmed the in vitro efficacy of the extracts, although without statistical significance. This study suggests that extracts of Ipê-Roxo may be potential candidates for the development of new antibiotics against infections caused by Gram-positive bacteria, highlighting the need for further research to validate these findings.

Keywords: ipê-roxo; purple ipê; antibiotic activity; antimicrobial resistance.

INTRODUCTION

Antimicrobials are drugs that contribute to the death or inhibition of the growth of various bacteria. However, the indiscriminate use of these substances over time has strongly influenced the development of the phenomenon known as antibacterial resistance, a major problem from a clinical and public health perspective (Pan American Health Organization, 2024).

Thus, alternatives to these drugs are being sought in an attempt to overcome growing antimicrobial resistance. Among these alternatives, the use of herbal medicines, such as Ipê Roxo (*Handroanthus impetiginosus*), collected in various regions of Brazil, stands out due to its history of popular use in infectious and inflammatory processes (SOUSA, 2017).

H. impetiginosus is a plant with a broad spectrum of secondary metabolites with clinical applications, presenting antioxidant, antiviral, antibiotic, bactericidal, healing,

antifungal, and antineoplastic activities (SANTOS; OLIVEIRA, 2024). Therefore, considering the various benefits of this plant in the context of the current scenario of antimicrobial resistance, the present study aimed to evaluate the antibiotic activity of methanolic and hexane extracts of Ipê-roxo (*Handroanthus impetiginosus*).

METHODOLOGY

A qualitative and quantitative experimental study was conducted to evaluate the antimicrobial activity of an extract obtained from the inner bark of *H. impetiginosus*. The dried chips were macerated, stored in ethanol at 4°C, filtered, dried, and stored in an amber bottle.

In vitro antimicrobial tests were conducted using strains of *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Salmonella typhimurium*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Proteus mirabilis*, and *Streptococcus agalactiae*. The bacteria were cultured in Mueller-Hinton agar and subjected to microdilution in plates according to CLSI M7-A6, with an initial extract concentration of 3120 ppm. Antimicrobial activity was verified by the colorimetric method with resazurin.

After the *in vitro* results, *in vivo* experiments were performed with the bacteria inhibited by the extract *in vitro*. *Tenebrio molitor* larvae were infected with pathogens previously washed and suspended in phosphate-buffered saline (PBS). A control group received PBS and the infected group received the bacterial suspension. Larval mortality was monitored to determine the efficacy of the extract, with experiments performed in duplicate, each with 25 larvae. Larval survival was analyzed and represented in survival curves.

RESULTS

The antimicrobial activity of *H. impetiginosus* extracts was initially evaluated using the microdilution plate technique, in which microorganisms were exposed to the extracts in question to determine the Minimum Inhibitory Concentration (MIC). After this evaluation, *in vivo* tests were performed.

Table 1. Determination of MIC (in mg/mL) of purple ipê against methanolic and hexane extracts

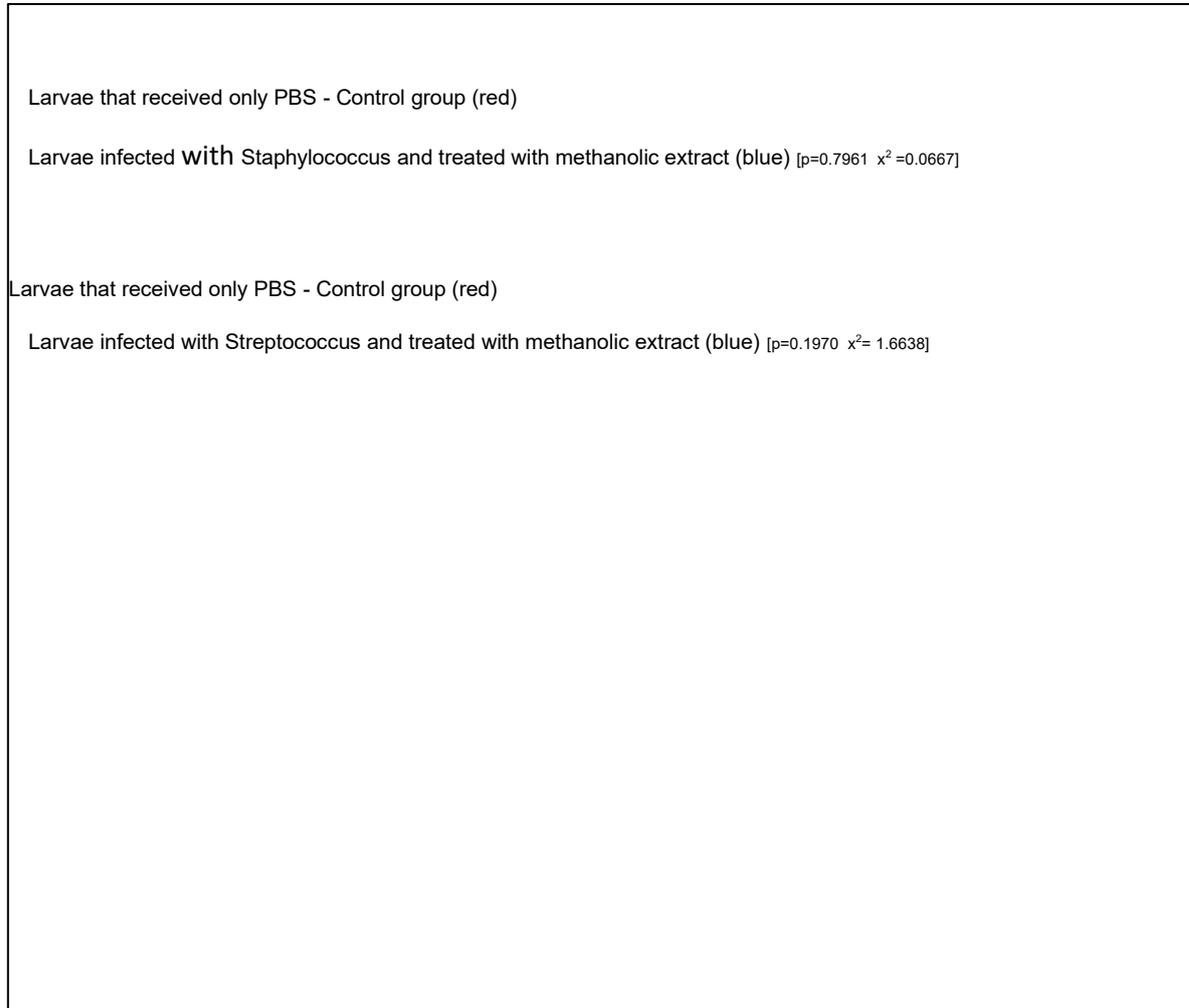
	Methanol extract:		Hexane extract:	
	Experiment 1	Experiment 2	Experiment 1	Experiment 2
<i>Streptococcus agalactiae</i>	0.125	0.125	0.062	0
<i>Streptococcus pyogenes</i>	0.03125	0.015625	0.125	0.125
<i>Staphylococcus aureus</i>	0.0625	0	0	0
<i>Enterococcus faecalis</i>	0.25	0	0.25	0.25
<i>Escherichia coli</i>	No inhibition	No inhibition	No inhibition	No inhibition
<i>Klebsiella pneumoniae</i>	No inhibition	No inhibition	No inhibition	No inhibition
<i>Pseudomonas aeruginosa</i>	No inhibition	No inhibition	0.25	1
<i>Salmonella typhimurium</i>	No inhibition	No inhibition	1	0.5

Source: Author's own work.

The table above (Table 1) presents the results of antimicrobial activity tests using methanolic and hexanic extracts of *H. impetiginosus* against various bacterial strains. The results are presented as MIC in mg/mL for two experiments of each extract. As shown in the table, *S. agalactiae*, *S. pyogenes*, *S. aureus*, and *E. faecalis* (gram-positive bacteria) showed some sensitivity to the methanolic extract, with different MIC values, meaning that the extract was able to inhibit their growth at specific concentrations. On the other hand, the microorganisms *E. coli*, *K. pneumoniae*, *P. aeruginosa*, and *S. typhimurium* (gram-negative bacteria) did not show inhibition, suggesting that the methanolic extract of *H. impetiginosus* was not effective against these pathogens.

In the *in vivo* analysis (Figure 1), the effectiveness of the methanolic extract was evaluated based on the results obtained *in vitro*, according to which only Gram-positive bacteria were inhibited. These results were also reproduced *in vivo*. However, there was no statistical significance in either the *Staphylococcus* analysis ($p=0.7961$) or the *Streptococcus* analysis ($p=0.1970$).

Figure 1. Survival analysis of larvae that received PBS (Group 1) and methanolic extract (Group 3)



Source: Author's own work.

CONCLUSION

The methanolic and hexane extracts of *H. impetiginosus* demonstrated some antibacterial efficacy against Gram-positive strains, such as *S. agalactiae* and *S. aureus*, although not statistically significant. However, the extracts did not show activity against Gram-negative bacteria, such as *E. coli* and *K. pneumoniae*. The results suggest that Ipê-Roxo may be a promising source of antibiotic compounds, especially against Gram-positive bacterial infections, but further research is needed to explore its full therapeutic potential and clinical applications.

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