

Allelopathic potential of *Baccharis salicifolia* against *Staphylococcus aureus*

Abstract

Baccharis salicifolia is a species that has been shown to have significant bioactivities; several species of this genus are used in the popular medicine like diuretic, digestive and antifungal; however, there are few studies on the composition and active compounds of *Baccharis*. Allelopathic potential of ethanolic fractions of *B. salicifolia* was evaluated on antimicrobial activity against *Staphylococcus aureus*. The antibacterial activity of the *B. salicifolia* ethanolic extract on *S. aureus* was evaluated by the disc method and the bioguide fractionation by Thin Layer Chromatography (CCF) and Chromatography in Column (CC). The results showed that inhibition exists in the various fractions of the ethanolic extract (between 50-80% respectively) with respect to the positive control; The fractionation by CCF and with CC, allowed to evaluate 10 ethanolic fractions which possess the metabolites responsible for the antibacterial activity on *S. aureus*.

Keywords: antibacterial activity, *Baccharis salicifolia*, ethanolic extract, *Staphylococcus aureus*

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Introduction

Allelopathic plants are known to produce compounds that may influence stimulating or inhibiting different biological processes of other organisms.¹ It has been suggested that allelopathy is an important factor in regulating the structure of plant communities and the speed of growth of plants in the field.² This allelopathic function has been attributed to several flavonoids, phenolic and terpenoid structures.³ The allelopathic potential of plants can be used as a bactericide, fungicide, herbicide, insecticide, among others; and one of the applications that have taken relevance in recent years is the use of compounds from these plants for the control of foodborne diseases.⁴ A large variety of microorganisms can lead to food spoilage including *Escherichia coli*, *Klebsiella pneumoniae*, *Listeria monocytogenes*, *Salmonella sp.*, *Bacillus cereus* and *Staphylococcus aureus*.^{5,6} Some plant species with allelopathic properties have shown, through different extracts, activity against enteropathogenic organisms. Some plant extracts prove to be an alternative for the control of pathogenic bacteria with resistance to conventional drugs.⁷

Baccharis salicifolia L. is a member of the Asteraceae family and has several species that have already been reported in the treatment of some human diseases in traditional medicine.⁸ Studies accomplished on the chemical composition of different species of the genus, shown the presence of numerous secondary metabolites such as diterpenoids and flavonoids.⁹ In the present work, the fractions of the ethanolic extract of *Baccharis salicifolia* were evaluated for allelopathic potential and its effect against *S. aureus* microorganism. Chromatographic fractions were obtained from conventional methods of separation of chemical compounds such as thin layer chromatography (TLC) and column chromatography (CC).

Methodology

The extract was obtained from 10 g of dry and ground *B. salicifolia* leaves with 125ml ethanol in a Soxhlet apparatus for 5 h. Subsequently it was evaporated to dryness using a vacuum rotary evaporator and the sample was stored in amber flasks at -20°C. The ethanolic extract was fractionated by column chromatography (CC) with 35-70 mesh silica

gel (210.7560g), on a 2.5×10cm column. The solvent system used was of ascending polarity: chloroform, ethyl acetate and acetone, (1:1:1). The total of fractions collected were 10 which were enumerated from 1 to 10. Obtained fractions were stored at low temperatures.¹⁰

Evaluation of antibacterial activity

Bacterial strain *Staphylococcus aureus* (strain 921) isolated was obtained from the collection of the Microbiology Department of the Chemical Sciences Faculty of Universidad Autónoma de Puebla (BUAP), Mexico. Antibacterial activity of the fractions was evaluated using the disc method, for which the strain was inoculated at a concentration of 1.5×10⁸ cells/mL, corresponding to tube 0.5 of McFarland Nephelometer. Mueller Hinton agar plates were placed on Whatman#3 filter paper with 20µL of each fraction, using Vancomycin as positive control and two negative controls, sterile water and solvent. Plates were incubated at 37°C for 24h, and size of the inhibition halos was measured after this time. To determine the inhibition percent, the was that applied by Martínez.¹¹ At least three repetitions were run for each assay.

Results and discussion

The results of the biological activity of ethanolic extract fractions against *S. aureus* are reported in Figure 1, where it can be observed that the first four fractions (1, 2, 3, and 4) did not show inhibition activity on the microorganism at 24h. However, the following fractions (5 to 10) have antibacterial activity in the different percentages ranging from 52.5-85%. Fraction 10 showed the highest bioactivity of inhibition (85%) on the target organism, compared to the other fractions 5-9 and the control treatment (conventional chemical bactericide). This shows that the fractions with higher polarity present greater bactericidal activity, which indicates the presence of possible biologically active polar compounds of *B. salicifolia* against *S. aureus* microorganism. The results obtained are correlated with previous studies, which also demonstrate the antibacterial activity of *B. salicifolia* on *Staphylococcus aureus*.¹² However, Carrizo et al.⁵ shows that oily extracts of *B. salicifolia* had activity on *Staphylococcus aureus*, *Listeria monocytogenes* and *Bacillus cereus*. This diverse activity

in the extracts can be due to the diverse chemical compounds that have been found and analyzed in some species of the genus *Baccharis* like *B. glutinosa*, *B. salicifolia* and *B. genistelloides*, emphasizing the presence of flavonoids, terpenes and steroids, substances reductants, lactones and coumarins. The metabolites present in the genus *Baccharis* that have been attributed with various biological activities and properties are mainly flavonoids of the flavanone and flavone type; the kaurane nucleus diterpenes, cleorodans and labdano.¹³

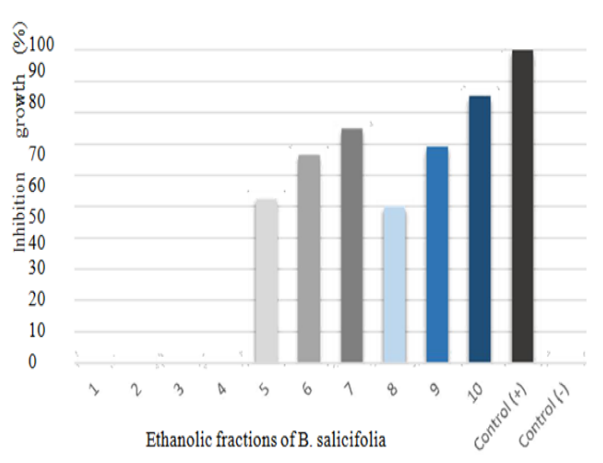


Figure 1 Percentage inhibition of the antibacterial activity of the various ethanolic extract fractions of *B. salicifolia* against *S. aureus* at 24h.

In *B. salicifolia* at least five flavonoids have been isolated in organic extracts with methylene chloride.¹⁴ Analyzing the chromatographic profiles obtained in this work, we consider that these types of compounds are responsible for the antibacterial activity. According to our results, *B. salicifolia* possesses the potential to inhibit the growth of resistant microorganisms overcoming the effect of some conventional drugs.

Conclusion

Ethanolic fractions obtained from *Baccharis salicifolia* report antibacterial activity, finding that the fraction 10 was the one of greater growth inhibition activity against *S. aureus*, compared to the positive control treatment. These data demonstrate that it would be interesting for future investigations the discovery of new allelopathic compounds with antibacterial potential.

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None.

Conflict of interest

The authors declare there is no conflict of interest.

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