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ABSTRACT

Recently, many studies reported a worrying increase in the emergence of antibiotic-resistant bacteria. In Mexico, the appearance of several cephalosporins and ciprofloxacin-resistant strains in hospitals was reported. A pharmacological alternative is a traditional medicine using plant extracts. The prime objective of this study was to evaluate the antimicrobial activity of eight plants used commonly in Mexican traditional medicine against some of the primary nosocomial bacterial diseases. Our results showed that all studied plants impair *Clostridium difficile* growth. Among these, rosemary, mint and estafiate possess high antimicrobial properties impairing membrane permeability and macromolecular synthesis.

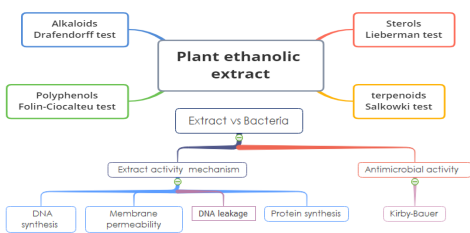
INTRODUCTION

Antibiotic resistance is a global threat according to the World Health Organization. Fecal pollution, medical abuse of antibiotics and pharmaceutical untreated wastewater induces antibiotic resistance¹. A retrospective study in 47 health centers from 20 states in Mexico shown that a 12.5% of Klebsiella strains and a 40% of Pseudomonas strains were carbapenem and TZP resistant, 20% of S. aureus strains were methicillin or vancomycin resistant strains². *Clostridium difficile* is the leading cause of health care associated diarrhea and causes severe disease complications such as pseudomembranous colitis, toxic megacolon and death³. Mexican folk medicine include several plants with antibiotic activity. These plants contains phytochemical compounds with antimicrobial activity; polyphenols as rosmarinic acid and terpenoids as eugenol, geraniol and thymol⁴. These compounds show intrinsic antibacterial activity inducing damage to bacterial cell membrane, inhibiting DNA and protein synthesis and inhibiting efflux pumps⁵. Among traditional medicine plants, Wormwood (*Artemisia absinthium*), Estafiate (*Artemisia ludoviciana*), Epazote (*Dysphania ambrosioides*), Mint (*Mentha piperita*), Toloache (*Datura ferox*), Rosemary (*Rosmarinus officinalis*) and Rue (*Ruta graveolans*) shown antimicrobial activity on some reference bacteria strains, however, antimicrobial activity on clinical strains or their action mechanism has not been shown.

OBJECTIVES

- ⇒ Evaluate the antimicrobial activity *in vitro* of ethanolic extract from various plants used in Mexican traditional medicine.
- ⇒ Elucidate phytochemical profile of plant extracts
- ⇒ Characterize the antibacterial mechanisms of plant extracts.

METHODS



RESULTS

TABLE. 1 Phytochemical profile of ethanolic plant extract

Plant	Alkaloids	Sterols	Terpenoids	Polyphenols
<i>Artemisia absinthium</i>	-	+	+	-
<i>Artemisia ludoviciana</i>	+	-	-	+
<i>Datura ferox</i>	+	-	+	+
<i>Dysphania ambrosioides</i>	+	-	+	-
<i>Mentha piperita</i>	-	-	-	+
<i>Rosmarinus officinalis</i>	+	+	-	+
<i>Ruta graveolans</i>	+	+	+	+
<i>Thymus vulgaris</i>	+	-	+	+

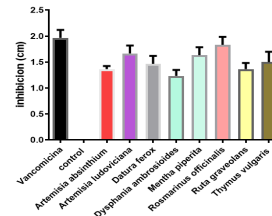


Fig. 1 Antimicrobial activity of studied plant extracts

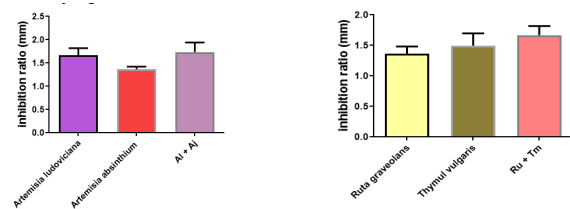


Fig. 2 Synergic effect in *C. difficile*

TABLE.2 Plant extracts antibacterial mechanism on *C. difficile*

	DNA leakage	Membrane permeability	DNA synthesis	Protein synthesis
<i>Artemisia absinthium</i>	-	-	-	-
<i>Artemisia ludoviciana</i>	-	-	-	✓
<i>Datura ferox</i>	-	-	-	-
<i>Dysphania ambrosioides</i>	-	✓	✓	-
<i>Mentha piperita</i>	-	-	-	✓
<i>Rosmarinus officinalis</i>	-	-	✓	-
<i>Ruta graveolans</i>	✓	-	-	-
<i>Thymus vulgaris</i>	-	✓	-	-

CONCLUSIONS

- ⇒ Ethanolic extract of studied plants has antimicrobial activity on clinical and reference bacterial strains
- ⇒ *Artemisia ludoviciana*, *Thymus vulgaris* and *Mentha piperita* shown higher antimicrobial activity on studied strains .
- ⇒ Plant extracts induces membrane permeabilization on *C. difficile*.

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