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Research Article

Investigation of *in vitro* antifungal activity of *Salicornia iranica* Akhani

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Abstract

Salicornia is one of the halophyte plants that grow in salt marshes and beaches. The aim of the present study is to evaluate the *in vitro* antifungal activity of *Salicornia iranica*, an endemic species of Iran, in two fungal species, including *Aspergillus niger* and *Candida albicans*. For this purpose, *S. iranica* 70% of ethanolic extract was prepared and mixed in plates with agar medium containing *A. niger* and *C. albicans* separately and allowed to gelatinize. Fungal samples were placed on each plate by the sampler. After absorption of microbial suspension into the agar plates, all of them were incubated at 25 °C for 72 hours. The results showed that *S. iranica* has no inhibitory effect on tested fungi. Since the antimicrobial activity of *Salicornia* have been attributed to fatty acid methyl esters, negative antifungal activity may be due to the lack of this compound in ethanolic extract, degradation of them through extraction, or the resistance of tested fungal species to the related compounds.

Keywords: *Salicornia Iranica*, Antifungal Activity, Ethanolic Extract, *Aspergillus Niger*, *Candida Albicans*

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1. INTRODUCTION

Salicornia from the family Chenopodiaceae is one of the halophyte plants that grow in salt marshes and beaches. This is an annual herbaceous plant native to North America, Europe, South Africa, and South Asia. In Iran, it naturally grows in salt marshes of Khuzestan, Shiraz, Yazd, Ghom, Isfahan and Bushehr [1]. Studies on this plant showed that it can improve agricultural irrigation with seawater. *Salicornia* cultivation coastal and irrigation with salt water is possible [2].

Salicornia has an economic, agronomic and therapeutic properties including antioxidant, anti-inflammatory, immunization, anti-hyperglycemia, and hyperlipidemia, and also it has the ability to generate a significant amount of forage, and the ability of lysis oil pollution from soil [3], [4], [5], [6]. Positive reports exist about the antibacterial effects of *Salicornia iranica*, but there is no research about the antifungal activity of this plant.

The aim of the present study is to evaluate the *in vitro* antifungal activity of *S. iranica*, an endemic species of Iran, in two fungal species including *Aspergillus niger* and *C. albicans.*

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2. METHODS

2.1 Plant Material

The shoots of *S. iranica* were collected from Arsanjan Saline water channel in Fars province in 1390. The plants were dried in the shade for a week and then stored in sealed containers. Dried plants have been prepared by agricultural biotechnology branch of Shiraz University.

2.2 Extraction Methods

65 g powder of dried plant with 1000 ml of 70% ethanol was extracted by percolation method at room temperature for 24 hours. The obtained extract was separated by No.1 Whatman paper, and Sediment was extracted again under the same conditions. After mixing the filtered extracts, the solvent was evaporated at below 40 °C, by using a vacuum oven, and the extract was concentrated as much as possible. The resulting matter dried and weighed to determine the efficiency of extraction. Extraction efficiency was obtained by dividing the weight of dry extract on weight of plant powder. By this method, the extraction efficiency was determined as 52%.

2.3 Preparation of Fungi

A. niger and *C. albicans* at Strains, prepared from Microbial Control Laboratory of Food and Drug Control branch of Faculty of Pharmacy, Tehran University of Medical Sciences, as frozen Shape. Then the strains above were cultured on sabouraud dextrose agar medium, in four regions, and incubated for 72 hours at 25 °C. After the appearance of colonies, a single colony was taken for testing microbial subcultures.

2.4 Microbial Suspension Preparation

Some colonies of *A. niger* and *C. albicans* were separately removed by sterile lobes and distributed by vortex in physiologic serum with Tween 80 to prepare microbial suspensions samples. Then, the total number of microorganisms present in the suspension was determined by pour plate method.

2.5 Assessing the Effect of S. iranica Extract with Agar Dilution Method

In this method, 2 g of the dried extract were dissolved in 4 ml of ethanol, and mixed in plates with 10 ml of agar medium containing *A. niger* and *C. albicans* separately, and allowed to gelatinize. After the medium was gelatinized, 5 µl of each bacterial sample was placed on each plate by the sampler. With the volume of 5 µl of microbial suspensions, number of 1.5×10^5 µg was transferred. After absorption of microbial suspension into the agar plates, all of them were incubated at 25 °C for 72 hours.

3. RESULTS

After 72 hours at 25° C, on the medium containing *A. niger*, strands of hyphae formed. Therefore, *S. iranica* had no inhibition effect on this fungus. Also, after 72 hours of incubation of *C. albicans* samples, fungal colonies were detected on the medium, and it was determined that *S. iranica* could not prevent the growth of this fungus.

4. DISCUSSION

Public attention to reduce the use of pesticides has made researchers to seek more natural and environmentally compounds that have high performance with less remaining in foods. Plants naturally produced over thousands of low molecular weight secondary metabolites, that many of them are effective in plant defense against pests and diseases [4], [7], [8]. Essential oils and plant extracts containing compounds with different biological activities, including their antimicrobial properties. In this context, many researchers have studied on the effects of antibacterial, antifungal and insecticide essential of oils and plant extracts [2], [7], [8], [9], [10].

In the present study, fungal growth and colony formation revealed that *S. iranica* had no inhibitory effect on the growth of *A. niger* and *C. albicans*. They have several reports about the antimicrobial activity of other *Salicornia* species. *Salicornia brachiata* showed an antifungal effect on the species of *Aspergillus japonicus*, whereas the two other

species *Aspergillus* have not been affected [3]. The efficacy of *S. brachiata* was evaluated against *Macrophomina phaseolina* the incitant of the dry root of black gram. Aqueous extract of the plant resulted in complete inhibition of the pathogen and were on par with carbendazim [11]. Methanolic extract of leaves was more active than the aqueous extracts against *Bacillus subtilis*, *Bacillus pumilus*, *Micrococcus luteus*, and *Staphylococcus aureus* [12].

It seems that fatty acid methyl esters are active metabolites in *Salicornia* species that responsible for their antifungal activity [13]. One of the possible reasons for negative antifungal activity may be the lack of fatty acid methyl esters in the extractor degradation of these compounds through extraction. Another is the resistance of tested fungal species against these compounds.

Therefore, it can be concluded that the effect of extracts depends on species of plant and species of the host, so it could be possible to observe different effects on various Bacteria or fungi.

6. Conflict of Interests

Authors have no conflict of interests.

7. Acknowledgments

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