

## Assessment of Antifungal Properties of the Exudate Gel from the Stem of *Caralluma retrospiciens* Against Clinical Isolate of *Candida albicans*

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### Abstract

The desert plant *C. retrospiciens* (Ehrenb.) is an inhabitant of the southern region of Kingdom of Saudi Arabia (KSA). The stem of *C. retrospiciens* produces a gel which is often applied by local people to cure wounds. This study was aimed at determination of the antifungal effect of the exudate gel (EG) against *Candida albicans* (*C. albicans*). The antifungal activity of EG was measured using agar well diffusion method. Results showed excellent antifungal activity of the exudate gel. The spectrum of antifungal activity of EG against *C. albicans* was almost equivalent to that of standard amphotericin B, with statistical insignificance ( $p < 0.05$ ).

**Keywords:** Desert plants; *Caralluma retrospiciens*; Stem; Exudate gel; Anti-fungal; *Candida albicans*.

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### INTRODUCTION

The succulent taxon *Caralluma retrospiciens* (Ehrenb.) which belongs to the family *Apocynaceae*, is dispersed throughout the world's desert regions. It is widespread in mountainous zones of KSA [1]. In Saudi Arabia, the desert covers 30% of the country's territory and is home to various rare plants [2]. The traditional medicinal plants, particularly desert plants, exhibit strong relationship as regards natural remedies, health, diet, and traditional methods of healing. Although the *Caralluma* species have been traditionally used in folk medicine for various purposes, including antimicrobial activities, there is limited scientific research, specifically on *C. retrospiciens* and its antifungal properties. In the southern areas of KSA, local people employ EG for treatment of wounds [3].

Candidiasis is a type of fungal infection attributed to various species of the genus *Candida*. The presence of these fungi in the human body is normal, they are commonly found in the gastrointestinal tract, oral cavity and vaginal area and have commensal

properties without having any harmful effects. Nevertheless, under certain circumstances, these microorganisms have the potential to multiply excessively, leading to the development of diseases. Candidiasis is one of the most widespread human fungal diseases caused by *C. albicans*. Candidiasis of the skin frequently results in the development of a red and irritating rash which typically appears within the creases of the skin. It is often regarded as the most significant factor in developing opportunistic mycoses globally [4]. *Candida* is widely recognized as an important pathogen in development of healthcare-associated infections in immune-compromised and immune-sufficient hosts [5, 6]. Candidiasis infection is widespread in Saudi Arabia, and infections of the bloodstream caused by *Candida* are substantial contributors to an increased risk of morbidity and mortality in healthcare settings [7, 8]. In continuation of previously published research [1] this research investigated the antifungal effect of EG against *C. albicans*.

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## METHODS

### Source of plant material

The plant (Fig 1) was collected from Saudi Arabia's Asir province in the hilly region of Rijal Almaa at coordinates of N 2015840.65 and E 211634.87, 45 kilometers west of Abha. The plant samples were delivered to the laboratory in punctured plastic containers and rinsed with water to wash off dirt and contaminants. The stem sections were allowed to air-dry after rinsing twice with distilled water. An herbarium curator at the herbarium of Jazan University identified the plant. A voucher specimen with allotted reference number of JAZUH 1623 was kept the University herbarium.

### Collection of exudate gel and preparation of sample analyte

The EG was extracted from sliced stem portions kept at slanted angles as described earlier [1]. The physical appearance, color, texture, and uniformity of EG were used to determine its organoleptic properties. Then, the EG was transferred into a sterile glass beaker, and its homogeneity was checked utilizing visual examination. The collected EG was highly viscous. Therefore, a 2-fold dilution was made in Millipore H<sub>2</sub>O to get 50% (v/v) concentration. The EG was subjected to studies on its antifungal activity against *Candida albicans* (*C. albicans*).

### Collection of *C. albicans*

Isolate of *C. albicans* for the study was taken from a pure clinical isolate obtained from King Fahad Central Hospital laboratory, Abu Arish, Jazan province, Jazan, Saudi Arabia. The isolate, which had no evidence of resistance to commonly used antifungals, was maintained in Sabouraud dextrose (SD) broth for 3 days at 27 °C in the institutional laboratory. The crowded plate method was used to arrive at 10<sup>-3</sup> dilution as optimal for *C. albicans* growth.

### Determination of fungal growth inhibitory activity

The spread plate technique was employed for culturing *C. albicans* on SD agar, while agar well diffusion technique was used to measure anti-fungal activity of sample analyte, relative to a Amphotericin-B. The agar well diffusion method was performed by putting EG in wells punched in the SD agar plates on which *C. albicans* was cultured.

### Statistics

Data were processed with Prism 9 Graph Pad Instat software. One-way ANOVA and Tukey's Post hoc test were used for statistical analyses. Statistics were performed using one-way ANOVA, followed by Tukey's test (Post hoc test). Significance of differences were assumed at  $p < 0.05$ .

## RESULTS & DISCUSSION

Phytochemicals constitute a unique repository of compounds with diverse range of molecular diversity and possible healing properties. Arising from their enormous contents of numerous bioactive chemicals with medicinal properties, plants have traditionally been used to treat various illnesses [9-11]. Figure 1C illustrates the antifungal activity exhibited by EG against *C. albicans*, in terms of zone of inhibition (ZOI). The antifungal activity of EG (ZOI) was  $21 \pm 2.64$  mm, whereas that of amphotericin B was  $25.3 \pm 1.15$  mm. Interestingly, a comparison of the efficacies of EG and amphotericin B showed no significant difference at  $p < 0.05$ . Our previous research demonstrated the antibacterial activity of *C. retrospiciens* EG against Gram + ve and Gram-ve organisms, with stronger effect on Gram-ve organisms [1].

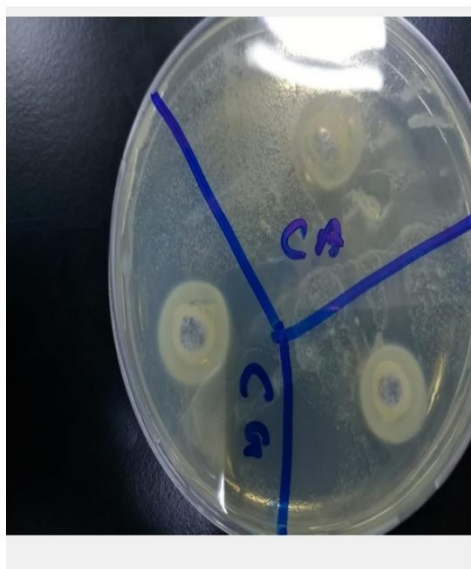
In the previous study, we reported the presence of several compounds in EG. In the current study, the ED contained sorbate, a natural phytochemical popularly applied in food preservation. Sorbic acid contains two carbon-carbon double bonds in the trans configuration. The presence of K<sup>+</sup> and Na<sup>+</sup> sorbates in EG is responsible for its antimicrobial properties [1]. Therefore, the bioactive ingredient sorbic acid exerted antifungal activity against *C. albicans*. Sorbic acid has been shown to have excellent antifungal activity against yeast-like fungi and molds [12-14]. A report in 2021 showed that hydroethanolic fraction of *Caralluma europaea* (Guss.) N.E.Br. was most active against both bacteria and yeasts [15]. In a previous study, the antifungal activity of ethyl acetate extract from the strain of *Caralluma fimbriata* was superior to that of butanol extract [16]. In contrast, in the present study, significant anti-*Candida albicans* activity was produced by EG without using organic solvents. Another study showed that the acetone extract of the milky sap of *Caralluma quadrangula* produced good antifungal activity against *C. albicans*, when compared to the water extract [17]. The current study showed an excellent spectrum of activity of EG against *C. albicans*.



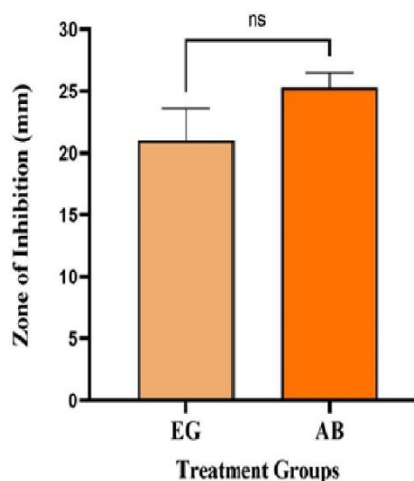
A



B



C



D

**Figure 1:** (A) Hilly region of Rijal Alma (B) Habitat of *Caralluma retropiciens* on rocky region of hills of Rijal Alma (C) Antifungal activity of exudate gel against *Candida albicans*, Zone around the well is indicating the potentiality of the exudate gel (D) Antifungal activity of exudate gel on comparing with standard amphotericin disc

Note: ns- Nonsignificant; EG: Exudate gel; AB: Amphotericin-B

## CONCLUSION

This investigation has demonstrated the antifungal property of EG collected from *C. retropiciens* against *C. albicans*. Based on the spectrum of activity of EG of *C. retropiciens* against *C. albicans*, future product development is crucial. To fully actualize the development of topical formulations containing the EG of *C. retropiciens*, additional research is required, and it should also be determined whether these formulations are effective against *C. albicans*. Furthermore, the findings have demonstrated

the potential human health care and welfare benefits of EG from the stem of *C. retropiciens*.

**Conflicts of Interest:** The authors declare that no conflict of interest is associated with this study, either financially or otherwise.

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