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# Exploration of Antifungal Potential of Methanolic Extract of *Foeniculum vulgare*

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**ABSTRACT**

The antifungal efficacy of the methanolic extract of the plant *Foeniculum vulgare* (Family: *Umbelliferacae*) was evaluated against selected pathogenic fungal strains namely *Trichophyton rubrum, Aspergillus parasiticus, Candida albicans, Aspergillus fumigates and monococcus egypsium*. The activity was carried out by the method of disc diffusion method. Clotrimazole was used as standard antifungal drug. Results for the assay ensured that the plant possess significant antifungal activity. Results are comparable to the standard drug selected. It is also evident form results that methanol extract showed better activity against pathogenic fungi.

## 1. INTRODUCTION

Medicinal plants play a central role not only as traditional medicines but also as trade commodities, meeting the demand of distant markets. Ironically, India has a very small share (1.6%) of this over-growing global market. To compete with the growing market, there is urgency to expeditiously utilize and scientifically validate more medicinally useful plants while conserving these species, which seems a difficult task ahead. [9]

Plants and plant-based medicaments are the basis of many of the modern pharmaceuticals we use today for our various ailments [7]. The discovery of medicinal plants has usually depended on the experience of the populace based on long and dangerous self-experiment.

In the constant effort to improve the efficacy and ethics of modern medical practice, researchers are increasingly turning their attention to folk medicine as a source of new drugs. [5]

Herbal medicine is still the mainstay of about 75 - 80% of the whole population, and the major part of traditional therapy involves the use of plant extract and their active constituents. [2]

*Foeniculum vulgare* commonly known as fennel is one of the widespread annual or perennial plants with aromatic odor. It was native to Southern Europe and Mediterranean region. Now it is widely cultivated throughout the temperate and tropical regions of the world. It is also a very popular medicinal and economic plant in China. The herb has many culinary and traditional medicinal uses. The bulb, young shoots, leaves and fully ripened and dried fruits are commonly used for homemade remedies. Its aromatic fruits have been used as a culinary spice in many countries. [8]

Antifungal work by exploiting differences between mammalian and fungal cells to kill off the fungal organism without dangerous effects on the host. Unlike bacteria, both fungi and humans are eukaryotes. Thus, fungal and human cells are similar at the molecular level, making it more difficult to find a target for an antifungal drug to attack that does not also exist in the infected organism. Consequently, there are often side effects to some of these drugs. Some of these side effects can be life-threatening if the drug is not used properly. [6]

An antifungal-drug is medication used to treat fungal infections such as athlete's foot, ringworm, candidiasis (thrush), serious systemic infections such as cryptococcal meningitis, and others.[4]

The test fungal strains used for the assay are;

- ***Trichophyton rubrum*** -is a fungus that is the most common cause of athlete's foot, jock itch, and ringworm. Their texture is waxy, smooth and even to cottony. From the top, the color is white to bright yellowish beige or red violet. Reverse is pale, yellowish, brown, or reddish-brown. *Trichophyton interdigitale* is the second most common source of fungal nail infections from the dermatophyte group.

- ***Aspergillus parasiticus*** -is a type of *aspergillus* mold usually found in cultivated soils and is considered as allergenic. It is difficult to differentiate this kind of mold from *aspergillus flavus*, although it is frequently isolated from seeds, insects, insects and some plants.

- ***Candida albicans*** -is a diploid fungus that grows both as yeast and filamentous cells and a causal agent of opportunistic oral and genital infections in humans, and a constituent of the normal gut flora comprising microorganisms that live in the human mouth and gastrointestinal tract.[1]

- ***Aspergillus fumigatus-*** is a fungus of the genus *aspergillus*, and is one of the most common *aspergillus* species to cause disease in individuals with an immunodeficiency.

- ***Monococcus egypsium-*** As far our literature survey could ascertain, no information was available on the antifungal activities of *Foeniculum vulgare*. Therefore the aim of the current investigation was to explore the antifungal potential of methanolic extract of *Foeniculum vulgare* against some pathogenic organisms.

## 2. MATERIALS AND METHODS

### 2.1 Collection of plant material

The shoots, stem and leaves of *Foeniculum vulgare* plant were collected from Coimbatore district, Tamil Nadu and it was authenticated from TNAU, Cbe.

### 2.2 Preparation of aqueous and methanolic extract

10gms of shade dried, powdered *Foeniculum vulgare* was weighed and transferred to a sterile beaker. 100ml of sterile distilled water (1:10) was added to it and mixed well. For methanolic extract 100ml of methanol was added to the plant powder. The extractions are carried out in a shaker for 24 hours and are filtered through Whatmann No: 1 filter paper. Then filtered solutions were used as test extract.

### 2.3 ANTI FUNGAL ACTIVITY

#### 2.3.1 Preparation of Medium

2.8gm of nutrient agar was weighed correctly and dissolved in 100ml of sterile distilled water. pH was adjusted to 7.2 and was autoclaved at $121^0$C for 15 minutes. 20ml of molten agar medium was poured in to the sterile petri plates and allowed to solidify.

#### 2.3.2 Test Organisms Used

Five different pathogenic fungi were used to test the antifungal activity of extract. The clinical isolates include *Trichophyton rubrum, Aspergillus parasiticus, Candida albicans, Aspergillus fumigatus,* and *Monococcus egypsium*- were used in the study. All these organisms were identified and confirmed by paper disc method.

#### 2.3.3 Preparation of Inoculum

The inoculums for the experiment were prepared in fresh sabouraud's broth from preserved slant culture. The inoculums were standardized by adjusting the turbidity of the culture to that of McFarland standards. The turbidity of the culture may be adjusted by the addition of sterile saline or broth (if excessive or by further incubating to get required turbidity.

#### 2.3.4 Preparation of sterile swabs

Cotton wool swab on wooden applicator or plastics were prepared and sterilized by autoclaving or dry heat (only for wooden swabs) by packing the swabs in culture tubes, papers or tins etc.

#### 2.3.5 Sterilization of forceps

Sterilize forceps by dipping in alcohol and burning off the alcohol

### 2.3.6 Experiment Method

The standardized inoculums is inoculated in the plates prepared earlier (aseptically) by dipping a sterile in the inoculums removing the excess of inoculums by passing by pressing and rotating the swab firmly against the side of the culture tube above the level of the liquid and finally streaking the swab all over the surface of the medium 3 times rotating the plate through an angle of 60º after each application. Finally pass the swab round the edge of the agar surface. Leave the inoculums to dry at room temperature with the lid closed. [3]

Each Petri dish is divided into 4 quadrants, in 4 quadrants extract discs (250mg and 500 mg of methanol and aqueous extract, discs are soaked overnight in extract solution) and center of the plate for standard clotrimazole 20µg, are placed in each quadrant with the help of sterile forceps. Then Petri dishes are placed in the refrigerator at 4º C or at room temperature for 1 hour for diffusion. Incubate at room temperature for 24 - 48 hours. Observe the zone of inhibition produced by different Antibiotics. Measure it using a scale or divider or venire calipers and record the average of two diameters of each zone of inhibition.

## 3. RESULTS AND DISCUSSION

The results of the disc diffusion assay of both methanolic and aqueous crude extract of the medicinal plant *Foeniculum vulgare* have been tabulated in Table No 1.The results shows that the plant extract shows profound antifungal activity with respect to the fungal strains namely *Trichophyton rubrum* and *Candida albicans*.The results of the disc diffusion assay of the plant crude extracts were compared with that of the standard antibiotic clotrimazole (20µg/disc).

**TABLE -1-Antifungal activity of methanolic and aqueous extract of *Foeniculum vulgare***

| S.No | Test Organisms | Standard Clotrimazole (20µg/disc). | Aqueous Extract | | Methanolic Extract | |
|---|---|---|---|---|---|---|
| | | | 250mg | 500mg | 250mg | 500mg |
| 1. | *Trichophyton rubrum* | 16 ± 0.816 | 8 ±1.63 | 11 ±0.86 | 10 ±1.63 | 15 ±1.63 |
| 2. | *Aspergillus parasiticus* | 15 ±1.632 | NZ | NZ | 08 ±1.63 | 09 ±1.63 |
| 3. | *Candida albicans* | 13 ±1.63 | 9 ±1.63 | 12 ±0.82 | 10 ±1.63 | 12 ±1.63 |
| 4. | *Aspergillus fumigates* | 11 ±0.816 | 7 ±0.68 | 8 ±1.63 | 9 ±0.816 | 11 ±0.816 |
| 5. | *Monococcus egypsium*. | 14 ±0.816 | NZ | NZ | 10 ±0.816 | 11 ±2.44 |

Values are mean ± standard deviation; NZ- No detectable zone of inhibition

Values are mean of triplicates experiment.

## 4. SUMMARY AND CONCLUSION

From the above results, it was concluded that the methanolic extract of plant *Foeniculum vulgare* possess significant antifungal activities. This property is surely due to the presence of some active phyto constituents present in it. The present work justifies the use of these plant materials for antifungal activity as claimed in folklore medicines.

## 5. ACKNOWLEDGEMENT

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## 6. CONFLICT OF INTEREST

I declare that there is no conflict of interest for the present study.

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