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Evaluation of the antifungal activity of various solvent extracts of *Feronia elephantum* correa (*Rutaceae*)

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ABSTRACT

Medicinal plants play an important role for health care. Medicinal plants have ability to cure both infectious and non infectious diseases. According to an estimate about 25 % of medicines are derived from plants. The objective of the present study was to evaluate the antifungal activity of *Feronia elephantum* Correa by using Agar well diffusion assay. The fungal strains used in this research work were *Aspergillus niger*, *Penicillium exspansum*, *Candida albicans* and *Fusarium oxysporum*. The length of inhibition zone was measured in millimetres. The results were referenced against Glucanazole antifungal agent. Methanolic fruit extract showed maximum antifungal activity against most of the strains where as moderate antifungal potential was shown by leaf extract in aqueous extract.

***Keywords*:** Antifungal activity; plant extract; Agar well Diffusion Assay

1. INTRODUCTION

Feronia elephantum Correa belongs to the family *Rutaceae* commonly known as Elephant apple or Wood apple (English). It is found through out India and is known from pre-historic time immemorial in traditional systems of medicine for receiving constipation diarrhoea, dysentery, peptic ulcer and respiratory infections (Shoba., 2000).

The pulp is applied externally as a remedy for bites of venomous insects and reptiles. Limited information is available regarding antifungal activity of *Feronia elephantum* therefore, present study is carried out to investigate antifungal activity of serial extracts from leaf, stem and fruit of *Feronia elephantum* against various fungal species (Photo 1 and 2). Leaves, stem and fruits of this tree at all stages of maturity are used as ethanomedicines against various human ailments. The fruits are used in gastric troubles, as heart tonic (Nadkarni., 2000).

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Photo 1. *Feronia elephantum*.



Photo 2. *Feronia elephantum* (Wood Apple, Elephant Apple).

2. MATERIALS AND METHODS

Plant parts (leaf, bark and fruit) were thoroughly washed air dried and grinded into powder form for preparation of extract. Aqueous plant extract was prepared by macerating powdered plant sample with 50 ml sterile distilled water. The macerate was filtered and filtrate was centrifuged at 8000 rpm for 15 minutes. Supernatant obtained after centrifugation was heat sterilized at 120 ºC for 30 minutes. Extract obtained was preserved aseptically. Solvent extracts of plant parts were prepared in 70 % ethanol / methanol using Soxhlet extraction (Hoffman *et al.,* 2004) for 72 hours and extract was preserved at 4 ºC in air tight containers. 1 mg of each solvent residue was redissolved in 1 ml of respective in 1 ml of respective solvent and were used as test extract for antifungal activity.

2. 1. Test fungal strains

The test fungal strains namely *Aspergillus niger* (MTCC 2723), *Penicillium exspansum* (MTCC 2006), *Candida albicans* (MTCC 183) and *Fusarium oxysporum* (MTCC 1755) were produced from Microbial Type Culture Collection (MTCC), Chandigarh, India.

2. 2. Antifungal activity

In vitro antimicrobial activity was screened by using Potato Dextrose Agar (PDA) using agar well diffusion method (Chung *et al.,* 1990). Fungal strains were activated in Potato Dextrose Broth (PDB) and incubated for 24 h. 0.05 ml of inoculum was uniformly spread on agar plates. Ethanolic, Methanolic and Aqueous extracts were introduced in agar wells in concentration of 25 ppm, 50 ppm, 75 ppm and 100 ppm. Control experiment was carried out with Glucanazole. Antifungal potential was then determined on the basis of diameter of zone inhibition.

3. RESULTS AND DISCUSSION

All the concentration of plant extract had shown activity against test fungal organisms. The results showed that increase in concentration of extract increased zone of inhibition. *Penicillium exspansum* and *Candida albicans* were most susceptible to methanolic fruit extract by forming inhibition zone of 17.33 to 26 mm and 21.33 to 27 mm respectively (Table - I, II, III & IV). Methanolic leaf extract was found to be less effective of *Penicillium exspansum* and *Fusarium oxysporum.* Maximum activity against *Aspergillus niger* was shown by leaf extract in aqueous solution by forming the zonal inhibition of 14 mm, 21.66, 24.33 mm and 26 mm at 25 ppm, 50 ppm, 75 ppm and 100 ppm respectively.

Many researchers have suggested antifungal activity of medicinal plants against *Aspergillus niger Penicillium exspansum*, *Candida albicans* and *Fusarium oxysporum* (Fawzia *et al.,* 2004, Sivaraj *et al.,* 2011) and (Satish *et al.,* 2007). Unsaponifiable matter of wood apple and bael seeds has also shown *in vitro* activity against various fungi namely *A. fumigatus, A. niger* and *A. flavous* (Singh *et al.,* 1983). The ethanolic bark extract showed notable antifungal potential for *Fusarium oxysporum* at 100 ppm (Zone inhibition 23.33 mm) and ethanolic fruit extract showed very less activity (Zone inhibition 11 mm) for the same strain at same concentration. Here the aim was to summarize the more recent common actions and therapeutic application of *Feronia elephantum* and its active constituent.

Table I. Results for *Feronia elephantum* Extracts showing measurement of Zone inhibition fungal cultures and control drug at 25 ppm.

Fungal Strains	Zone of inhibition (mm)*									Control Glucanazole
	Methanolic Extract			Ethanolic Extract			Aqueous Extract			
	Leaf	Bark	Fruit	Leaf	Bark	Fruit	Leaf	Bark	Fruit	
Aspergillus niger	10 ± 0.00	7.62 ± 0.47	15 ± 1.41	14.32 ± 0.47	12 ± 1.42	17 ± 0.80	14 ± 0.00	7.33 ± 0.94	11 ± 0.81	17 ± 0.81
Penicillium *expansum*	9.66 ± 0.47	10 ± 0.00	17.33 ± 0.42	14 ± 1.63	7.32 ± 0.47	18 ± 1.63	9.66 ± 0.94	6 ± 1.63	12 ± 1.41	9.66 ± 0.47
Candida albicans	10 ± 0.81	12 ± 0.81	21.33 ± 0.94	8 ± 1.41	2 ± 0.00	15.66 ± 0.47	16.66 ± 0.47	3 ± 1.00	14 ± 1.41	10.66 ± 0.47
Fusarium oxysporum	12 ± 1.63	10 ± 0.81	13 ± 0.00	13 ± 0.81	15 ± 0.81	3.66 ± 0.47	14 ± 1.41	13.66 ± 0.94	10 ± 1.63	7 ± 0.00

*Values are the mean of three replicates

Table II. Results for *Feronia elephantum* Extracts showing measurement of Zone inhibition fungal cultures and control drug at 50 ppm.

Fungal Strains	Zone of inhibition (mm)*									Control Glucanazole
	Methanolic Extract			Ethanolic Extract			Aqueous Extract			
	Leaf	Bark	Fruit	Leaf	Bark	Fruit	Leaf	Bark	Fruit	
Aspergillus niger	13.35 ± 0.47	11 ± 1.41	18 ± 1.41	18 ± 0.00	14.62 ± 0.47	20 ± 1.63	21.62 ± 0.47	10.66 ± 0.47	13.66 ± 0.47	20 ± 1.63
Penicillium *expansum*	13 ± 0.81	14 ± 0.81	20 ± 1.42	16 ± 1.41	11 ± 0.81	20 ± 1.42	14 ± 0.81	8 ± 0.81	14.66 ± 0.47	13 ± 0.00
Candida albicans	14 ± 0.00	14 ± 0.81	22.62 ± 0.47	12 ± 1.41	4.33 ± 0.47	18 ± 0.81	20.66 ± 0.47	5 ± 1.61	18 ± 2.15	13 ± 0.00
Fusarium oxysporum	14 ± 0.81	12 ± 0.94	16.62 ± 0.94	15 ± 0.81	15 ± 0.81	7 ± 1.41	16.33 ± 0.94	17 ± 1.63	12 ± 0.81	10.66 ± 0.47

*Values are the mean of three replicates

Table III. Results for *Feronia elephantum* Extracts showing measurement of Zone inhibition fungal cultures and control drug at 75 ppm.

Fungal Strains	Zone of inhibition (mm)*									Control Glucanazole
	Methanolic Extract			Ethanolic Extract			Aqueous Extract			
	Leaf	Bark	Fruit	Leaf	Bark	Fruit	Leaf	Bark	Fruit	
Aspergillus niger	15 ± 0.81	13 ± 1.41	21 ± 0.81	22 ± 0.81	16 ± 0.81	22.33 ± 0.94	24.33 ± 0.94	13 ± 0.00	18 ± 1.41	24 ± 0.81
Penicillium *expansum*	15 ± 1.41	19 ± 1.41	23 ± 0.81	20.23 ± 0.47	13 ± 1.44	22 ± 1.63	18 ± 0.00	10.66 ± 0.47	18 ± 0.81	16 ± 0.81
Candida albicans	19.66 ± 0.47	16.33 ± 0.47	25 ± 0.00	15.33 ± 0.47	8 ± 1.41	21 ± 1.41	23 ± 0.00	7 ± 1.41	22 ± 1.41	17 ± 0.81
Fusarium oxysporum	16 ± 0.81	15 ± 0.81	21.33 ± 0.47	17 ± 1.41	19 ± 0.00	8.66 ± 1.69	18 ± 0.81	19.33 ± 1.24	14 ± 0.00	12.66 ± 0.47

*Values are the mean of three replicates

Table IV. Results for *Feronia elephantum* Extracts showing measurement of Zone inhibition fungal cultures and control drug at 100 ppm.

Fungal Strains	Zone of inhibition (mm)*									Control Glucanazole
	Methanolic Extract			Ethanolic Extract			Aqueous Extract			
	Leaf	Bark	Fruit	Leaf	Bark	Fruit	Leaf	Bark	Fruit	
Aspergillus niger	19 ± 0.81	16 ± 0.00	13.33 ± 0.47	25 ± 1.47	18 ± 1.47	24 ± 1.47	26 ± 0.82	15 ± 0.81	22 ± 1.41	27 ± 0.00
Penicillium *expansum*	19 ± 1.41	22.66 ± 0.47	26 ± 0.81	23 ± 0.00	14.66 ± 0.47	25 ± 0.81	22 ± 0.81	14 ± 0.00	19.66 ± 0.45	20 ± 0.81
Candida albicans	20 ± 0.82	18 ± 0.00	27 ± 2.13	18.32 ± 0.47	12 ± 1.41	24.33 ± 0.94	26 ± 0.81	9.66 ± 0.94	25 ± 1.41	20 ± 1.63
Fusarium oxysporum	18 ± 1.41	19 ± 1.41	24 ± 0.00	20.65 ± 0.47	23.33 ± 0.47	11 ± 1.41	21 ± 1.41	21 ± 0.81	17.33 ± 0.47	17 ± 1.41

*Values are the mean of three replicates

4. CONCLUSION

The present study exhibited the antifungal activity of various extracts of Feronia elephantum against Aspergillus niger, Penicillium exspansum, Candida albicans and Fusarium oxysporum. As a result it is sure that these extracts can surely inhibit the growth of these microorganisms there by preventing various diseases such as asthma, cough, dysentery etc. The inhibitory effect of the extracts justified the medicinal use of Feronia elephantum and further study is required to find out active component of medicinal value.

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