Int J Pharm Bio Sci 2012 July; 3(3): (B) 571 - 577

Research Article **Plant Pathology**

International Journal of Pharma and Bio Sciences **ISSN 0975-6299**

EVALUATION OF ANTI-FUNGAL POTENTIAL OF AQUEOUS EXTRACT OF *SYZYGIUM CUMINI* Linn. AGAINST *Alternaria alternata* Nees. AND *Fusarium oxysporum* Schle.

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ABSTRACT

Experiments were carried out to evaluate the antifungal potential of aqueous extracts of leaves, bark, seeds and fruits of *Syzygium cumini* against two important fungal plant pathogens, *Alternaria alternata* and *Fusarium oxysporum.* Results revealed that among various plant parts, aqueous extract of fruit was most effective against the growth of *F. oxysporum* as compared to other extracts whereas, the aqueous extract of bark showed potential to inhibit the growth of *A. alternata*. Leaves extract were not found much effective against the both test organisms.

KEYWORDS : ***Syzygium cumini*, Antifungal potential, *Alternaria alternata*, *Fusarium oxysporum*.**

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INTRODUCTION

Syzygium cumini L., commonly known as "Jambolin" belongs to family Myrtaceae. It is an evergreen tropical tree native to India and Indonesia. It is also grown in Malaysia, Myanmar, Pakistan and Afghanistan for its fruit and pharmaceutical uses. In Brazil, it is a traditional medicinal plant and is used for antifungal activity [1]. Most of the parts of *Syzygium cumini* such as leaves, bark, seed and fruit have been used in traditional medicine. Plant bark is astringent, sweet, refrigerant, stomachic, carminative, diuretic, digestive, antihelminthic, constipating and antibacterial [2]. The leaves have been extensively used for the treatment of diabetes, constipation, leucorrhoea, stomachalgia, fever, gastropathy and dermopathy [3]. Fruit is useful in various diseases such as diabetes, diarrhea, dysentery, liver disorders, bleeding piles, female sterility and polyuria [4] and seeds are used to cure diabetes, pharyngitis, spleenopathy and ringworm infection. These medicinal properties may be attributed due to the presence of various medicinally important phytoconstituents such as tannins, alkaloids, steroids, flavonoids, terpenoids, and phenolics [5]

Fusarium oxysporum Schle and *Alternaria alternata* Nees. are causative agents of several crop diseases, greenhouse plants, trees as well as most difficult plant pathogens to control. Alternaria stem canker in tomato [6] , leaf spot disease of cucumber, Alternaria blight disease in cotton, *Chrysanthemum* and tomato due to *A. alternata* and panama wilts of banana, Fusarium wilt of water melon, radish, cotton, pea and root and stem rot of cucumber by *F. oxysporum* have been reported from India[7].

Even though effective and efficient control of these pathogenic fungi can be achieved by the use of synthetic fungicides but inappropriate use of synthetic fungicides were found to possess adverse effects on every ecosystem. Plant metabolites and plant based fungicides appear to be one of the better alternatives as they are known to have minimal environmental impact and danger to consumers in contrast to synthetic fungicides [8]. Thus, there is need to develop new management system to reduce the dependency on the synthetic chemical fungicides. Recent trends favor the use of alternative substances derived from the plants to control pests without any toxicity and eco-friendly in nature. In present investigation, attempt has been made to evaluate the antifungal potential of aqueous extract of leaves, bark, seeds and fruits of *Syzygium. cumini* against the growth of *A. alternata* and *F. oxysporum.*

MATERIALS AND METHODS

Plant material

Various parts of *S. cumini* L.(leaves, bark, seed and fruits) were collected from different localities of Gwalior (M.P.). To avoid contamination and for effective extraction, collected parts were washed with running tap water and sterilized with 70% alcohol, followed by 0.01% mercuric chloride ($HgCl_2$), and further washed with sterilized distilled water. Sterilized parts were dried in oven at 60^0C and grounded to fine powder and packed in air tight container for further use.

Test organism

Alternaria alternata (Nees), (ITCC # 6306) and *Fusarium oxysporum* (Schle.), (ITCC # 6246) were obtained from the Indian Type Culture Collection Centre, IARI, New Delhi in 2010.

Both the cultures were further sub cultured on PDA (Potato Dextrose Agar) at 26 ±1 °C for 7days.

Preparation of Extract

Ten gram (10gm.) powdered sample of each part i.e. leaves, bark, seed and fruit of *S. cumini* was dissolved in 40 ml of sterilized distilled water, percolated for 24 hrs and filtered with muslin cloth. Filtrate was centrifuged at 5000rpm for 10 minutes.

Obtained extract was evaporated and crude extract was redissolved in 20 ml of sterilized distilled water and filtered through Millipore filter [9].

Evaluation of antifungal potential

Assessment of antifungal potential of each plant part was carried out by measuring the inhibitory effect of extracts on mycelial growth of *A. alternata* and *F. oxysporum* at various concentrations i.e.10%, 20%, 30%, 40% and 50%. These concentrations were prepared by mixing 2, 4, 6, 8, and10 ml of aqueous extract with 18, 16, 14, 12 and 10 ml of PDA (Potato Dextrose Agar) to make final volume 20 ml. Mixture is shaken well for uniform mixing and poured in to sterilized petriplates. Five replicates of each concentration and one control (without test extracts) were maintained. 5 mm disc of 7 days old culture of test organism was inoculated to the center of each petriplates. The inoculated plates were incubated at 26 ±1 °C for 8 days. Mycelial growth of *A. alternata* and *F. oxysporum* was observed by measuring the radial diameter of fungus (mm) with the help of antimicrobial inhibition zone scale in each petriplate at 8^{th} day.

The percentage inhibition of each extract was calculated by the following formula [10].

% inhibition = dc – dt × 100/dc

Where,

dc = Average increase in mycelia growth in control,

dt = Average increase in mycelia growth in treatment.

RESULTS AND DISCUSSION

Present study showed significant antifungal activity of aqueous extracts of various part of *S. cumini,* against two plant pathogens i.e. *A. alternata* and *F. oxysporum* (Table.2). Antifungal activity of various parts and their potency was assessed by measuring the mycelial zone diameter (Table.1). The results of screening are encouraging as out of four parts i.e. leaves, bark, seeds and fruits, extracts of two parts i.e. fruit and bark were found very much effective against the growth of *F. oxysporum* and *A. alternata.*

In *F. oxysporum,* maximum percent inhibition was observed in fruit extract (37.23± 1.35) followed by bark (16.37± 1.18), seed (14.47± 1.95) and leaves (4.25±.84) at 50% concentration*;* whereas at this concentration bark extract showed maximum percent inhibition (28±1.93) against *A. alternata* followed by fruit (27.86±0.67), seed (10.92±0.66) and leaves (2.68±1.05) (Fig.1). Over all both the test organism showed different approach toward different plant parts. *F. oxysporum* was found most susceptible toward fruit extract followed by seed, bark and leaves, whereas, *A. alternata* was most susceptible toward bark extract followed by fruit, seed and leaves extract. This trend also prove that different pathogens are susceptible toward different phytoextract (phytochemicals), as in present study fruit extract is most effective against *F. oxysporum* but not against *A. alternata* similarly bark extract is most effective against *A. alternata* not against *F. oxysporum* (Fig. 3&5). Aqueous extract of seed was more effective against the growth of *F. oxysporum* as compared to *A. alternata* (Fig.4) whereas extract of leaves was not found effective at all (Fig.2).

Extreme use of synthetic pesticides and their harmful effect on environment and biota is motivating various organization and research laboratories for the development of efficient and cost effective biopesticides. Some plants like *Azadirachta indica* and *Chrysanthemum* were found to posses pesticidal properties and were commercially exploited up to certain extent. Research is still going on and efforts are on to screen every plant for their pesticidal properties. Many researches have also reported antimicrobial activity in various plants against different microorganisms [11, 12, 13].

In this attempt, studies carried out by Javed and Rehman [14] to investigate antifungal activity of leaf extracts (of various solvent) of *Syzygium cumini* (L.) Skeels against *Macrophomina phaseolina.* Inhibitory effect of

Syzygium cumini leaves fruit, root-bark, stem-bark against *Ascochyta rabiei* has also been reported by Jabeen and Javaid [15], where as in our findings leaves extract was not found effective. Anticandidial activity of ethanol extracts of *Syzygium jambolanum* has been reported by Prabhakar [16]. Antifungal activity of aqueous extract of *Syzygium cumini* and various other medicinal plants against *Aspergillus* species has been reported [17]. This also signifies our findings against A. *alternata* and *F. oxysporum*. In 2010, Riaz et al. [18] used leaves of *Eucalyptus citriodora*, *Syzygium cumini, Coronopus didymus, Chenopodium album* and *Cyperus rotundus* for management of the corm rot disease of gladiolus (*Gladiolus grandiflorus*) caused by *F. oxysporum*. Considering all these findings we screened four parts i.e. leaves, bark, seed, and fruit of *Syzygium cumini* against two important plant pathogens. The present investigation is an important step toward development of ecofriendly and cost effective plant based pesticides for the management of various plant diseases caused by *F. oxysporum* and *A. alternata*. Further investigation is still on to find out the active priniciple so that effective management can be achieved up to hundred percent marks.

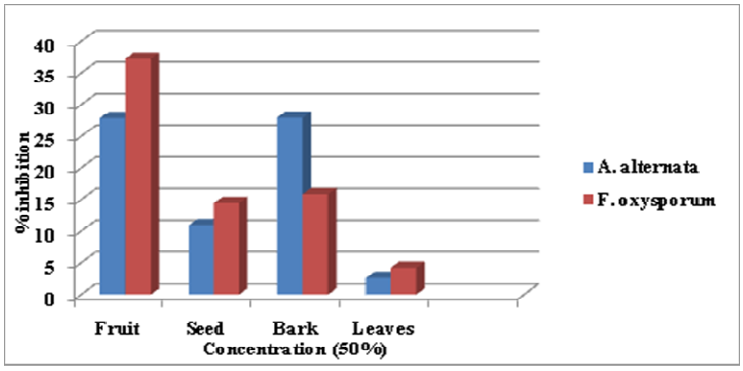

Figure.1

Percent inhibition of Fruit, Seed, Bark and leaves extract of S. cumini at 50% conc. against A. alternata and F. oxysporum.

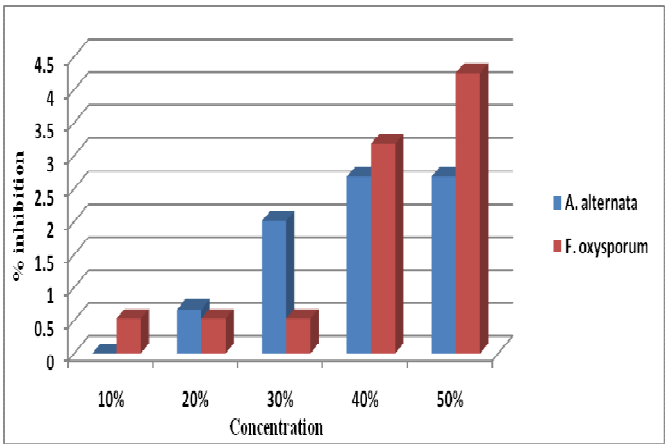

Figure 2

Effect of Leaf extract of S. cumini on the growth of A. alternata and F. oxysporum at various concentrations.

Table: 1

Mycelial growth inhibition of A. alternata and F. oxysporum by various part of S. cumini at various concentration (Means of five replicates ± standard deviation).

S. No.	Plant extracts of *S. cumini*	Mycelial growth inhibition (mm).									
		Concentrations (%)									
		10		20		30		40		50	
		Alt.	*Fus.*	*Alt.*	*Fus.*	*Alt.*	*Fus.*	*Alt.*	*Fus.*	*Alt.*	*Fus.*
1.	Leaves	29.8± 0.51	37.4± 0.54	29.6± 1.00	37.4± 0.54	29.2± 0.44	37.4± 0.54	29.0± 1.00	36.4± 0.54	29.0± 0.70	36.0± 0.70
2.	Bark	28.2± 1.09	42.6± 0.89	26.2± 0.83	42.6± 0.89	25.4± 1.14	40.8± 0.83	23.8± 1.30	40.0± 0.44	22.2± 1.30	37.2± 1.09
3.	Seed	35.0± 0.70	42.8± 0.83	34.2± 0.44	42.6± 1.67	34.2± 0.44	40.6± 0.89	33.4± 0.54	40.6± 0.54	32.6± 0.54	39.0± 2.00
4.	Fruit	32.0± 1.09	32.0± 1.00	31.8± 0.83	27.8± 0.83	29.2± 0.83	26.6± 0.89	29.0± 0.70	25.6± 1.14	26.4± 0.54	23.6± 1.14

Alt: Alternaria alternata, Fus: Fusarium oxysporum

Table: 2

Percent inhibition of A. alternata and F. oxysporum by extracts of various parts of S. cumini at various concentrations (Means of five replicates ± standard error).

S. No.	Plant extracts of *S. cumini*	Percent mycelium inhibition									
		Concentrations (%)									
		10		20		30		40		50	
		Alt.	*Fus.*	*Alt.*	*Fus.*	*Alt.*	*Fus.*	*Alt.*	*Fus.*	*Alt.*	*Fus.*
1.	Leaves	00.0± 1.25	0.53± 0.64	0.67± 1.70	0.53± 0.64	2.01± 0.66	0.53± 0.64	2.68± 1.49	3.18± 0.64	2.68± 1.05	4.25± 0.84
2.	Bark	8.43± 1.58	3.61± 0.90	14.93± 1.21	3.61± 0.90	17.52± 1.65	7.68± 0.84	22.72± 1.89	8.94± 0.45	28.0± 1.93	16.37± 1.18
3.	Seed	4.36± 0.86	6.13± 2.23	6.55± 0.54	6.31± 1.61	6.55± 0.54	10.69± 1.11	8.73± 0.66	10.69± 1.90	10.92± 0.66	14.47± 1.95
4.	Fruit	12.56± 1.22	14.89± 1.17	13.11± 1.01	26.06± 0.99	20.21± 1.01	29.25± 1.05	20.76± 0.86	31.91± 1.35	27.86± 0.67	37.23± 1.35

Alt: Alternaria alternata, Fus: Fusarium oxysporum

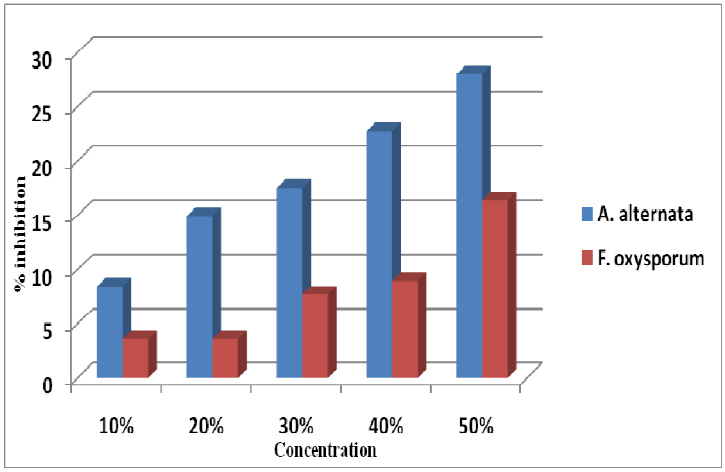

Figure .3

Effect of Bark extract of S. cumini on the growth of A. alternata and F. oxysporum at various concentrations

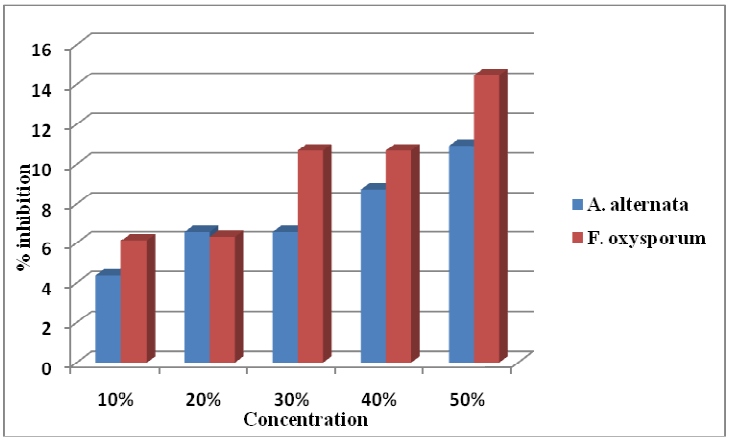

Figure 4

Effect of Seed extract of S. cumini on the growth of A. alternata and F. oxysporum at various concentrations.

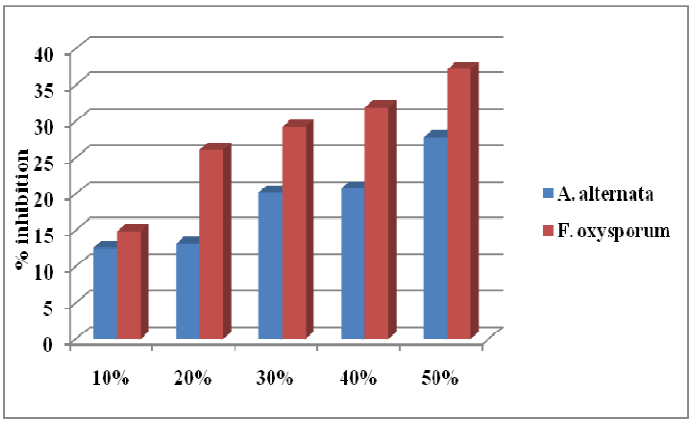

Figure 5

Effect of Fruit extract of S. cumini on the growth of A. alternata and F. oxysporum at various concentrations.

ACKNOWLEDGEMENT

The first author is thankful to Head, School of Studies in Botany, Jiwaji University, Gwalior (M.P.) for providing support, continuous help, encouragement and necessary laboratory facilities to carry out the experimental work.

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