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ANTIFUNGAL ACTIVITY OF *ALOE VERA* GEL AGAINST PLANT PATHOGENIC FUNGI

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Abstract

Aloe vera gel extracted from the *Aloe vera* leaves was evaluated for their antifungal activity @ 0.15%, 0.25% and 0.35% concentration against five plants pathogenic fungi viz., *Aspergillus niger*, *Aspergillus flavus*, *Alternaria alternata*, *Drechslera hawaiensis* and *Penicillum digitatum* 0.35% concentration *Aloe vera* gel completely inhibited the growth of *Drechslera hawaiensis* and *Alternaria alternata*.

Introduction

Aloe vera belongs to the family *Lilaceae*. *Aloe vera* contain over 75 nutrient and 200 active compounds, including vitamins, enzymes, minerals, sugar, lignin, anthraquinones, saponins, salicylic acid and amino acids (Park & Jo, 2006). Herbal medications in particular have seen a revival of interest due to a perception that there is a lower incidence of adverse reaction to plant preparation compound to synthetic pharmaceuticals. *Aloe vera* has been shown to have anti-inflammatory activity (Afzal *et al*., 1991; Malterud *et al*., 1993) immuno stimulatory activity (Ramamoorthy & Tizard, 1998) and cell growth stimulatory activity (Tizard *et al*., 1994), Furthermore, activity against a variety of infectious agent has bee attributed to *Aloe vera*; for instance antiviral (Khalon *et al*., 1991) and anti fungal (Kawai *et al*., 1998). There are limited reports on the antimicrobial effects of isolated *Aloe vera* components. Ferro *et al*., (2003) have shown that *Aloe vera* leaf gel can inhibit the growth of two gram positive bacteria *Shigella flexneri* & *Streptococcus progenes*. Specific plant compound such as anthraquinones (Gracia-Sosa *et al*., 2006; Dabai *et al*., 2007) and dihydroxyanthraquinones (Wu *et al*., 2006), as well as saponins (Reynolds & Dweck, 1999) have been proposed to have direct antimicrobial activity. Shamim *et al*., (2004) were noted high zone of inhibition with ethanol extracted from *Aloe vera baradenisis* against *Candida* species. The study showed that *Aloe vera* juice has antimicrobial activity against *Mycobacterium smegmatis, Klebisella pneumoniae, Enterococcus faecalis, Micrococcus luteus, Candida albicans* & *Bacillus sphricus* (Suleyman & Sema, 2009). Casian *et al*., 2007, found that hydroalcoholic extracts of fresh leaves of *Aloe vera* have inhibitory effect against the mycelial growth of *Botrytis gladiolorum, Fusarium oxysporum, Heterosporium pruneti* and *Penicillium gladioli*. Jasso *et al*., (2005) also evaluated antifungal activity of pulp and liquid fraction of *Aloe vera* on the mycelium development of *Rhizoctonia solani, Fusarium oxysporum* & *Collectotrichum coccodes* and found positive results. Antimicrobial susceptibility test showed that both the gel and the leaf inhibited the growth of *Staphylococcus aureus* and *Candida albicans* (Agarry *et al*., 2005). Experiment has been carried out to define the effect if *Aloe vera* gel *In vitro* for the control of seed borne fungi.

Materials and Methods

The agar plate diffusion plate method (Nene & Thaplliyal, 1979) was used to test antifungal activity of *Aloe vera* gel against five plant pathogenic fungi viz., *Aspergillus niger*, A. flavus, *Alternaria alternata*, *Drechslera hawaiensis* and *Penicillium digitatum*. Required amount if *Aloe vera* gel were dissolved in pure acetone and thoroughly mixed with melted potato dextrose agar to provide 0.15%, 0.25% & 0.35% concentration. About 10 ml treated and untreated medium were poured into petriplates (70 mm diameter). Untreated medium was used as control. Seven days old fungal cultures were placed in the center of each petriplate. There were three replicates of each treatment; the inoculated petriplates were incubated at 28±2^{o}C and radial growth in cm was recorded after 7 days of incubation and data analyzed statistically to observe the difference among various treatments.

Results and Discussion

Antifungal activity of *Aloe vera* gel was determined against five plant pathogenic fungi viz., *Aspergillus niger*, A. flavus, *Alternaria alternata*, *Drechslera hawaiensis* & *Penicillium digitatum*. The *Aloe vera* gel @ 0.15%**,** 0.25% & 0.35% concentration tested by agar diffusion plate method caused significantly reduction in the growth of above mentioned fungi. The rate of growth reduction was directly proportional to the concentration of tested material in the medium. Result showed that *Aloe vera* gel significantly inhibited the growth of all tested fungi. 0.15% concentration of *Aloe vera* gel posses' remarkable antifungal activity toward all fungi compared to control except *Aspergillus niger*; whereas *Aspergillus flavus* & *Penicillium digitatum* showed moderate antifungal activity at this concentration. Only two fungal species viz., *Alternaria alternata* and *Drechslera hawaiensis* had strong antifungal properties towards *Aloe vera* gel at same concentration (Table 1). The result inclose conformity with the finding of Yolanta & Galon (1995) who tested antifungal activity of natural *Aloe vera* gel on four plant pathogenic fungi viz., *Penicillium digitatum*. *P. expansum, Botrytis cinerea* and *Alternaria alternata*. The result showed that natural gel suppress the mycelial growth of *Alternaria alternata* and *P. digitatum*.

Table 1. Mean diameter of colonies (cm) of fungi on Potato Dextrose Agar (PDA) amendment with different concentration of Aloe vera gel.

Sr.No.	Name of fungi	Doses (X±S.E)			
		Control	0.15%	0.25%	0.35%
1.	*Aspergillus niger*	4.833 ± 0.288	3.0 ± 0.0	2.166 ± 0.288	1.166 ± 0.288
2.	*A. flavus*	3.566 ± 0.115	2.366 ± 0.230	1.433 ± 0.404	0.333 ± 0.152
3.	*Alternaria alternata*	4.0 ± 0.2	1.5 ± 0.55	0.166 ± 0.288	0
4.	*Drechslera hawaiensis*	3.166 ± 0.288	1.333 ± 0.577	0.666 ± 0.577	0
5.	*Penicillium digitatum*	2.666 ± 0.763	2.1 ± 0.1	0.733 ± 0.635	0.166 ± 0.288

At 0.25% concentration *Aloe vera* gel showed greater suppression in the growth of *Alternaria alternata*, *Drechslera hawaiensis* & *Penicillium digitatum*. However, the least inhibitory effect was found on *Alternaria alternata* compared to all fungi and gave only 4.15% mycelial growth (Fig. 1). Bajwa & Shafique (2007) used *Aloe vera* extract against pathogenic species of genus *Alternaria* viz., *A. alternata*, *A. citri* & *A. tenuissima*. The result of this study clearly reflect that *Aloe vera* has inherent ability to induce toxic effect on mycelial growth and proliferation of these fungi. 0.25% dose of *Aloe vera* gel had more inhibitory effect in *Aspergillus flavus* compare to *A. niger*. Cooposamy & Magwa (2007) also proved that *Aloe vera* extract had antifungal effect on *A. flavus*, *A. glaucus*, *Candida albicans*, *C. tropicalis*, *Trichophyton mentagrophytes* and *T. rubrun*. *Aloe vera* gel @ 0.35% concentration was most significantly effective towards all tested fungi. At this concentration, the inhibition in mycelial growth was 24.29% against *Aspergillus niger*, 9.26% for *Aspergillus flavus* and only 6.24% for *Penicillium digitatum*. Cock (2008) also examined that *Aloe vera* gel has inhibitory effect on *Aspergillus niger*. According to Arunkumar & Muthuselvam (2009) the maximum antifungal activity of *Aloe vera* was observed in acetone extract against *Aspergillus niger* and *A. flavus*.

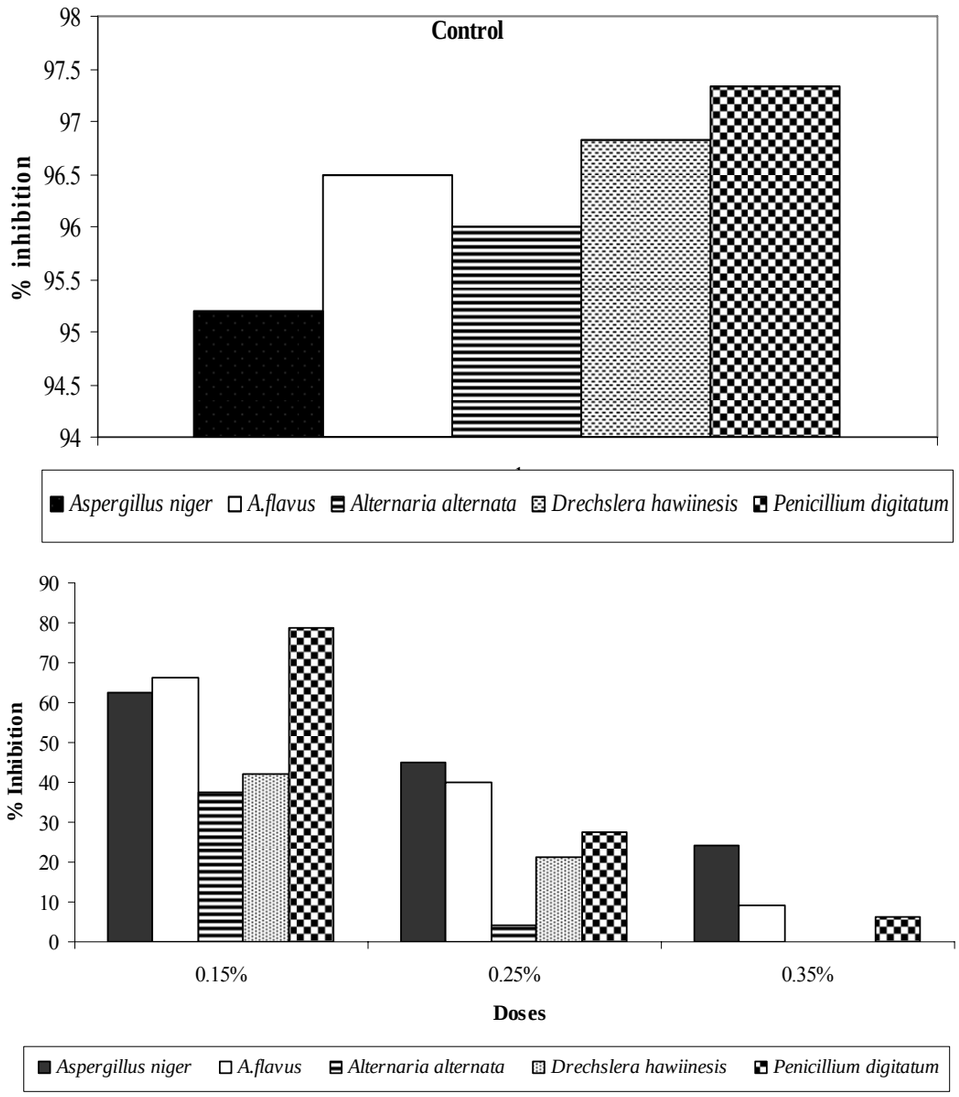

Fig. 1. Effect of different doses of *Aloe vera* gel on radial growth of fungi.

Analysis of variance (ANOVA) shows that in Agar plate method efficacy of *Aloe vera* gel as well as effect on fungi are highly significantly different for all doses (α =005, $p<0.001$) (Table 2). According to this study *Aloe vera* gel showed strong antifungal activity at 0.35% concentration, more work should also be carried out on *Aloe vera* gel to reveal some of its potentials.

Table 2. Analysis of variance of fungi and doses at different concentration.

Source of variation	SS	df	MS	F	P-value	F crit
Between fungi	20.591	14	1.470786	7.211137	2.78E-07	1.935007
Between doses	93.24867	3	31.08289	152.3967	1.34E-22	2.827051
Error	8.566333	42	0.20396			
Total	**122.406**	**59**				

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