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Antifungal activity and phytochemical analysis of *Achyranthus aspera* roots

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ABSTRACT

The different fractions of root of *Achyranthus aspera* were tested for *Fusarium oxysporum* species in the current research, and all separated fractions were analysed for phytochemical analysis. The antifungal activity of the ethanolic and ethyl acetate fractions against *Fusarium oxysporum* was highest. Alkaloids, tannins, saponins, and glycosides were found in ethyl acetate and ethanolic fractions of *Achyranthus aspera* root.

Keywords: Antifungal activity, phytochemical Analysis, root extract, *Achyranthus aspera, Fusarium oxysporum*

INTRODUCTION

As a primary or secondary invader, *Fusarium* is a ubiquitous and highly widespread soil-borne pathogen that causes serious illnesses in a broad variety of hosts. Crown rot, stalk rot, head blight, and scab are some of the illnesses they may cause in cereals and grains. It also causes vascular wilts in a variety of horticultural crops, including tomato, root rots in beans, peanuts, and soybeans, and other illnesses. Several *Fusarium* species have also been intensively researched because to the mycotoxins they generate, which are secondary metabolites that elicit a variety of physiological and pharmacological reactions in plants and animals. *Fusarium* species may be found in a variety of places, including soil, plant roots and aerial tissues, plant waste, and other organic substrates. They are often found in tropical and temperate climates, as well as deserts, alpine, and arctic environments. Depending on the host and Fusarium species involved, plant infection by Fusarium may occur at any developmental stage, from germinating seeds to mature vegetative tissues (Srinivas *et al*, 2019). Phytochemicals and secondary metabolites, which contribute to the plant's defence system, are abundant in medicinal plants. The presence of a range of phytochemicals such as alkaloids, flavonoids, saponins, tannins, and others prevents microorganisms and fungal mycelium from invading the plant.

MATERIAL AND METHODS

Plant material: Taxonomist, Department of Botany, Yeshwant Mahavidyalaya, Nanded-431602, Maharashtra, identified and authenticated the plant *Achyranthus aspera* (Acanthaceae) collected from Bhokar area, Dist. Nanded.

Preparation of Plant extracts: The roots of *Achyranthus aspera* were taken, cut into tiny pieces, and dried in the shade. The dried roots were ground into powder using an electric grinder. The fine powder of the plant was fractionated using the Soxhlet equipment with ethanol, ethyl acetate, and petroleum ether as solvents. Finally, the resulting fraction was concentrated and utilised for antifungal and phytochemical testing.

Preliminary Phytochemical analysis: Phytochemical analysis of alkaloids, tannins, saponins, and glycosides were carried out on different solvent root fractions of *Achyranthus aspera* using a conventional methodology. (Yadav and Agarwala, 2011).

***Fusarium* Culture:** Fusarium (*Fusarium oxysporum*) was collected from the culture collection centre at the School of Life Sciences, S.R.T.M. University in Nanded, Maharashtra, for this study. The *fusarium* cultures were sub cultured and incubated at 37°C using potato dextrose agar.

Antifungal Assay: Fungal fragments were precultured in mycelial growth media before being poured in the middle of PDA plates and incubated for 96 hours at 25 °C in the dark. Spores were isolated from cultures growing in PDA after incubation. After increasing spore concentrations in potato dextrose broth to 2×10^4 spores/mL, 80 microlitres of the broth were poured to the wells of sterile 96-well flat-bottomed microtiter plates, along with 20 microlitres of fraction. As a control, several wells were untreated to monitor fungus development. Plates were incubated in the dark at 25 °C for 24 hours before hyphal development was assessed using a microtiter plate Elisa reader to measure optical density at 595 nm (Hadian, 2012). Each test was carried out twice. After that, inhibition percentages were determined.

RESULTS AND DISCUSSIONS:

The phytochemical examination of several solvent fractions of *Achyranthus aspera* revealed positive results for alkaloids, tannins, saponins, and glycosides in the ethanolic and ethyl acetate fractions. Saponins, Tannins and glycosides were not found in the petroleum ether fraction of *Achyranthus aspera*.
Table 1 shows the findings of preliminary phytochemical investigation of various fractions of *Achyranthus aspera*.

Table 1. Preliminary phytochemical analysis of roots fraction of *Achyranthus aspera*

Sr. No.	Phytochemical Test	Roots fraction of *Achyranthus aspera*		
		Ethanol Fraction	Ethyl acetate fraction	Pet. Ether fraction
1	Alkaloids	+ +	+ +	+ +
2	Tannins	+ +	+ +	--
3	Saponins	+ +	+ +	--
4	Glycosides	+ +	+ +	--

Table 2. Antifungal activity of plant fraction (100 µg) on *Fusarium* species

Sr. No.	Fractions of *Achyranthus aspera*	Percent inhibition of growth
		Fusarium oxysporum
1	Ethanolic fraction	69
2	Ethyl acetate fraction	54
3	Petroleum ether fraction	26
4	Chloramphenicol (25 µg)	79

Fusarium species growth were examined for percent inhibition. Table 2 summarises the findings of antifungal activity of all fractions. Ethanolic fraction (69%), ethyl acetate fraction (54%) against *Fusarium oxysporum*. The petroleum fraction of *Achyranthus aspera* showed least inhibition of growth *Fusarium oxysporum* (26%). For comparison, the fusarium growth control was also performed with Chloramphenicol (25 g). Among the plants studied, ethanolic and ethyl acetate extracts were efficacious in inhibiting both *fusarium* species.

Given the need for an eco-friendlier way to manage the phytopathogen, it was thought that screening the antifungal effects of locally available flora would be useful. Because many of these extracts have substantial inhibition against the mycelium proliferation of the test fungus, the findings of this research indicate that plant extracts have varied actions on the mycelium growth of Fusarium species, and a clear possibility for novel efficient fungicide exists. The ethanolic and ethyl acetate fractions of *Achyranthus aspera* showed the most inhibitory effects among the diverse plants evaluated, which might be related to the presence of antimicrobial secondary metabolites in the plant samples, and it has numerous therapeutic qualities (Bhardwaj, 2012). As a result, spraying the ethanolic and ethyl acetate fractions of *Achyranthus aspera* on diseased plants could also provide protection against pathogenic organisms such as Fusarium species. Phytochemicals such as alkaloids, saponins, tannins, and glycosides found in plant extracts have a wide range of therapeutic characteristics (Ross, 1965). Several studies have shown that combining these two or more plant extracts may increase activity. This might be due to the synergistic impact reported on pathogenic organisms where two or more phytochemicals are combined. Several *Fusarium* species are spreading uncontrollably, destroying food grains, oil seed plants, vegetables, and a number of fruit plants both directly and indirectly. There are a variety of bio-control approaches, and diverse plant extract treatments will also give a large platform for the natural prevention of a variety of plant infections.

CONCLUSION

The ethanolic and ethyl acetate fractions of *Achyranthus aspera* roots have substantial antifungal activity. Alkaloids, tannins, saponins, and glycosides are bioactive chemicals found in selected plant. With these therapeutic plant, further research is required to identify and understand the structure of the bioactive constituents in plant extracts that seem to be responsible for antifungal activity.

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Conflict of interest
The author declares that there is no conflict of interest.

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