

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Efficacy of terminalia bark extracts against seed-borne pathogens checked by paper disc method

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ABSTRACT

The bark extract of five Terminalia species (*T. alata*, *T. arjuna*, *T. bellerica*, *T. catappa*, *T. chebula*) were used like aqueous, alcoholic and ethyl acetate extracts against five seed borne pathogenic fungi of cereals like *Aspergillus flavus*, *Aspergillus niger*, *Alternaria brassicicola*, *Alternaria alternata* and *Helminthosporium tetramera*. The antifungal activities of all these extracts were determined by paper disc method. Nearly all the extracts were found effective against these fungi. The positive results so obtained were compared with that of the reference standard fungicide (Carbendazim). It was found that most of the plant extracts showed more inhibitory effect against fungi than the control fungicide.

Keywords: Antifungal activity, Terminalia, medicinal plants, carbendazim.

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INTRODUCTION

Medicinal plants have been used in developing countries as alternative treatments to cure diseases. Many plant extracts and essential oils isolated from plants have been shown to possess biological activity *in vitro* and *in vivo*, which justifies research on plant based medicine focused on the characterization of antimicrobial activity of these plants [1-2]. Thus the use of medicinal plants in disease treatment and prevention can also be seen as prehistoric and their present use can be supported by the traditional optimization of their application in disease control. Medicinal uses of plants range from the administration of the roots, barks, stems, leaves and seeds to the use of extracts from the plants [3]. These plant extracts are a source of many potent and powerful drugs [4-5]. The antimicrobial activity of medicinal plants evaluated against enteric food borne pathogen [6]. Antibacterial activity of some medicinal plants observed [7].

The cultivated crops are infected by one or more pathogens causing economic losses. The majority of the diseases are caused by seed borne pathogens. These seed borne pathogens resulting in to losses or death of crop plants. The damage caused by plants parasitic pathogens seed borne fungi considered as worldwide and have extensive host range. Due to this they cause potentially serious constrains to crop productivity.

Apart from cultural methods of disease management, chemical control methods are widely used to control the diseases caused by these pathogens. More use of bactericides and fungicides like organomercurical, carbamates etc. have posed serious problems to human and environmental health [8]. So search for natural bio-degradable source of bactericides and fungicides have always been quest for the researchers for control of bacterial and fungal diseases of plants. Because of the present day public perception on pesticide contamination of foods especially the edible fruits, seeds, vegetables and oils, there is need for development of alternative economical and eco-friendly approaches for bacterial and fungal disease management. We tried to explore the potential of locally available plants against bacteria and fungi causing diseases of plants.

With this view, the present investigation was undertaken to select plant extracts that could be effective in the development of new tools for the control of diseases caused by bacteria and fungi to the plants of economic importance.

MATERIAL AND METHODS

Collection of plant materials

Bark of Terminalia alata, T. arjuna, T. bellerica, T. catappa and T. chebula were collected from Nanded and Hingoli district. The bark was separated and dried at room temperature. The dried bark was milled to a fine powder and stored at room temperature.

Source of microorganisms

The fungi used were *Alternaria brassicicola*, *A. alternata*, *Helminthosporium tetramera*, *Aspergillus flavus* and *A. niger*. These were most common and important disease causing fungi of plants and seeds of this region. All these fungi were isolated from their respective seeds and brought in to pure cultures and maintained on PDA (Potato Dextrose Agar).

Extract preparation

For testing efficacy of plant extracts aqueous, alcoholic and ethyl acetate extracts of these plant parts were prepared. 5 ml of the alcoholic and ethyl acetate extracts were evaporated on water bath under hood and slowly sterile distilled water was added to make up the volume of 5 ml.

Antifungal activity of plant extracts

The paper disc method was used for testing antifungal activity. The medium (25 ml) inoculated with spore suspension of experimental organism was poured into sterilized Petri dishes and left to get at room temperature. Whatman's No. 1 filter paper discs (6 mm in diameter) were soaked in 0.5 ml aqueous, alcoholic and ethyl acetate extracts as well as a 10 ppm solution of carbendazim (Standard fungicide). The filter paper discs were placed equidistantly on inoculated media. Plates were incubated at room temperature for 72 hours. Three plates were employed per treatment and the average zone of inhibition was recorded.

Statistical analysis

The data were statistically analyzed by method suggested by [9]. All the experiments were done in three replicates.

RESULTS

Bark extracts

The antifungal activity of aqueous, alcoholic and ethyl acetate bark extracts of five *Terminalia* species were tested against the five test fungi like *Alternaria brassicicola*, *Alternaria alternata*, *Helminthosporium tetramera*, *Aspergillus flavus* and *Aspergillus niger* and their results are presented in Table-1.

Antifungal activity of aqueous bark extract

The bark extracts of all the species of Terminalia were antifungal against all the treated fungi but showed less activity than the fungicide (control).

Table: Antifungal activity of bark extracts of some species of Terminalia

Name of the plant	Diameter of inhibition zone (mm)				
	A.flavus	A. niger	A.brassicicola	A.alternata	H.tetramera
Solvent Aqueous extracts					
Terminalia alata	07	06	05	04	04
T. arjuna	08	08	06	09	06
T. bellerica	10	08	09	08	09
T. catappa	06	08	08	08	05
T. chebula	10	08	09	10	04
Control (Carbendazim)	20	21	19	18	20
SE ±	0.75	0.62	0.45	0.48	0.83
CD at 5%	2.31	1.89	1.75	1.51	2.63
Solvent Alcohol extracts					
Terminalia alata	18	16	17	17	16
T. arjuna	20	21	20	18	16
T. bellerica	15	16	14	15	14
T. catappa	13	14	15	13	13
T. chebula	15	15	16	16	13
Control (Carbendazim)	20	21	19	18	20
SE ±	0.80	0.82	0.51	0.94	0.67
CD at 5%	2.54	0.26	1.62	2.98	2.12
Solvent Ethyl acetate extracts					
Terminalia alata	16	15	15	16	17
T. arjuna	18	17	16	15	15
T. bellerica	15	16	16	14	16
T. catappa	13	14	14	12	13
T. chebula	12	10	13	14	13
Control (Carbendazim)	20	21	19	18	20
SE ±	0.92	0.70	0.56	0.76	0.76
CD at 5%	2.90	2.22	1.78	2.41	2.41

Antifungal activity of alcoholic bark extracts

Alcoholic bark extracts of all the five species of Terminalia showed antifungal activity against all the five tested fungi like Alternaria brassicicola, Alternaria alternata, Helminthosporium tetramera, flavus and Aspergillus niger. However antifungal activities showed by all the five species except T.catappa were less inhibitory to test fungi than the other test plants. In case of T. arjuna inhibition were at par with control or slightly more than the control.

Antifungal activity of ethyl acetate bark extract

Ethyl acetate bark extract of five species of Terminalia were tested against five fungal pathogens like *Alternaria brassicicola*, *Alternaria alternata*, *Helminthosporium tetramera*, *Aspergillus flavus* and *Aspergillus niger* and it was found that extracts of all the five species showed the inhibition against all test fungi but were less than the standard fungicide carbendazim (control).

DISCUSSION

The antifungal activities of extracts of all five plants tested were recordable with plant pathogenic fungi i.e. *A.flavus*, *A.niger*, *A.brassicicola*, *A.alternata* and *H.tetramera*. These plant pathogens were inhibited by the bark extracts of all five plants. Antifungal activity of the extracts of *T.arjuna* and *T.alata* was recorded higher than other plants.

The antifungal activity of the aqueous, alcoholic and ethyl acetate extracts of bark of five Terminalia species varied distinctly in *T.alata*, *T.arjuna*, *T.bellerica*, *T.catappa* and *T.chebula* plants. This study is in agreement with the work of [10]. Generally in all the plants the activity of aqueous bark extracts was relatively less than the activity of ethyl acetate extracts, while the alcoholic extracts possessed the highest activity against all tested pathogens. Earlier [11-12] reported antifungal activity of alcoholic bark extracts against fungal pathogens.

Most of the results were effective than the fungicide (control) used. Out of these solvents bark extracts used viz. aqueous, alcoholic and ethyl acetate extracts, alcoholic bark extracts showed more inhibition of fungal growth similar results were reported by [13-14].

CONCLUSION

It is concluded that antifungal activity of bark extracts of *T. alata*, *T. arjuna*, *T. bellerica*, *T. catappa* and *T. chebula* and its active constituents would be helpful in treating various kinds of plant diseases and seed borne diseases. The low number of papers that have appeared to work on screening of antifungal activity as compared to work on antibacterial activity. These results may contribute to a resolution of these difficulties.

ACKNOWLEDGMENTS

The authors are thankful to Principal, Yeshwant Mahavidyalaya, Nanded for providing laboratory facilities and the authors are also thankful to Western Regional office U.G.C, Pune for providing financial support {Project file no.F47-1306/09(WRO)}.



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