

Short Communication

Antifungal Activity of Forty Higher Plants against Phytopathogenic Fungi

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Ethanol extract of 40 higher plants representing 23 families were tested for antifungal activity against some phytopathogenic fungi. The two most active plants showing potent antifungal activity were *Acorus calamus* and *Piper betel*. The rhizome extract of *A. calamus* exhibited highest antifungal activity inhibiting the mycelial growth completely (100%) against all the 6 test pathogens. *P. betel* exhibited more than 50% inhibition against most of the test fungi. The ethanol extract of several higher plants could be used as alternative source of antifungal agents for protection of plants or crops against fungal infection.

Keywords: Antifungal activity, Phytopathogenic fungi, Higher plants

Every year a lot of crop damage is caused by various diseases and among them fungal diseases are very common¹⁻². Although the use of synthetic fungicides in plant disease control have shown its fruitfulness in the improvement of agriculture, several of these have been found to display side-effects in the form of carcinogenicity, detrimental effects and other residual toxicities. The alternative choice therefore would be the use of botanical fungicides, which are advocated to be largely non-phytotoxic, systematic and easily biodegradable in nature²⁻³.

It is believed that antimicrobial agents are present in higher plants. Some recent researches on antifungal activity of extracts of several higher plants have indicated the possibility of their exploitation as natural antifungal agents for control of plant diseases^{1,4-8} but as yet little has been known in this field.

So, an attempt has been made to search the higher plants of Bangladesh for active antifungal agent, which may be useful therapeutically against the fungal diseases of crops prevalent in the country.

The plant materials (whole plant, aerial parts, leaf, root, bark and rhizome) were collected fresh from various localities in Chittagong, Cox's Bazar, Rangamati and Moheshkhali areas and were identified by one of us. A set of voucher herbarium specimens was made for each collection and these vouchers have been preserved in the herbarium Bangladesh Council of Scientific and Industrial Research (BCSIR) Laboratories, Chittagong. Plant materials were cut into small pieces (1-2 cm), air-dried, powdered mechanically and extracted with 80% ethanol. The extracts were filtered and concentrated to near dryness under reduced pressure and low temperature (40°-50°C) with the help of rotary vacuum evaporator. *In vitro* antifungal activity of the extract was done by poisoned food technique⁹. Potato dextrose agar (PDA) medium was used

for the culture of fungi. Each extract was redissolved in specific volume of absolute ethanol and mixed with sterilized melted PDA medium to obtain the desired concentration (1 mg/ml.) and this was poured in sterilized petriplates (20 ml/plate). At the center of each Petri plate 5-days-old fungal mycelial block (5 mm in diameter) was inoculated, which was subsequently incubated at 25° ± 1°C. The diameter of each fungal colony was measured after 3-5 days of incubation. Nystatin (100 µg/ml) was used as a standard antifungal drug for comparison of results under identical conditions. The percent of mycelial growth inhibition of the test fungus was calculated as described earlier¹⁰.

The results of *in vitro* antifungal activity of ethanol extract of 40 higher plants belonging to 23 families are summarized in Table 1. Plant extracts that inhibited more than 50% of the normal growth were considered as effective. The degree of susceptibility varied depending on the plant species. Among the plants screened, 11 showed antifungal activity against one or more phytopathogenic fungi tested. Extract of *Hedychium thyrsiformae*, *Clerodendrum viscosum* and *Zingiber zerumbet* were found effective only against *Botryodiplodia theobromae* showing more than 50% inhibition. Extracts of *Dalbergia sisoo* was found effective against *Fusarium equiseti* (ca. 52%) and *Colletrotrichum corchori* (ca. 53%); *Datura metel* against *Macrophomina phaseolina* (ca. 53%) and *B. theobromae* (ca. 72%). Inhibition of mycelial growth (>50%) was also obtained with the extract of *Eupatorium odoratum* against *M. phaseolina* (ca. 74%) *B. theobromae* (ca. 66%) and *C. corchori* (ca. 52%); *Hyptis suaveolens* against *Alternaria alternata* (ca. 53%), *Curvularia lunata* (ca. 54%) and *B. theobromae* (ca. 61%); *Vitex negundo* against *F. equiseti* (ca. 54%), *B. theobromae* (ca. 58%) and *C. corchori* (ca. 52%).

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Table 1. Antifungal activities of the extracts 40 higher plants against 6 phytopathogenic fungi

Plant (Family)	Plant part	Percent radial mycelial growth inhibition					
		AA	CL	FE	MP	BT	CC
<i>Acorus calamus</i> (Araceae)	Rhizome	100	100	100	100	100	100
<i>Adhatoda vasica</i> (Acanthaceae)	Leaf	21	12	12	9	15	23
<i>Aeschynomene Americana</i> (Leguminosae)	Aerial part	3	2	17	7	19	13
<i>Anogeissus latifolia</i> (Combretaceae)	Leaf	13	0	24	6	3	14
<i>Avicennia alba</i> (Avicenniaceae)	Leaf	42	48	43	34	40	42
<i>Avicennia marina</i> (Avicenniaceae)	Leaf	33	15	29	29	20	25
<i>Avicennia officinalis</i> (Avicenniaceae)	Leaf	32	23	29	36	27	31
<i>Catharethus roseus</i> (Apocynaceae)	Leaf	25	15	19	0	30	23
<i>Citrus grandis</i> (Rutaceae)	Leaf	15	0	10	7	1	10
<i>Cissus repens</i> (Vitaceae)	Aerial part	8	0	0	26	0	0
<i>Clerodendrum viscosum</i> (Verbenaceae)	Leaf	34	24	11	39	59	11
<i>Cymbopogon flexuosus</i> (Gramineae)	Leaf	29	16	25	20	13	30
<i>Cymbopogon osmastonii</i> (Gramineae)	Leaf	24	22	19	17	38	27
<i>Dalbergia sisoo</i> (Leguminosae)	Leaf	34	49	52	29	45	53
<i>Datura metel</i> (Solanaceae)	Leaf	42	37	38	53	71	54
<i>Dioscoria aculeate</i> (Dioscoreaceae)	Aerial part	24	11	19	0	11	24
<i>Eupatorium odoratum</i> (Compositae)	Leaf	48	41	44	74	66	52
<i>Eupatorium triplinerve</i> (Compositae)	Aerial part	32	39	39	24	27	38
<i>Garcinia cowa</i> (Guttiferae)	Leaf	11	2	0	18	17	0
<i>Hedychium thyrsoforme</i> (Zingiberaceae)	Leaf	34	36	34	35	56	39
<i>Hedyotis corymbosa</i> (Rubiaceae)	Whole plant	22	18	15	12	37	26
<i>Hyptis suaveolens</i> (Labiatae)	Leaf	53	54	40	47	61	22
<i>Lantana camara</i> (Verbenaceae)	Leaf	21	18	13	0	44	28
<i>Lawsonia inermis</i> (Lythraceae)	Leaf	12	8	31	18	15	30
<i>Lippa javanica</i> (Verbenaceae)	Leaf	20	18	33	19	37	28
<i>Litsea glutinosa</i> (Lauraceae)	Leaf	22	11	18	0	32	20
<i>Melastoma malabathricum</i> (Melastomaceae)	Leaf	29	19	20	0	18	26
<i>Michelia champaca</i> (Magnoliaceae)	Leaf	27	18	27	0	23	32
<i>Micromelum minutum</i> (Rutaceae)	Leaf	52	58	56	42	75	54
<i>Mikania cordata</i> (Compositae)	Whole plant	31	17	29	15	34	30
<i>Paederia foetida</i> (Rubiaceae)	Whole plant	5	7	10	17	0	12
<i>Phyllanthus emblica</i> (Euphorbiaceae)	Leaf	10	0	3	18	9	8
<i>Piper betel</i> (Piperaceae)	Leaf	61	57	58	49	65	58
<i>Samanea saman</i> (Leguminosae)	Leaf	21	0	16	31	7	19
<i>Sapium indicum</i> (Euphorbiaceae)	Bark	10	2	1	21	0	0
<i>Sarca indica</i> (Leguminosae)	Bark	10	8	3	29	0	2
<i>Solanum filicifolium</i> (Solanaceae)	Leaf	42	29	43	14	39	44
<i>Terminalia chebula</i> (Combretaceae)	Leaf	34	34	27	0	52	38
<i>Wedelia chinensis</i> (Compositae)	Whole plant	20	11	19	0	11	24
<i>Zingiber zerumbet</i> (Zingiberaceae)	Aerial part	48	40	44	24	58	42
Nystatin (Antifungal antibiotic)	-	56	72	46	71	82	42

AA = *Alternaria alternata*; CL = *Curvularia lunata*; FE = *Fusarium equiseti*; MP = *Macrophomina phaseolina*; BT = *Botryodiplodia theobromae*; CC = *Colletotrichum corchori*

The plants that showed wide spectrum of antifungal activity were *Acorus calamus* and *Piper betel*. *A. calamus* exhibited highest antifungal activity inhibiting the mycelial growth completely (100%) against all the 6 test pathogens. *P. betel* exhibited more than 50% inhibition against all the test pathogens except *M. phaseolina* (ca. 49%).

Although the extracts from higher plants are known to control some of the plant diseases¹¹⁻¹⁴, the availability of antifungal principles in plants is less compared to antibacterial and antiviral principles. According to a test report of medicinal plant project in India only 1 (*Arnebia nobilis*) out of about 880 plants tested exhibited antifungal activity against *Candida albicans*¹⁵. In

another study, Anwar *et al.*⁷ reported that out of 23 plants tested for antifungal activity against 5 phytopathogenic fungi, none of them was found to be total inhibitor of the fungi tested. So, the present findings on the antifungal activity of higher plants might serve as a potential source of antifungal agents against a wide variety of pathogenic fungi.

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