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Short Communication

# Antifungal Activity of Forty Higher Plants against Phytopathogenic Fungi

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**Ethanolic 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 ethanolic 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 common[1-2]. 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 nature[2-3].

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 technique[9]. Potato dextrose agar (PDA) medium was used for the culture of fungi. Each extract was redissolved in specific volume of absolute ehanol 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 diametre) 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 earlier[10].

The results of *in vitro* antifungal activity of ethanolic 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 |
| *Acorus calamus* (Araceae) | Rhizome | 100 | 100 | 100 | 100 | 100 | 100 |
| *Adhatoda vasica* (Acanthaceae) | Leaf | 21 | 12 | 12 | 9 | 15 | 23 |
| *Aeschynomene Americana* (Leguminosae) | Aerial part | 3 | 2 | 17 | 7 | 19 | 13 |
| *Anogeissus latifolia* (Combtetaceae) | Leaf | 13 | 0 | 24 | 6 | 3 | 14 |
| *Avicennia alba* (Avicenniaceae) | Leaf | 42 | 48 | 43 | 34 | 40 | 42 |
| *Avicennia marina* (Avicenniaceae) | Leaf | 33 | 15 | 29 | 29 | 20 | 25 |
| *Avicennia officinalis* (Avicenniaceae) | Leaf | 32 | 23 | 29 | 36 | 27 | 31 |
| *Catharenthus roseus* (Apocynaceae) | Leaf | 25 | 15 | 19 | 0 | 30 | 23 |
| *Citrus grandis* (Rutaceae) | Leaf | 15 | 0 | 10 | 7 | 1 | 10 |
| *Cissus repens* (Vitacear) | Aerial part | 8 | 0 | 0 | 26 | 0 | 0 |
| *Clerodendrum viscosum* (Verbenaceae) | Leaf | 34 | 24 | 11 | 39 | 59 | 11 |
| *Cymbopogon flexuosus* (Gramineae) | Leaf | 29 | 16 | 25 | 20 | 13 | 30 |
| *Cymbopogon osmastonii* (Gramineae) | Leaf | 24 | 22 | 19 | 17 | 38 | 27 |
| *Dalbergia sisoo* (Leguminosae) | Leaf | 34 | 49 | 52 | 29 | 45 | 53 |
| *Datura metel* (Solanaceae) | Leaf | 42 | 37 | 38 | 53 | 71 | 54 |
| *Dioscoria aculeate* (Dioscoreaceae) | Aerial part | 24 | 11 | 19 | 0 | 11 | 24 |
| *Eupatorium odoratum* (Compositae) | Leaf | 48 | 41 | 44 | 74 | 66 | 52 |
| *Eupatorium triplinerve* (Compositae) | Aerial part | 32 | 39 | 39 | 24 | 27 | 38 |
| *Garcinia cowa* (Guttiferae) | Leaf | 11 | 2 | 0 | 18 | 17 | 0 |
| *Hedychium thyrsiforme* (Zingiberaceae) | Leaf | 34 | 36 | 34 | 35 | 56 | 39 |
| *Hedyotis corymbosa* (Rubiaceae) | Whole plant | 22 | 18 | 15 | 12 | 37 | 26 |
| *Hyptis suaveolens* (Labiatae) | Leaf | 53 | 54 | 40 | 47 | 61 | 22 |
| *Lantana camara* (Verbenaceae) | Leaf | 21 | 18 | 13 | 0 | 44 | 28 |
| *Lawsonia inermis* (Lythraceae) | Leaf | 12 | 8 | 31 | 18 | 15 | 30 |
| *Lippa javanica* (Verbenaceae) | Leaf | 20 | 18 | 33 | 19 | 37 | 28 |
| *Litsea glutinosa* (Lauraceae) | Leaf | 22 | 11 | 18 | 0 | 32 | 20 |
| *Melastoma malabathricum* (Melastomaceae) | Leaf | 29 | 19 | 20 | 0 | 18 | 26 |
| *Michelia champaca* (Magnoliaceae) | Leaf | 27 | 18 | 27 | 0 | 23 | 32 |
| *Micromelum minutum* (Rutaceae) | Leaf | 52 | 58 | 56 | 42 | 75 | 54 |
| *Mikania cordata* (Compositae) | Whole plant | 31 | 17 | 29 | 15 | 34 | 30 |
| *Paederia foetida* (Rubiaceae) | Whole plant | 5 | 7 | 10 | 17 | 0 | 12 |
| *Phyllanthus emblica* (Euphorbiaceae) | Leaf | 10 | 0 | 3 | 18 | 9 | 8 |
| *Piper betel* (Piperaceae) | Leaf | 61 | 57 | 58 | 49 | 65 | 58 |
| *Samanea saman* (Leguminosae) | Leaf | 21 | 0 | 16 | 31 | 7 | 19 |
| *Sapium indicum* (Euphorbiaceae) | Bark | 10 | 2 | 1 | 21 | 0 | 0 |
| *Sarca indica* (Leguminosae) | Bark | 10 | 8 | 3 | 29 | 0 | 2 |
| *Solanum filicifolium* (Solanaceae) | Leaf | 42 | 29 | 43 | 14 | 39 | 44 |
| *Terminalia chebula* (Combretaceae) | Leaf | 34 | 34 | 27 | 0 | 52 | 38 |
| *Wedelia chinensis* (Compositae) | Whole plant | 20 | 11 | 19 | 0 | 11 | 24 |
| *Zingiber zerumbet* (Zingiberraceae) | 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 = *Colletrotrichum 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 diseases[11-14], 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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