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Antifungal Activity of Some Plant Extracts Against *Chaetomium globosum*

S.K. Bhardwaj* and J.S. Laura

Department of Bio-Sciences, M.D.University, Rohtak - 124 001, India.

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The efficacy of aqueous extracts of twenty plants was observed for their antifungal activity against *Chaetomium globosum*, inciting decay of cotton and other cellulose materials. Test results showed a differential activity of the plant extracts against the mycelium growth. The maximum inhibitory effect was shown by rhizome extracts of *Curcuma domastica* and seed extracts of *Acacia arabicae*. The seed extracts of *Albizia stipulata*, leaf extracts of *Aegle marmelos* and root extracts of *Acacia catechu* showed appreciable inhibitory effect against the test fungi. Other plants viz. *Casuarinae equisetifolia* > *Cuscuta reflexa* > *Cassia fistula* > *Carissa carandus* >*Azadirachta indica*> *Capparis decidua* > *Ceiba pentandra* showed inhibitory activity in that order.

Key words: *Chaetomium globosum*, Antifungal Activity, Plant-extracts, Phytochemicals.

Cotton is grown virtually everywhere where climatic conditions are suitable and the world production is about 12 million tons of cotton and 20 millions of oils annually where India produces about 9 per cent[1]. For the ever increasing world population requires the production of huge quantities of cotton but efforts are hampered due to biotic as well as abiotic factors. Among the biotic factors various diseases caused due to phytopathogens are major hindrance in desired production of cotton. To combat these phytopathogens, farmers are using huge quantities of synthetic chemicals. According to the WHO survey, more than 50,000 people in developing countries are annually poisoned and 5,000 die as a result of the effects of toxic agents, used in agriculture. In India 35,000 – 40,000 tons of hazardous chemicals are sprayed on the crops every year, instead of helping the poor, these chemicals are causing cancer, sterility and death[2]. So there is an urgent need to develop sustainable methods for controlling the disease. As plants are known to possess various secondary metabolites having antifungal activities against the growth of pathogens[3, 4], therefore, the efforts are underway to search economic safe phytochemicals, which could be utilized for disease control.

* To whom all correspondence should be addressed.
Mob.: - 09315411357
e-mail: skbmdu66@gmail.com

MATERIAL AND METHODS

Plant materials viz. flowers, leaves, root, seed and stems were collected from various parts of Haryana and their neighboring states on the basis of their traditional values (Table 1). The collected plant materials were thoroughly washed with tap water and then followed by distilled water and kept in dark in between the filter papers at room temperature till completely dry. Each plant sample was individually grounded into powder for preparation of extract. The fungi *Chaetomium globosum* used for the study was obtained from the Division of Plant Pathology, IARI, New Delhi. The cultures were maintained at 4°C on Yeast Glucose Agar medium with periodic sub-culturing. Plant part extract (15% w/v) was prepared by brewing in hot water. 15g dry powder of each plant sample was weighed and put in a cheese cloth bag and suspended in 100ml of boiling distilled water for 20 minutes. The extract was allowed to stand for some time and decanted off in to the flask and supernatant was used for assay the antifungal activity of each plant part extract by measuring the mycelium growth inhibition of test fungi[5]. A known volume of 15% plant sample extract was supplemented with yeast extract, glucose and agar. The medium was sterilized by autoclaving at 15lb. pressure for 15 minutes. Yeast Glucose Agar plates, without any plant extract supplementation, was run as control. The test inoculum consisted of a disc 0.65cm. in diameter cut out from the edge of a growing fungal colony on glucose agar medium using a sterilized cork borer and placed at the centre of the agar medium in sterilized conditions. The experiments were conducted in triplicates along with equal number of controls. The fungus was incubated at 27 ± 1°C and their growth diameters were measured after five days. The percentage inhibition was calculated by the formula as:

% inhibition =>((C-T) X 100/C),

Where C= Diameter of control, T= Diameter of test.

RESULTS AND DISCUSSION

The activity of the plant-extracts against the mycelium growth of *Chaetomium globosum* is presented in Table 2. It is commonly observed that out of 20 plants parts extracts tested, two plants have shown strong inhibitory effect against the mycelium growth of *Chaetomium globosum* i.e. rhizome extracts of *Curcuma domastica* (60.0%) and seed extracts of *Acacia arabicae* (52.78%). The other three plants have shown moderate inhibitory effect i.e. seed extracts of *Albizia stipulata* (49.41%), leaf extracts of *Aegle marmelos* (46.73%) root extracts of *Acacia catechu* (40.0%), while the four plants samples have shown intermediate inhibitory effect against the test fungus i.e. stem extracts of *Casuarinae equisetifolia* (29.41%), whole plant extracts of *Cuscuta reflexa* (23.86%), seed extracts of *Cassia fistula* (16.13%) and fruit extracts of *Carissa carandus* (12.44%) and three plants have shown insignificant inhibition of mycelium growth against the test fungus and rest eight plants samples did not show any inhibitory activity. Considering the need for an alternative eco-friendly approach to control the phytopathogens, it was believed to be worthwhile to screen the antifungal effects of locally available flora. The results obtained are indicating of the differential activities of the plant extracts on the mycelium growth of *Chaetomium globosum* because many of these extracts have shown very strong inhibition against the mycelium growth of test fungi and a definite potential for new effective fungicides. Among the different plants whose extracts were found to be effective were rhizome extracts of *Curcuma domastica* and seed extracts of *Acacia arabicae*. The rhizome extracts of *Curcuma domastica* found strong effective against the test fungi. The plant is reported to possess various medicinal properties[1, 6] and various antifungal properties against phytopathogenic fungi[7, 8]; hence the extract of *Curcuma domastica* could be used for protecting plants against pathogenic organisms.

The bark extracts of *Acacia arabicae* shown strong inhibitory effect against the mycelium growth of test fungus, which might be due to the presence of some antimicrobial phytochemicals, hence, the spray of the extracts of *Acacia arabicae* could be used for protecting plants against pathogenic organisms instead of synthetic chemicals.

The antimicrobial activities of plants

Table 1. Common Names and Families of Plants used in Experiment

S No.	Botanical Name	Common Name	Name of Family	Distribution	Traditional Uses of Plants
1.	*Acacia arabicae* Willd.	Kikar	*Mimosaceae*	India and Tropical Africa	Used for making furniture's, tanning, dyeing fabrics yellow, stem yields gum while seeds are fermented with dates to give beverages[1].
2.	*Acacia catechu* Willd.	Katha	*Mimosaceae*	East India	Used in the treatment of diarrhea and throat infections1.
3.	*Adhatoda vasica* Nees.	Adusa	*Acanthaceae*	Tropical India	A decoction of the leaves is expectorant, and is used to relieve bronchitis[1].
4.	*Aegle marmelos* (L.)	Bael Patter	*Rutaceae*	India	A decoction of the leaves is a febrifuge and expectorant and is particularly used for asthmatic complaints. Also used to treat acute bronchitis, fever and dysentery[18].
5.	*Albizia stipulata* Benthm.	Siris	*Mimosaceae*	Tropical Asia to Australia	The bark is used to treat boils and the leaves and seeds to treat diseases of the eyes[1].
6.	*Anthocephalus cadamba* (Mig.)	Kadam	*Rubiaceae*	Tropical Asia	The bark is used as a tonic and reduces fever[1].
7.	*Azadirachta indica* (A.)	Neem	*Meliaceae*	East India, Ceylon	Non-drying oil is extracted from the seeds. It is used for soap-Juss. making and to treat skin diseases, locally. The bark and leaf extracts are used as a tonic, and to reduce fevers[1].
8.	*Brassicae juanca* (L.)	Sarson	*Cruciferae*	Temperate Europe, Asia, introduced to N. America	The oil (Ravinson Oil), extracted from the seeds. It is used locally as a luminant, Lubricant, and in the manufacture of Black Sea soap[1].
9.	*Cannavis sativa* (L.)	Bhang	*Cannabidaceae*	Central Asia	Fibres used for cordage, sailcloth and caulking boat, seeds used in manufacture of paints, varnishes and soap, drug (bhang, hashish, ganja and marihuana) is produced. Its use is illegal in many countries[1].
10.	*Capparis decidua* (Roth.)	Karil	*Capparidaceae*	Sahara	Fruits eaten locally[1].
11.	*Carissa carandus* (L.)	Kraundha	*Apocynaceae*	India to Malaysia	The red, plum-like berries are eaten locally and made into jellies and preserves[1].
12.	*Cassia fistula* (L.)	Amaltash	*Leguminosae*	Tropical Africa	The pulp of pods is used as a laxative[1].
13.	*Casuarinae equisetifolia* (L.)	Chok/Jhau	*Casuarinaceae*	New South Wales, Queensland, India	Wood is used for roof shingles and posting [1].

Table 1. Cont.

14.	*Cedrela toona* (Roxb.)	Toon	*Meliaceae*	India to Australia	Flowers are source of a red and yellow dye, wood is used for furniture, house building, tea chests, oil casks and cigar box[1].
15.	*Ceiba pentandra* (Benth.)	Kapok Tree	*Bombraceae*	South America, India	The fibres are insect repellent; gum is laxative and used in bowel complaints, juice from its roots is a cure for diabetes[1].
16.	*Citrus limon* (Burmann.)	Nimbu	*Rutaceae*	Sub Tropical Asia, Greeks and Romanas, Azores, California and Italy	Fruits are good source of Vitamin C and B_1, carotene, Juice is extracted and used for fruit drinks, confectionery and flavouring, also a commercial source of citric acid. Lemon oil is used in perfumery, flavouring foods, flavouring liqueurs[1].
17.	*Clerodendron inerme* (Gaertn.)	Lanjai	*Verbenaceae*	Tropical &Sub Tropical, India	Used as blood purifier [20].
18.	*Colvillea wallichii* (L.)	Losara	*Boraginaceae*	India	Fruits are demulcient, expectorant and useful in bronchial affections and in irritation of urinary passages[19].
19.	*Curcuma domastica* (L.)	Haldi	*Zingiberaceae*	South Asia, India, China, East Indies and West Indies	Rhizome is a source of yellow dye. In India and Far East the juice is used for treating stomach complaints, bruises; fumes from the burning rhizome relieve colds and catarrh, and a paste of the rhizome accelerates the formation of scabs caused by smallpox and chickenpox[1].
20.	*Cuscuta reflexa* (L.)	Amar Bel	*Convolvulaceae*	Tropical and Temperate, India, Western Peninsula and Baluchistan	Seeds are carminative and anthelmatic; plant used externally against itch, internally in protracted fevers; Infusion of the plant is used to wash sores[19].

studied have also been found registered in various literature i.e. *Acacia catechu*[9], *Aegle marmelos*[10], *Albizia stipulate*[11], *Azadirachta indica*[12, 13], *Capparis decidua*[14], *Carissa carandus*[15], *Cassia fistula*[16], *Casuarinae equisetifolia*[15].

Since the extracts of *Acacia arabicae* and *Cuscuta reflexa* used in this study have not been tested before as inhibitor of phytopathogenic

Table 2. Anti-fungal activity of Plant-Extracts against *Chaetomium globosum* (Mean ± SD)

S. No.	Name of Plant	Part Used	Percentage Inhibition of Mycelium Growth
1.	*Acacia arabicae* Willd.	Seed	52.78 ± 0.74
2.	*Acacia catechu* Willd.	Root	39.39 ± 1.17
3.	*Adhatoda vasica* Nees.	Leaf	-
4.	*Aegle marmelos* (L.)	Leaf	46.73 ± 1.11
5.	*Albizia stipulata* (Benthm.)	Seed	49.41 ± 0.73
6.	*Anthocephalus cadamba* (Mig.)	Leaf	-
7.	*Azadirachta indica* (A.) Juss.	Seed	5.51 ± 3.74
8.	*Brassicae juanca* (L.)	Seed	-
9.	*Cannavis sativa* (L.)	Leaf	-
10.	*Capparis decidua* (Roth.)	Seed	2.19 ± 3.11
11.	*Carissa carandus* (L.)	Fruit	12.44 ± 2.74
12.	*Cassia fistula* (L.)	Seed	16.13 ± 3.19
13.	*Casuarinae equisetifolia* (L.)	Seed	29.41 ± 2.29
14.	*Cedrela toona* (Roxb.)	Leaf	-
15.	*Ceiba pentandra* (Benth.)	Seed	2.15 ± 3.55
16.	*Citrus limon* (Burmann.)	Seed	-
17.	*Clerodendron inerme* (Gaertn.)	Leaf	-
18.	*Colvillea wallichii* (L.)	Leaf	-
19.	*Curcuma domastica* (L.)	Rhizome	60.00 ± 0.48
20.	*Cuscuta reflexa* (L.)	Whole Plant	23.86 ± 1.37

fungi, therefore, they are the new addition to this field of study. The presence of various secondary metabolites such as alkaloids, quaternary alkaloids, coumarins, flavanoids, steroids/ terpenoids, phenols etc. have been reported in the various plants extracts[15,14, 17]which may be responsible for the antifungal properties of the plant studied.

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