International Journal of Agricultural Sciences, Vol. 5 Issue 1, January to May, 2009 : 320-323

Antifungal properties of some plant-extracts against *Chaetomium globosum*

S.K. BHARDWAJ* AND J.S. LAURA
Department of Bio Sciences, M.D. University, ROHTAK (HARYANA) INDIA

ABSTRACT

The efficacy of aqueous extracts of twenty plants was observed for their antifungal activity against *Chaetomium globosum*, causal organism of decay of cotton and other cellulose materials. The maximum inhibitory effect was shown by stem extracts of *Aloe vera* (85.72%), while leaf extracts of *Camellia sinensis* (79.69%), bark extracts of *Acacia arabicae* (79.06%) and bark extracts of *Callistemon lanceolatus* (58.34%) showed strong inhibitory effect. Some of the other plants showed moderate inhibition against the mycelium growth of test fungi *i.e. Azadirachta indica> Albizia lebbeck> Aegle marmelos> Acacia catechu.*

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

INTRODUCTION

In order to maintain the productivity, more and more chemicals are being added in the natural environment, which enter the food chain through water, soil, and air resulting serious harmful affect in human health (Ramachandra and Nagarathna, 2003). According to the survey made by the WHO, 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 (Das, 1983). To avoid the use of these horrible diseases causing synthetic chemicals, the plants and their product should be utilized to combat the diseases causing pathogens. As plants are known to possess various secondary metabolites, which showed inhibitory effect against the growth of pathogens. Keeping these problems in view, efforts are underway to search economic safe phytochemicals, which could be utilized for disease control.

MATERIALS AND METHODS

The various parts of each plant were collected from different region of Haryana and its neighboring states on the basis of their traditional values (Table 1). The collected plant materials were thoroughly washed with tap water, followed with distilled water and then kept in dark under the filter papers at room temperature till completely dry. Each sample was individually grounded into powder form for preparation of extract. The fungi *Chaetomium globosum* used for the study was procured from the Division of Plant Pathology, IARI, New Delhi. The culture was maintained at 4ºC on Yeast Glucose Agar medium with periodic sub-culturing. Fifteen per cent plant part extract was prepared by brewing in hot water for 20 minutes. The assay for antifungal activity of each plant part extract was assayed by measuring the growth inhibition as described by Bragulat *et al*. (1991). A known volume of 15 per cent 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 a control. The test inoculums consisted of a disc 2 mm in diameter cut out from the edge of a growing fungal colony on glucose agar medium using a cork borer and placed at the center of the agar medium in sterile conditions. The experiments were conducted in triplicates along with equal number of controls. The fungus was incubated at 26 ± 1ºC 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 activities of the plant-extracts against the mycelium growth of *Chaetomium globosum* are presented in Table 2. It is commonly observed that out of 20 plants parts extracts tested, four plants have shown marvelous inhibitory effect against the mycelium growth of *Chaetomium globosum i.e*. stem extracts of *Aloe vera* (85.72%), leaf extracts of *Camellia sinensis* (79.69 per cent), bark extracts of *Acacia arabicae* (79.06%), bark extracts of *Callistemon lanceolatus* (58.34%) while four other plants have shown moderate inhibitory effect *i.e. Acacia catechu* (37.78%), *Aegle marmelos* (40.08%), *Albizia lebbeck* (40.6%), *Azadirachta indica* (34.36%) and seven plants have shown insignificant inhibition of mycelium growth against the test fungi and rest five plants samples did not show any antifungal activity.

*** Author for correspondence**

Table 1 : Common names and families of plants used in experiment

Sr. 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 (Usher, 1971).
2.	*Acacia catechu* Willd.	Katha	*Mimosaceae*	East India	Used in the treatment of diarrhea and throat infections (Usher, 1971).
3.	*Acacia fernesiana* (L.) Willd.	Ghand Babul	*Mimosaceae*	Tropics	Flowers are a source of essential oil used in perfumery (Usher, 1971).
4.	*Achyranthus asper* L.	Chirchita	*Amaranthaceae*	Asia	Pulmonary affections cough asthma and skin diseases (Dastur, 1962)
5.	*Adhatoda vasica* Nees.	Adusa	*Acanthaceae*	Tropical India	A decoction of the leaves is expectorant, and is used to relieve bronchitis (Usher, 1971).
6.	*Aegle marmelos* (L.) Corr.	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 (Dastur, 1962)
7.	*Albizia lebbeck* Benth.	Siris	*Mimosaceae*	Tropical Asia to Australia	The bark is used to treat boils and the leaves and seeds to treat diseases of the eyes (Usher, 1971).
8.	*Aloe vera* L.	Gawar Patha	*Liliaceae*	Mediterranean. Introduces to New World Tropics.	The active principle is aloin which is used to treat intestinal worms, to encourage menstruation and as a cathartic (Usher, 1971).
9.	*Alstonia scholaris* R.Br.	Chitvan	*Apocynaceae*	Ceylon to Australia	The dried bark has been used since ancient times as a tonic and to treat intestinal complaints, including worms (Usher, 1971).
10.	*Anthocephalus cadamba* Miq.	Kadam	*Rubiaceae*	Tropical Asia	The bark is used as a tonic and reduces fever (Usher, 1971).
11.	*Asparagus racemosus* Willd.	Satawari	*Liliaceae*	Middle East, India, Australia	The roots are applied to relieve irritations. They are also used to treat dysentery, and are diuretic (Usher, 1971).
12.	*Astercantha longifolia* Nees.	Talamkhana	*Acanthaceae*	India	Decoction of root is diuretic; seeds are given in gonorrhoea, and with milk sugar in spermatorrhoea (Vasishta, 1972).
13.	*Azadirachta indica* A. Juss.	Neem	*Meliaceae*	East India, Ceylon	Non-drying oil is extracted from the seeds. It is used for soap-making and to treat skin diseases, locally. The bark and leaf extracts are used as a tonic, and to reduce fevers (Usher, 1971).
14.	*Bambusa sapinosa* Roxb.	Bans	*Gramineae*	East India	Boiled young shoots eaten locally as a vegetable. Wood used for general construction work. (Usher, 1971).
15.	*Brassicae campestris* L.	Sarson	*Cruciferae*	Temperate Europe, Asia, introduced to N. America. Grown around the black sea	The oil (Ravinson Oil), extracted from the seeds. It is used locally as a luminant, Lubricant, and in the manufacture of soap (Usher, 1971).
16.	*Bryophyllum calycinum* Salisb.	Patherchat	*Crassulaceae*	Throughout India and N. Temprate	Leaves are useful in vitiated conditions of pitta and vata, haematemesis, haemorrhoids, menorrhagia, cuts and wounds, discolouration of the skin, boils, sloughing ulcers, burns, scalds, corn, diarrhoea, dysentery, vomiting and acute inflammations (Sala, 1995).

Contd. .... Table 1

Table 1 Contd...

17.	*Caesalpinia bonducella* F.	Karnju	*Caesalpiniaceae*	Tropics	In India seeds are mixed with black pepper to make a tonic and to reduce fevers. A tonic is also made from the bark (Usher, 1971).
18.	*Callistemon lanceolatus* D.C.	Bottle brush	*Myrtaceae*	Australlia , India	Leaves are a Tea substitute and have a delightfully refreshing flavour (Cribb, 1976), tan dye is obtained from the leaves (Grae, 1974).
19.	*Calotropis procera* Br.	Ak	*Ascliapdaceae*	Tropical Africa and India	The root bark is used to treat leprosy in India (Usher, 1971).
20.	*Camellia sinensis* (L.) Kuntze.	Chai	*Theaceae*	India and China	Astrigent, diuretic stimulant (Chopra *et al*., 1992).

Considering the need for an alternative eco-friendly approach to control the phyto pathogens, 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 (Table 2) and a definite potential for new effective fungicides. Among the different plants whose extracts were found to be effective were stem extracts of *Aloe vera*, leaves extracts of *Camellia sinensis* and bark extracts of *Acacia arabicae.*

The test fungus *Chaetomium globosum* was observed most sensitive to the stem extracts of *Aloe vera*

Table 2 : Anti-fungal activity of plant-extracts against *Chaetomium globosum* (Mean ± SD)

Sr. No.	Name of plant	Part used	Percentage inhibition of Mycelium growth
1.	*Acacia arabicae*	Bark	79.06 ± 0.26
2.	*Acacia catechu*	Bark	37.78 ± 4.18
3.	*Acacia fernesiana*	Seed	-
4.	*Achyranthus asper*	Stem	3.28 ± 1.90
5.	*Adhatoda vasica*	Flower	-
6.	*Aegle marmelos*	Fruit	40.08 ± 1.24
7.	*Albizia lebbeck*	Seed	40.6 ± 4.08
8.	*Aloe vera*	Stem	85.72 ± 0.48
9.	*Alstonia scholaris*	Leaf	-
10.	*Anthocephalus cadamba*	Bark	-
11.	*Asparagus racemosus*	Root	19.45 ± 3.33
12.	*Astercantha longifolia*	Seed	1.68 ± 4.23
13.	*Azadirachta indica*	Leaf	40.89 ± 0.86
14.	*Bambusa sapinosa*	Seed	-
15.	*Brassicae campestris*	Seed	18.61 ± 1.13
16.	*Bryophyllum calycinum*	Leaf	3.45 ± 1.55
17.	*Caesalpinia bonducella*	Leaf	9.80 ± 2.48
18.	*Callistemon lanceolatus*	Bark	58.34 ± 0. 28
19.	*Calotropis procera*	Leaf	1.34 ± 3.93
20.	*Camellia sinensis*	Leaf	78.69 ± 1.88

that might be due the presence of some antimicrobial secondary metabolites in the plant. The antiviral properties of *Aloe vera* were registered in literature against a latent virus of potato called PVX (Singh and Joshi, 1977) and various reports were found in literature about the medicinal properties of *Aloe vera* as aloës is the main source of medicinal properties and obtained from *Aloe vera* (Usher, 1971; Pandey, 1993). Therefore, synthetic chemicals could be replaced by the use of *Aloe vera* for protecting plants against pathogenic organisms.

The leaf extracts of *Camellia sinensis* and bark extracts of *Acacia arabicae* were observed almost equally effective against the mycelium growth of *Chaetomium globosum.* Leaves extracts of *Camellia sinensis* showed strong activity against the test fungi, because the antimicrobial activity of *Camellia sinensis* extracts have been attributed to its different components like caffeine, tannins and other polyphenolic compounds particularly gallocatechin (Fukai *et al*., 1991; Kubo *et al*., 1992). The use of tea sprays could be used for protecting plants against pathogenic organisms. Such applications have also been suggested earlier (Dubey, 1991).

The antimicrobial activities of plants studied have also been found registered in various literature *i.e. Acacia catechu* (Singh and Sharma, 1978), *Achyranthes asper* (Aswal *et al*., 1984), *Adhatoda vasika* (Chitra and Kannabiran, 2002), *Aegle marmelos* (Ganesan *et al*., 2004), *Asparagus racemosus* (Chitra and Kannabiran, 2002), *Azadirachta indica* (Sharma and Nanda, 2000; Newton *et al*., 2002), *Brassicae campestris* (Mishra and Dixit, 1977), *Caesaelpinia bonducella* (Aswal *et al*., 1984), *Callistemon lanceolatus* (Dubey *et al*., 1990), *Calotropis procera* (Singh and Sharma, 1978).

Since the extracts of *Acacia arabicae, Albizia lebbeck, Astercantha longifolia* and *Bryophyllum calycinum* used in this study have not been tested before as inhibitor of phytopathogenic 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 (Aswal *et al*., 1984; Abraham *et al*., 1986; Chopra *et al*., 1992) which may be responsible for the antifungal properties of the plant studied.

REFERENCES

Abraham, Z., Bhakuni, D.S., Garg, H.S., Goel, A.K., Mehrotra, B.N. and Patnaik, G.K. (1986). Screening of Indian Plants for Biological Activity. Part X11. *Indian J. Exp. Biol.,* **24** : 48-68.

Aswal, B.S., Bhakuni, D.S., Goel, A.K., Kar, K. and Mehrotra, B.N. (1984). Screening of Indian Plants for Biological Activity. Part X1. *Indian J. Exp. Biol.,* **22** : 487-504.

Bragulat, M.R., Abarca, M.L., Bruguera, M.T. and Cabanes, F.J. (1991). Dyes as Fungal Inhibitors: Effect on Colony Diameter. *Appl. Environ. Microbiol.,* **57** : 2777-2780.

Chitra, H. and Kannabiran, B. (2002). Screening of aqueous extracts of some plants on conidial germination and mycelial growth of *Colletotrichum capsici* (SYD) Butler & Bisby. *Geobios.,* **29** : 185-186.

Chopra, R.N., Nayer, S.L. and Chopra, I.C. (1992). *Glossary of Indian Medicinal Plants*. 3rd Ed. Council of Scientific and Industrial Research, New Delhi, pp. 1 - 246.

Cribb, A.B. (1976). *Wild Food in Australlia. Fontana*, ISBN 0 – 00 – 634436 – 4. A very good Pocket Guide.

Das, T. (1983). "Death in the garb of pesticides". *The Hindustan Times*. Dec. 30, 1983.

Dastur, J.F. (1962). *Medicinal Plants of India and Pakistan*. D.B. Taraporevala Sons and Co. Private Ltd., Bombay.

Dubey, P., Dube, S. and Tripathi, S.C. (1990). Fungitoxic properties of essential oil of *Anethum graveolens* L. *Proc. Nat. Acad. Sci.*, India, **60** (B) : 11.

Dubey, R.C. (1991). Fungicidal effect of essential oils of three higher plants on sclerotia of *Macrophomina phaseolina*. *Indian Phytopath.,* **44** : 241-244.

Fukai, K., Ishigami, T. and Hara, Y. (1991). Antibacterial activity of tea polyphenols against phytopathogenic bacteria. *Agri. Biol. Chem.*, **55** : 1895-1897.

Ganesan, T., Kumarakurubaran, S. and Nirmalkumar, K. (2004). Effect of extracts on Conidial germination of *Alternaria brassicae* (Berk.) SACC., *Geobios*., **31**: 187-188.

Grae, I. (1974). *Nature's Colors – Dyes from Plants*. Mac Millan Publishing Co. New York, ISBN 0 – 02 – 544950 – 8.

Kubo, I., Murei, H. and Himejina, M. (1992). Antimicrobial activity of green tea flavour components and their combination effect. *J. Agric. Chem.,* **40** : 245-248.

Mishra, S.B. and Dixit, S.N. (1977). Screening of some Medicinal Plants for Antifungal Activity. *Giobios.,* **4** : 129-132.

Newton, S.M., Lau, C., Gurcha, S.S., Besra, G.S. and Wright, C.W. (2002). The evaluation of forty-three plant species for *in vitro* antimycobacterial activities; isolation of active constituents from *Psoralea corylifolia* and *Sanguinaria Canadensis*. *J. Ethnopharmacol.,* **79** : 57-67.

Pandey, B.P. (1993). *Taxonomy of Angiosperms.* Pub. S.Chand & Co., New Delhi. pp. 1-642.

Ramachandra, T.V. and Nagarathna, A.V. (2003). *Eco-Degradation, Biodiversity and Health*. Book Reviews (Editor: B.N. Pandey. 2002; Daya Publ. Delhi, pp: 335). *Current Sci.,* **85** (9, 10) : 1368-1369.

Sala, A.V. (1995). *Kalanchoe pinnata* (Lam.) Pers. (*Bryophyllum calycinum* Salisb.). *Indian Medicinal Plants* (Eds. Warrier, P.K., Nambiar, V.P.K. and Ramakutty, C.), Orient Longman Publishing Ltd., **3**: 282-284. ISBN 81 – 250 – 0302 – 9.

Sharma, I. and Nanda, G. S. (2000). Effect of plant extracts on Teliospore germination of *Neovossia indica*: *Indian Phytopath*., **55** : 323-324.

Singh, L. and Joshi, R. (1977). The inhibitory activity of some plant juices and chemicals on the infectivity of potato virus x (PVX). *Geobios.,* **4** : 116-117.

Singh, L. and Sharma, M. (1978). Antifungal properties of some plant extracts. *Geobios.,* **5** : 49-53.

Usher, G. (1971). *A Dictionary of Plants used by Man*.pp. 1 - 619. (1st Indian Eds. 1984, CBS Pub. And Distr. Print Orient. Delhi).

Vasishta, P.C. (1972). *Taxonomy of Angiosperms.* Pub. R.Chand & Co. , New Delhi. pp. 1-884.

Received : May, 2007; Accepted : December, 2008