Antifungal activity of medicinal plant extracts against seed-borne pathogenic fungi

M. Chandra, N.M. Mahesh

Department of Biosciences, Mangalore University, Mangalagangothri, Karnataka, 574199, India,
Email: drchandram1@gmail.com

ABSTRACT

The *in vitro* studies have been performed by using cup plate method to examine the antifungal activity of some leaf extracts. Leaf extracts of 6 plants, viz., *Hemidesmus indicus*, *Celosia argentea*, *Digera muricata*, *Coccinia indica*, *Cocculus hirsutus* and *Portulaca oleracea* were screened against 5 seed-borne pathogenic fungi, viz., *Alternaria alternata*, *Aspergillus niger*, *Curvularia lunata*, *Fusarium moniliforme* and *Trichoderma viridae*. Out of 6 leaf extracts, 5 leaf extracts showed antifungal activity. The extracts of *Hemidesmus indicus* showed maximum activity; while minimum activity was observed with *Coccinia indica* against the fungi under investigation. These plant extracts can possibly be exploited in the management of seed-borne pathogenic fungi to prevent biodeterioration of seeds in an eco-friendly way.

Keywords: antifungal activity, medicinal plant extracts, seed-borne fungi

Fungal diseases are known to cause great damages all over the world. Different species of *Alternaria*, *Aspergillus*, *Ceratobasidium*, *Cercospora*, *cochliobolus*, *Curvularia*, *Dreschlera*, *Fusarium*, *Penicillium*, *Pyricularia*, *Pythium*, *Rhizoctonia*, *Rhizopus*, *Sclerophthora*, *Trichoderma* and *Tricoconella* are most common associates of seeds all over the world, causing pre- and post-infections and considerable quality losses, viz., seed abortion, seed rot, seed necrosis, reduction or elimination of germination capacity, seedling damage and their nutritive value have been reported [1,2]. Seed treatment is the safest and the cheapest way of control of seed-borne fungal diseases and to prevent biodeterioration of grains [3].

Even though effective and efficient control of seed-borne fungi can be achieved by the use of synthetic chemical fungicides, the same cannot be applied to grains for reasons of pesticides, the toxicity [4]. It is now realized that chemical pesticides cause serious environmental problems and are toxic to non-target organisms [5]. There are evidences from earlier works that several plant species possess antifungal and antibacterial properties. The toxic effect of synthetic chemicals can be overcome, only by persistent search for new and safer pesticides accompanied by wide use of pest control methods, which are eco-friendly and effective [6,7]. Green plants represent a reservoir of effective chemotherapeutants and can provide valuable sources of natural pesticides [8,9]. Leaf extracts of various plants are known to possess antimicrobial activity [10]. Plant metabolites and plant based pesticides appear to be one of the better alternatives as they are known to have minimal environmental impact and danger to consumers in contrast to synthetic pesticides [11]. Extracts of many higher plants have been reported to exhibit antifungal properties under laboratory trails [12]. Exploitation of plant metabolites in crop protection and prevention of biodeterioration caused by fungi appear to be promising. In view of these, the attempt was made to screen some leaf extracts against seed-borne pathogenic fungi.

Short Communication, Acta Biologica Indica 2013, 2(2):481-483

pISSN 2319-1244, eISSN 2279-0160

Fungal pathogens were isolated on PDA medium from different stored seeds. Identified fungal cultures were isolated and pure cultures of each fungus made separately on PDA slants. These pure cultures were used for further investigation. For the study, fresh leaf extracts were used. The fresh leaves were collected, washed thoroughly with tap water and rinsed with sterile distilled water. Fresh leaves weighing 1 gm were crushed in mortar and pestle with 10 mL sterile distilled water. Then it was centrifuged for 20 min at -4°C at the 11000 rpm speed. 20 mL of PDA was poured in sterilized petridishes (9 cm diameter) allowed to solidify. Then pure cultures of fungi were streaked out in regular intervals on the media poured in petridishes. In the centre of the medium, a cup cavity of 8 mm diameter was made with sterilized No. 4 cork borer. This cup was filled with 0.1 mL of the leaf extract [13]. The petridishes were incubated for 6 days at 30±2°C temperature and the observations were recorded as diameter of inhibitory zone in mm. Cup plate filled with sterile distilled water was used as control in all the experiments. All the experiments were in triplicate and means has been considered in observation table 1. The antifungal activity of 6 leaf extracts against 5 seed borne fungi is presented in table 1 as zone of inhibition (in mm). It was observed from table 1, out of 6 leaf extracts, 5 leaf extracts showed antifungal activity; out of which *Hemidesmus indicus* showed maximum activity (mean activity zone 22. 96 mm), followed by *Cocculus hirsutus* (Mean activity zone 22.10 mm) *Celosia argentea* (mean activity zone 20.15) and *Digera muricata* where as minimum activity was observed with leaf extract of *Coccinia indica* (mean activity zone 15.54 mm).

Table 1. Antifungal activity of leaf extracts against seed-borne pathogenic fungi.

Plant Name	Zone of inhibition (in mm)				
	Alternaria alternata	*Aspergillus niger*	*Curvularia lunata*	*Fusarium monilifome*	*Trichoderma viride*
Hemidesmus indicus	22.96	21.35	20.95	22.58	21.34
Celosia argentea	20.11	19.78	19.90	20.15	19.78
Digera muricata	19.25	19.00	18.52	18.65	19.00
Coculus hirstus	22.10	20.00	21.35	18.50	18.75
Coccinia indica	16.25	15.54	16.19	16.34	17.25

** Values are the means of three replications.

Natural products from many plants are known to control plant pathogens. The antimicrobial potency of plants is believed to be due to tannins, saponins, phenolic compounds, essential oils and flavonoids [14]. The antimicrobial activity of plant oils and extracts has formed on the basis of many applications, including raw and processed food preservation, pharmaceuticals, alternative medicine and natural therapies [15]. Biofungicides are easily biodegradable, selective and locally produced, especially for the farmers who cannot afford expensive synthetics fungicides. By using plant species as raw materials for plant derived fungicides, can manage the disease at a greater extent [16]. The available reports revealed that, plant metabolites and plant based pesticides appear to be one of the better alternatives as they are known to have minimal environmental impact and danger to consumers in contrast to synthetic pesticides [17,18]. Even though effective and efficient control of seed borne pathogenic fungi can be achieved by the use of synthetic fungicides, the same cannot be applied to grains for reasons of pesticide toxicity [4,9]. Thus, there is a need to search for alternative approaches to store grains/cereals for human consumption without toxicity problems that are eco-friendly and not capital intensive. Considering these as first step in the present investigation 6 leaf extracts were screened against 5 important seed-borne phytopathogenic fungi isolated from stored seed.

REFERENCES

[1] Janardhana GR, Raveesha KA, Shetty HS, J. Sci. Food Agric. 1998, 76(4):573-578.
[2] Kavitha R, Umesha S, Shetty HS. Seed Research 2005, 33(2):187-194.
[3] Sharma VK, Bagga PS, J. Mycol. Plant Pathol. 2006, 59:305-308.
[4] Haris CA, Renfrew MJ, Woolridge MW, Food Additiv. Contam. 2001, 18(12):1124-1129.
[5] Anon. Int. J. Pest Control 2005, 45(2):369-372.
[6] Mohana DC, Raveesha KA, Lokanath R. Arch. Phytopathol. Plant Protect. 2008, 41(1):38-49.
[7] Chickkaiah MD, Prasad P, Vijayakumar V, Raveesha KA. J. Plant Protection Research 2011, 51(2):101-106.
[8] Balandrin MF, Klocke JA, Wurtele ES, Bollinger WH. Science 1985, 228:1154-1160.
[9] Wodageneh A, Wulp HVD. Pestic. Information 1997, 23(1):33-36.
[10] Powar BT. Int. Multidisciplinary Research Journal 2011, 1/4:11-13.
[11] Varma J, Dubey. Curr. Sci. 76(2):172-179.
[12] Parekh J, Karathia N, Chanda S. Afric. J. Biomed. Res. 2006, 9:53-56.
[13] Powar BT, Papdiwal AN. Int. J. Plant Protection 2010, 3(1):104-106.
[14] Roopa SV, Wadje SS. Int. J. Biol. Sci. 2012, 1(6):1-4.
[15] Satish S, Mohana DC, Raghavendra MP, Raveesha KA. J. Agri. Tech. 2007, 3(1):109-113.
[16] Pal GK, Kumar B, Shahi SK. Int. J. Universal Pharmacy and Life Sciences 2013, 3(2):5-14.
[17] Harborne JB. Phytochemical methods: A guide to modern techniques of plant analysis, 3rd ed., Chapman & Hall Pub., London, 1998, 7-8.
[18] Gottlieb OR, Borin MR, Brito NR. Phytochemistry 2002, 60(2):145-152.