ISSN: 2226-7522(Print) and 2305-3327 (Online)
Science, Technology and Arts Research Journal
Jan-Mar 2013, 2(1): 56-59
www.starjournal.org

Short Communication

Antifungal activity of Leaf and Pericarp of *polyalthia longifolia* Against Pathogens Causing Rhizome Rot of Ginger

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Abstract

The aqueous extracts of leaf, unripe pericarp and ripe pericarp of *Polyalthia longifolia* were assessed *in vitro* for inhibitory activity against *Fusarium oxysporum* f.sp. *zingiberi* and *Pythium aphanidermatum* isolated from rhizome rot specimen of ginger. The antifungal activity was determined by poison food technique. The extracts have shown dose dependent inhibition of mycelial growth of test fungi. The extracts were more effective in inhibiting *F. oxysporum* than *P. aphanidermatum*. Ripe pericarp extract inhibited test fungi to maximum extent followed by unripe pericarp extract and leaf extract respectively. The extracts of *P. longifolia* were found effective against ginger rhizome rot pathogens. Further, field experiments are to be carried out to recommend the extracts against the disease.

Article Information

Article History:
Received : 20-01-2013
Revised : 16-03-2013
Accepted : 17-03-2013

Keywords:
Rhizome rot of ginger
Poison Food Technique
Fusarium oxysporum
Pythium aphanidermatum
Polyalthia longifolia

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INTRODUCTION

Plants have been serving mankind as an important source of food, timber, fodder, medicine etc., Plants are very vulnerable for attack by a variety of pathogens such as bacteria, fungi, mycoplasma, actinomycetes & nematodes which causes a range of diseases in plants. Phytopathogens, in particular fungi are responsible for causing poor establishment and stand loss in a variety of economically important crops (Cowan, 1999; Farooq *et al*., 2010). Control of the disease by the use of chemicals is not so beneficial due to high cost, breakdown of resistance, residual problem and deleterious effect on non-target organisms including humans. This has necessitated search for alternatives for controlling the rhizome rot of ginger (Pandey *et al*., 2010). Antifungal agents based on natural products have always been promising in the control of fungi. The secondary metabolites produced by these plants have shown to affect the fungal agents. Moreover, these agents are not toxic and are decomposed easily. Numerous literatures have highlighted the inhibitory effect of plants and their possible utilization for control of plant diseases (Singh *et al*., 2006; Shrestha and Tiwari, 2009; Farooq *et al*., 2010; Nunez *et al*., 2010; Gupta and Tripathi, 2011).

Zingiber officinale Rosc. (ginger) belonging to the family Zingiberaceae is an important commercial crop grown for its aromatic rhizomes which are used as a spice and a medicine (Sharma *et al*., 2010). It is an important crop that earns a sizeable amount of foreign exchange for the country (Tarafdar and Saha, 2007). India is the largest producer of ginger accounting for about 1/3rd of total world output. Ginger is grown in various states such as Kerala, Karnataka, West Bengal, Andhra Pradesh, Orissa, Arunachal Pradesh and Sikkim (Sharma *et al*., 2010; Kumar *et al*., 2008). The production of ginger, however, is largely affected by diseases caused by bacteria, fungi, viruses, mycoplasma and nematodes. The crop suffers from diseases like bacterial wilt caused by *Ralstoniasolanacearum*, rhizome rot caused by *Pythium* species, *Fusarium* species, *Sclerotium* species, *Pseudomonas* species and others (Paret*et al*.,

2010; Kavyashree, 2011; Sharma *et al*., 2010; Senapati & Ghose, 2005; Dake & Edison, 1989). The disease management involves cultural, biological and chemical approaches for pathogen suppression (Bhai *et al*., 2005).

Polyalthia longifolia Thw. (Annonaceae) is native of Sri Lanka and is grown in gardens throughout the warmer parts of India. Stem bark contains clerodane diterpenes, polyalthialdoic acid and kolavenic acid. The stem and its bark also contain the cytotoxic aporphine alkaloid, liriodenine, besides *nor*-oliveroline and oliveroline-beta-N-oxide. Azafluorene alkaloids are also present in the bark and leaves (Khare, 2007). The plant is shown possessing antimicrobial (Faizi *et al*., 2008), antioxidant (Manjula *et al*., 2010), antitumor (Manjula *et al*., 2010), antiulcer (Malairajan *et al*., 2008), antileishmanial (Pal *et al*., 2011), hypotensive (Saleem *et al*., 2005), anti-hyperglycemic (Ghosh *et al*., 2010), anti-inflammatory (Tanna *et al*., 2009), hepato-protective (Tanna *et al*., 2009), anticataract-ogenesis activity (Sivashanmugam and Chatterjee, 2012) & others. Juice extracted from the fresh stem bark is taken orally to treat indigestion in Uthiramerur taluk, Kancheepuram district, Tamil Nadu, India (Sugumaran *et al*., 2010). The present study was designed to investigate inhibitory effect of aqueous extract of leaf and pericarp (ripe and unripe) of *P. longifolia* against *Fusarium oxysporum* f.sp. *zingiberi* & *Pythium aphanidermatum* isolated from rhizome rot specimen of ginger.

MATERIALS AND METHODS

Isolation of Fungi from Diseased Specimen of Ginger

Ginger specimens showing water soaked lesions along with yellowing and lodging of the pseudostem were selected for isolation of test fungi *viz*., *P. aphanidermatum* and *F. oxysporum* f.sp. *zingiberi*. Ginger specimens were collected from an infected field at Hosanagara (Taluk) of Shivamogga (District), Karnataka. The fungi were isolated on potato dextrose agar (PDA) and maintained on PDA.

Collection and Identification of Plant Materials

The leaves and fruits (ripe and unripe) of *P. longifolia* were collected from outskirts of Shivamogga during May 2012. The plant specimens were authenticated by Dr. Vinayaka K.S, lecturer, Department of Botany, Indira Gandhi Government College, Sagara, Karnataka.

Extraction

The leaves and pericarp of ripe and unripe fruits were cut into small pieces, shade dried and powdered using blender. For extraction, 10g of powdered material was added to 100ml of distilled water and boiled for about half an hour. The content was filtered through 4-fold muslin cloth followed by Whatmann filter paper and used for antifungal studies (Kekuda *et al*., 2010).

Antifungal Activity of Leaf & Pericarp Extracts

The antifungal efficacy of leaf and pericarp extracts was determined by Poisoned food technique. PDA media amended with different concentrations of leaf and pericarp extracts (10 and 20%) were sterilized by autoclaving and added to labelled petriplates. Fungal discs of 5mm diameter were cut from the periphery of 5 days old culture of *F. oxysporum* and *P. aphanidermatum* and were transferred aseptically on PDA plates poisoned with extracts and incubated for 5 days at 28°C. Colony diameters in mutual perpendicular directions were measured on the fifth day. The experiment was repeated twice and average colony diameter was recorded. Antifungal activity was recorded in terms of inhibition of mycelial growth (%) and calculated using the formula:

Inhibition of mycelial growth (%)=(C–T/C)×100

where 'C' is average diameter of fungal colony in control plates and 'T' is average diameter of fungal colony in poisoned plates (Gupta and Tripathi, 2011).

RESULTS AND DISCUSSION

The poisoned food technique was employed to determine inhibitory efficacy of different concentrations of leaf, ripe pericarp and unripe pericarp extracts of *P. longifolia* against *F. oxysporum* f.sp. *zingiberi* and *P. aphanidermatum* and the result is presented in Table 1 and 2. The average diameter of colonies of test fungi in poisoned plates was markedly lesser than that of colony diameter in control plates which is indicative of antifungal potential of extracts. The inhibition was concentration dependent. Among fungi tested, susceptibility to extracts was higher in *F. oxysporum* f.sp. *zingiberi* than *P. Aphani - dermatum*. Ripe pericarp extract caused highest inhibition of test fungi followed by unripe pericarp extract and leaf extract respectively.

Crop loss due to root rot-causing fungal pathogens is a significant problem. The most common method of control is the use of chemical fungicides. However, environmental concerns, costs, development of resistance in pathogens increased interest in alternatives such as plant

Table 1: Effect of leaf and pericarp extracts on mycelial growth of test fungi.

Treatment	Conce-ntration (%)	Colony diameter in cm	
		F. oxysporum	*P. Aphani-dermatum*
Control	-	3.5	3.5
Leaf	10	2.5	2.9
	20	1.9	2.3
Ripe pericarp	10	1.4	1.8
	20	0.8	1.2
Unripe pericarp	10	1.6	2.1
	20	1.0	1.6

Table 2: Inhibition of test fungi (%) by leaf and pericarp extracts.

Treatment	Conce nration (%)	Percent inhibition	
		F. oxysporum	*P. aphanidermatum*
Leaf	10	28.57	17.14
	20	45.71	34.28
Ripe pericarp	10	60.00	48.57
	20	77.14	65.71
Unripe pericarp	10	54.28	40.00
	20	71.42	54.28

extracts, antagonistic microbes and others to traditional synthetic chemical fungicides (Sealy *et al*., 2007). Plants and plant products have shown to be useful candidates for prevention and control of phytopathogenic fungi. Several studies have shown that the crude extracts and purified components of plants possess inhibitory activity against fungal agents including plant pathogenic fungi. The volatile oil and acetone extract of *Foeniculum vulgare* were shown to exhibit concentration dependent antifungal activity against species of *Aspergillus*, *Penicillium*, *Fusarium* and *Curvularia* (Singh *et al*., 2006). Shrestha and Tiwari (2009) observed dose dependent inhibitory effect of crude extracts of some medicinal plants against *Fusarium solani* (Mart.) Sacc., causing dry potato tuber rot. Farooq *et al*. (2010) showed the efficacy of plant extracts against *Sclerotium rolfsii*, causative agent of root rot of sugar beet and observed maximum inhibition of the fungus by *Azadirachta indica* followed by *Cassia fistula*, *Cannabis sativa* and others. Nunez *et al*. (2010) observed the inhibitory effect of hexane and ethanol extracts of aerial parts of *Juniperus lucayana* against phytopathogenic fungus *Botrytis cinerea* by poisoned food technique. Gupta and Tripathi (2011) showed fungitoxic activity of *Solanum torvum* against *Fusarium sacchari*.

Poisoned food technique has been routinely employed to screen the effect of plants and their compounds against fungi. The antifungal activity is observed as reduction in the mycelial growth of fungus in poisoned plates when compared to control plates. It has been employed by several researchers to evaluate antifungal activity of plants (Nunez *et al*., 2010; Gupta and Tripathi, 2011). In the present study, we have investigated the effect of aqueous extracts of leaf and pericarp of *P. longifolia* against mycelial growth of two pathogenic fungi *F. oxysporum* f.sp. *zingiberi* and *P. aphanidermatum* isolated from soft rot specimen of ginger. The extracts have shown marked concentration dependent inhibition of mycelial growth of test fungi indicating the presence of antifungal principles in the aqueous extracts. In an earlier study, Sagar *et al*. (2007) showed the fungitoxic efficacy of some plant extracts against *P. aphanidermatum* and *F. solani* isolated from rhizome rot specimen of ginger. It was found that *Azadirachta indica* and *Ferula asafeotida* showed maximum inhibition of mycelial growth of *P. aphanidermatum* and *F. solani* respectively.

CONCLUSION

From the results of the present study, it is concluded that the leaf and pericarp extracts of *P. longifolia* are effective against ginger rhizome rot pathogens. Further, field experiments are to be carried out in order to recommend the bioactive extracts against the disease.

ACKNOWLEDGEMENTS

The authors are sincerely thankful to HOD, Department of Microbiology & Principal, SRNMN College of Applied Sciences, Shivamogga and NES, Shivamogga for providing facilities to conduct work and giving moral support.

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