EFFICACY OF LEAF EXTRACTS AGAINST THE POST HARVEST FUNGAL PATHOGENS OF COWPEA

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ABSTRACT

The study aimed to control the fungi associated with cowpea legumes. Post-harvest fungal diseases of cowpea legumes in the markets of Jalna (MS) India, were isolated, identified and maintained on an agar medium. Efficacy of 10 % aqueous leaf extracts was tested against the growth of 06 post harvest fungal pathogens of Cowpea legumes. Aqueous leaves extract of *Parthenium hysterophorus, Annona reticulata, Polyalthia longifolia, Ipomea carnea, Tridax procumbens, Argemone mexicana, Cathranthus roseus, Eucalyptus globulus* and *Achyranthus aspera* were used against the post harvest fungal mycoflora. All the plants used were found to be antifungal. In particular *Eucalyptus globulus, Argemone mexicana, Tridax procumbens* and *Parthenium hysterophorus* were highly inhibitory. These plant extracts can be used for controlling fungal pathogens of Cowpea legumes during post harvest as these are eco-friendly and do not cause environmental hazard.

Keywords: Cowpea legume, aqueous leaves extracts, post harvest pathogens

INTRODUCTION

Cowpea (*Vigna Ungiculata*) is considered as one of the vegetable crops which have an importance for local consumption and exportation purposes in India. Studies in the sub-region have shown that losses on legumes during post harvest, drying and storage are significantly high. This is due to pod shattering in the field, poor drying systems, insect infestation that normally starts in the field and proceeds into storage, damage insects and mould. Legume may receive improper care on the farm or in temporary storage and become heavily invaded by hidden storage fungi. Upon transfer to another storehouse, it may spoil more rapidly than really sound legume. Invasion by storage fungi may occur very shortly after harvest.

Cowpea legumes are affected by various fungal pathogens; though various systemic fungicides are used to control fungal diseases of their indiscriminate use may cause environmental hazards. Biological control of plant disease, is safe and sustainable (Cook and Baker, 1982, Janisiewiez and Korsten, 2002; Spadaro and Gullino, 2005; Sobowale *et al*., 2008). Various plants are known to have antimicrobial properties and these are used as promising biocontrol agents, (Grane & Ahmad, 1988; Wilson *et al*., 1997; Abd-Alla *et al.,* 2001). Recently Alkhail (2005) showed that aqueous extracts of plants viz., *Allium sativum, Cymbopogon proxims, Carum carvi, Azadirachta indica* and *Eugenia caryophyllus* had strong antifungal activity against fungi viz., *Fusarium oxysporum, Botrytis cinerea* and *Rhizoctonia solani.* Most botanical pesticides are known to be general bio-cides or bio-irritants (White, 2004). An *in vitro* study showed that an aqueous extracts from leaves showed anticancer activity, (Kiranmayi Gali *et al*., 2011) and antibacterial activity (Kempraj and Bhatt, 2010). Mohanta *et al.* (2007) prepared the aqueous and organic solvent extracts of the plant *S. anacardium* and screened for antimicrobial (disc diffusion method) and phytochemical properties. The petroleum ether (PEE) and aqueous extract fractions (AQE) showed inhibitory activity against *Staphylococcus aureus* (Mona Semalty *et al.,* 2010). In the present study the antifungal activity of aqueous leaf extracts of nine plants against *post* harvest fungal pathogens of Cowpea legumes was investigated.

MATERIALS AND METHODS

Collection of plant materials:

Fresh and healthy leaves of nine allelopathic plant species viz., *Parthenium hysterophorus, Annona reticulata, Polyalthia longifolia, Ipomea carnea, Tridax procumbens, Argemone Mexicana, Cathranthus roseus, Eucalyptus globulus, Achyranthus aspera* were collected from the surrounding area of the Jalna City. Leaves were washed thoroughly with distilled water to remove any dust. Washed leaves were used in the preparation of leaf extract.

Preparation of aqueous extract:

Plant extracts were obtained by grinding 10 gm freshly collected leaves with 100 ml of distilled water and filtering it through double layered muslin cloth. It was diluted with distilled water to 10 % concentration, and used in the further experiment immediately.

Effect of Extract on Radial Growth

The method used for testing fungitoxic properties of plant extracts was poisoned food technique (Nene and Thapliyal, 1993). The leaf extract of 10 % concentrations were applied on Petri dishes and 10 ml melted PDA medium was added. The sterile distilled water containing 0.2% Tween-80 was used as control. The Petri dishes were shaken gently to allow the extract to distribute evenly. After the medium solidified, a mycelial plug (5 mm diam.) of fungi, taken from the edge of a 3-day old culture was put in the center of the PDA. Three Petri dishes were prepared for each concentration. The cultures were incubated for 7 days in the dark under room temperature. The diameter of fungal colony was measured daily. The inhibitory activity to the radial growth (IR) was determined according to the following formula (Pinto *et al*., 1998):

$$\text{IR} \ \% \ = \frac{dc - dt}{dc} x100$$

Where:

IR = inhibitory activity to the radial growth

dc = average increase in mycelia growth in control plates

dt = average increase in mycelia growth in treated plates.

RESULTS AND DISCUSSION

Seven fungi were isolated from the legume of Cowpea as, *Aspergillus niger, Penicillium digitatum, Botrytis cinera*, *Rhizopus arrhizus*, *Aspergillus flavus, Chaetomium brasiliense and Rhizoctonia solani.* Effect of aqueous leaf extract of nine plants viz. *Parthenium hysterophorus, Annona reticulata, Polyalthia longifolia, Ipomea carnea, Tridax procumbens, Argemone mexicana, Cathranthus roseus, Eucalyptus globulus* and *Achyranthus aspera* was evaluated. Data reveals that all plants used were found to be antifungal activity. The leaf extract of *Parthenium hysterophorus* (Table 1) inhibited the growth of *Chaetomium brasiliense* 64 %, followed by *Aspergillus niger* 61%, *Penicillium digitatum* 47% and *Botrytis cinera* 45 %. Lowest inhibition percentage was recoded in *Rhizoctonia solani* 21 %.

Pawar and Kolhe (2010) reported that, 10 % aqueous leaf extract of *Parthenium hystrophorus* retarted the growth of *C. lunata* 43 mm. The allelopathic and antifungal potential of *P. hysterophorus* results from the release of phytotoxic substances such as caffeic, ferulic, vanillic, chlorogenic, p- coumaric and parthenin, p-hydroxybenzoic acids, ambrosin and coronopilin (Jarvis *et al.,* 1985). The antifungal activities of root and shoot extracts of two Asteraceous plant species including *P. hysterophorus* and Ageratum conyzoides were determined against *Macrophomina phaseolina* (Tassi) Goid., the cause of charcoal rot disease of *Helianthus annus L. A* measured reduction in *M. phaseolina* biomass was observed due to aqueous extracts of different concentrations (Bajwa *et al.,* 2007).

Annona reticulata retarted the maximum growth of *Botrytis cinera* 41 % folloed by *Rhizopus arrhizus* 29 %, *Rhizoctonia solani 28 %* and less effective against *Aspergillus niger* 11 %. *Polyalthia longifolia* extracts inhibits the fungi like *Penicillium digitatum* 50 % followed by *Botrytis cinera 45 %* over control. The extracts of *Polyalthia longifolia, Annona squamosa and Tridax procumbens* were found to be inhibitory for the growth of *Alternaria porri, Aspergillus niger, Fusarium oxysporum and Cladosporium allii* (Ghangaonkar, 2007).

The leaf extract of *Ipomea carnea* effectively inhibited the growth of fungus *Botrytis cinera* 21 %, followed by *Aspergillus niger, Aspergillus flavus* and *Chaetomium brasiliense* each 14 % less recorded in *Penicillium digitatum, Rhizopus arrhizus* 13 % each. Kagale *et al.*, (2011) reported the *Ipomoea carnea* effectively reduce the incidence of sheath blight disease in rice

caused by *Rhizoctonia solani. Tridax procumbens* reduced the fungal mycoflora of cowpea legume. Maximum radial growth of fungus *Botrytis cinera* retarded by the *Tridax procumbens,* i. e. 48 % followed by Ra 26 %, An 25 % and minimum recorded by the fungi of pd 13%. 80% of both *Venonia amygdalena* and *Tridax procumbens* had high inhibitory effect of 49.20% against *Geotrichum candidium* and 53.30% against *Aspergillus niger* respectively (Ijato *et al.,* 2011).

Argemone Mexicana maximum reduced the growth of *Botrytis cinera* 47 %, follwed by *Rhizoctonia solani* 33 %, *Rhizopus arrhizus* 27 % and lowest rerecorded in the *Penicillium digitatum* 13 % over control. *Cathranthus roseus* highly retarded the growth of *Botrytis cinera* 42 %, followed by Rs 32 %, Ra 30 % and minimum recoded in the treatment of *Chaetomium brasiliense* 16 %. *Eucalyptus globulus* reduced the maximum radial growth of the fungus *Botrytis cinera* 46 %, followed by *Rhizopus arrhizus* 26 %, *Aspergillus flavus* 24 % and least recoded in the treatment of *Penicillium digitatum* 12 %. *Achyranthus aspera* was less effective against the fungi but showed the maximum effect on *Rhizoctonia solani* 20 % followed by *Rhizopus arrhizus* 19 % and least count was found in the *Aspergillus niger, Penicillium digitatum* each 08 %.All plants effectively controlled the fungi, *Botrytis cinera* except *Parthenium hysterophorus.*

Plant pathogens have a world wide host range covering all groups of plants. The biological control play an important role as per the modern concept of integrated disease management and sustainable agriculture and biopesticides, apart from reducing the use of synthetic fungicides avoid damage of non targeted beneficial flora. Thus it can be concluded that the plant extract offer much important scope for their exploitation of a promising material for use in plant disease control.

Table 1: Efficacy of plant extracts on post harvest fungi on legume of Cowpea.

Plant extracts	Fungal pathogens						
	An	Pd	Bc	Ra	Af	Cb	Rs
Parthenium hysterophorus	25 (61)	32 (47)	28 (45)	29 (29)	31 (22)	31 (64)	39 (21)
Annona reticulata	34 (11)	44 (13)	31 (41)	29 (29)	36 (15)	33 (12)	34 (28)
Polyalthia longifolia	29 (19)	30 (50)	28 (45)	34 (21)	32 (21)	33 (12)	35 (27)
Ipomea carnea	50 (14)	44 (13)	47 (21)	40 (13)	37 (14)	32 (14)	45 (13)
Tridax procumbens	25 (25)	28 (13)	26 (48)	31 (26)	30 (24)	27 (22)	40 (20)
Argemone mexicana	25 (25)	28 (13)	26 (47)	30 (27)	29 (25)	29 (19)	30 (33)
Cathranthus roseus	24 (26)	22 (23)	30 (42)	28 (30)	26 (30)	31 (16)	31 (32)
Eucalyptus globulus	29 (19)	29 (12)	27 (46)	31 (26)	30 (24)	28 (20)	40 (20)
Achyranthus aspera	36 (08)	31 (08)	50 (17)	36 (19)	38 (12)	31 (16)	40 (20)
Control	64	60	80	70	68	64	74

An- *Aspergillus niger,* Pd - *Penicillium digitatum,* Bc- *Botrytis cinera*, Ra - *Rhizopus arrhizus*, Af - *Aspergillus flavus,* Cb - *Chaetomium brasiliense and* Rs- *Rhizoctonia solani*

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How to Cite this Article:

Umesh P. Mogle, 2013. Efficacy of leaf extracts against the post harvest fungal pathogens of Cowpea. *Biosci. Disc.,* **4**(1):39-42