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Efficiency of various plant extracts against *Phytophthora sp.* causing leaf blight of tomato

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ABSTRACT

In the present investigation phyllosphere mycoflora of tomato vegetable crop have been exploited as well as attempt was also made to control the foliar pathogens by applying easily available angiosperm plants around our areas. With this view the attempt has made to screened the antifungal efficacy of 10 angiosperm taxa viz. *Zingiber officinale*, *Allium sativum*, *Calotropis procera*, *Ricinus communis*, *Citrus lemon, Acacia nilotica, Withania somnifera*, *Parthenium histerophorus*, *Phyllanthus fraternus* and *Euphorbia hirta.* The medicinally known different plant parts from these 10 plants were tested for its antifungal efficacy against *Phytophthora sp.*The 10 per cent aqueous and acetone extracts of plant parts were used along with commercial fungicides mancozeb against selected pathogens. The antimycotic study against the phytopathogenic fungi *Phytophthora sp.* showed that the aqueous and acetone extracts of Z. *officinale* and *Allium sativum;* acetone extracts of *C. procera* and aqueous extracts *E. hirta* found to be 100 per cent effective. The present study indicates that application of plant extracts as biocontrol agents was found to be effective in controlling tomato diseases and *Z. officinale* extracts may be an alternative for use of natural product to control phytopathogenic fungi avoiding chemical fungicides application. The present study clearly indicates that the commercial fungicide Mancozeb found highly effective which restricts the radial mycelia growth of all pathogens since 3rd day of incubation.

Keywords: Efficiency, Pathogen, Mycoflora, *Phytopthora sp.,* Plant extracts

INTRODUCTION

Many fungal diseases cause losses in the yield of vegetable crop plant. Rhizosphere fungi causes root rot, seedling diseases, canker, fruit rot, leaf spot etc. which result into loss of yield of vegetables. The diseases control by using chemical fungicides is an effective method, but the excessive use of chemical fungicides effect on environmental and contamination of various substances such as water, soil and air, which affect on human health concern and development of fungal resistance capacity of organisms.

organisms. Therefore, the merit attention of all concerned to look into the potential of integrating in the management of economically important diseases. The products prepared from green plants should be preferred as they are environmentally non-palliative and non- hazardous in preparation and use (Rout and Tiwari, 2012). The secondary components of some plants contain medicinally active fractions of plant tissue that are toxic to pathogens (Gurjar *et al*., 2012) and thus can be utilized in plant disease management program. To avoid the hazardous effects of chemicals, natural products of some plants have been used to control plant diseases. Development of safer anti-fungal agents such as plant extracts to control phytopathogens in agriculture was reported in recent years. The essential oils and their constituents have been found effective as antifungal agent. Extracts from plants such as garlic (*Allium sativum*) (Obagwu and Korsten, 2003), have been tested on many other soil borne fungi. Alkhail (2005) showed that extracts of *Allium sativum, Azadirachta indica* and *Eugenia caryophyllus* presented remarkable biological activity when tested against fungi viz., *F. oxysporum,* and *Botrytis cinerea*. Therefore, that it has been widely as an important ecological phenomenon. The efficacy of the bioagents was found to be hampered due to poisonous nature of different pesticides viz. fungicides, insecticides, nematicides and weedicides used simultaneously in crop production technology. (Sushir *et al*.,2015). Among alternative methods of grey mould control, the use of natural compounds as plant extracts is one which can be characterized by lack of toxicity for humans and environment, selectivity, biodegradable activity and a great variety of chemical composition, with a large variety of secondary metabolites, most of them not yet studied in correlation with the fungicidal action. The plant, ashwagandha (*Withania somnifera* (L) Dunal) is a representative of the *Solanaceae* family, the present study revealed was made to control fungal diseases of vegetables through biocontrol aspects. Some plant extract has been safe to replace various chemical fungicides and can be uses as environmental safe, ecofriendly and un-hazardous. The known some medicinal and non-medicinal undertaken to studies its antifungal efficacy against some fungal pathogen of vegetables'. The plant various parts that are root, leaf, fruit, stem and all part freshly collected and used preparing plant. Further work is required to control of mycelium growth of fungi through plant extract in laboratory conditions to determine the biologically active ingredient present in plant extract. The reported well-known common fungicide Mancozeb was use to compare study of angiosperm taxa.

In the present research topic, the fungal pathogen-causing root and leaf diseases of these vegetable crops was exploited along with their management by biocontrol agents. In the present study, different rhizosphere fungi were tested against the major fungal pathogens. The antimycotic efficiency of some selected plant extracts will be evaluate against *Phytopthora sp.*

MATERIAL AND METHODS

Collection of plant parts:

In the present investigation ten plants were undertaken to study the antifungal efficacy of plant extract, these are-

1.	*Zingiber officinale*	Rhizome
2.	*Allium sativum*	Bulb
3.	*Calotropis procera*	Flower
4.	*Ricinus communis*	Seed
5.	*Citrus lemon*	Fruit juice
6.	*Acacia nilotica*	Legume
7.	*Withania somnifera*	All parts
8.	*Parthenium histerophorus*	Inflorescence
9.	*Phyllanthus fraternus*	Branch
10.	*Euphorbia hirta*	All part

All these plants were collected from the various localities. These plants were undertaken for preparation of aqueous and acetone extracts and evaluating their relative efficacy against the pathogen. The fresh part of ten selected plants were collected and brought into the laboratory for the preparation of plant extracts.

Preparation of plant extracts

In the present study aqueous and acetone plants extract were tested. Required quantity of matured parts of test plants were collected from various localities. The following method was used for the preparation of plant extracts as followed by.

Sufficient quantities of fresh matured parts of test plants were washed in sodium hypochloride solution (0.6%) for surface sterilization for 2-3 minutes and then thoroughly washed with sterilized distilled water. 1 ml of distilled water was used for each gram of fresh plant materials for maceration. In this way required

quantities of distilled water and fresh part were macerated separately in mortar and pestle and extract was collected. The extract thus obtained was first filtrated through double folds of muslin cloth so as to remove fibrous and suspended material and later on through Whatman's filter paper No. 40. This filtered was taken as stock material of crude aqueous extracts. The 10% concentration of aqueous extracts of 10 test plants were prepared and used in the present study. The fungicide Mancozeb was taken in recommended dose (0.25%).

Acetone leaf extract was prepared by using acetone instead of distilled water and stock acetone extract was used for assessing the antifungal activity.

Collection of plant pathogens

The phytopathogens *Phytophthora sp* were collected from phyllosphere of vegetables were selected to screen against plant extracts.

Poisoned food technique

The plant extract was evaluated in the laboratory by using poisoned food technique (Nene and Thapliyal, 1979). The PDA medium was distributed in 250 ml conical flask @ 100 ml and the flasks were autoclaved for 15 minutes. The required quantities of fungicide Mancozeb and plant extract of each plant were added to the flask so as to get desired concentration. About 20 ml, melted poisoned PDA medium was poured in each sterilized petriplate and allowed to solidified. All the petriplate were inoculated by thirteen pathogenic fungi separately. Disc from 10 days old culture was cut with sterilized cork borer and transferred aseptically in the centre of petriplate. Four petriplate as control fungus, aqueous extract, acetone extract and fungicide Mancozeb were accommodated for each test fungus to assess the antifungal efficacy of experimented ten plants. These petriplate were incubated at 25-+2°C temperature. The radial mycelial growth in diameter were observed and recorded at 3rd, 5th and 7th days after inoculation. Mycelial diameter of each treatment was compared with control plates. The percent inhibition of mycelial growth was calculated with the formula given below.

$$\textit{Per cent inhibition} = \frac{TFC - TFTr}{TFC} \; X\,100$$

Where-

TFC = Test fungus in control, TFTr = Test fungus in treatment.

RESULTS

The result from observation Table-1 (Fig.1) showed that the aqueous and acetone extract of *Zingiber officinale* and *Allium sativum* and aqueous extracts of *Euphorbia hirta*and acetone extracts of *Calotropis procera* recorded 100 per cent effective against *Phytophthora sp.* since 3rd day of incubation.

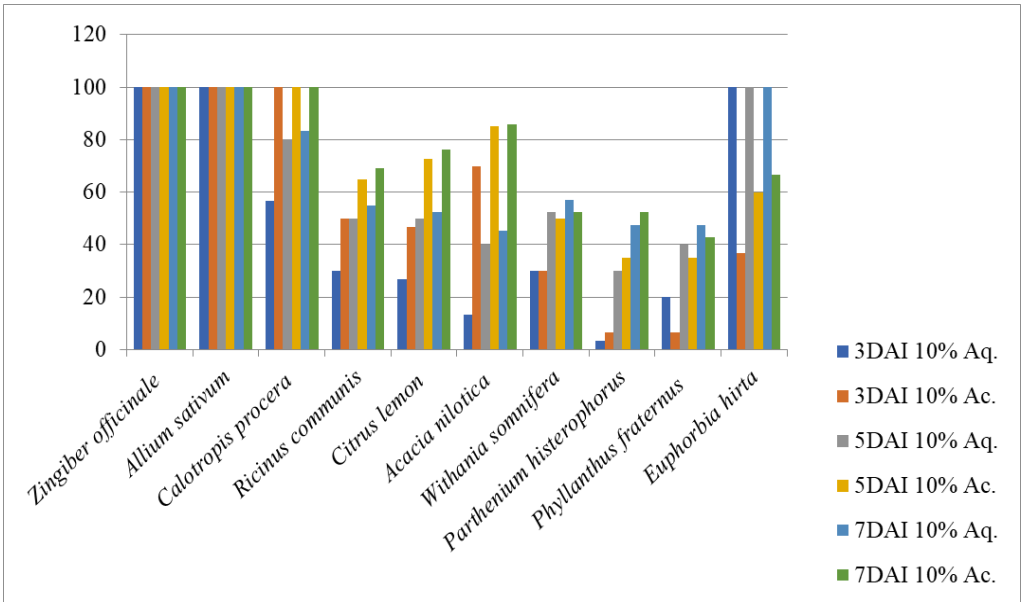

Fig.1- Effect of different plant extracts on radial mycelial growth of *Phytophthora sp.*

Table 1:- Effect of different plant extracts on radial mycelial growth of *Phytophthora sp.*

Sr. No.	Plant extracts	Radial mycelial growth (mm)*						% growth inhibition					
		3DAI		5DAI		7DAI		3DAI		5DAI		7DAI	
		10% Aq.	10% Ac.	10% Aq.	10% Ac.	10% Aq.	10% Ac.	10% Aq.	10% Ac.	10% Aq.	10% Ac.	10% Aq.	10% Ac.
1	*Zingiber officinale*	00.00	00.00	00.00	00.00	00.00	00.00	100.00	100.00	100.00	100.00	100.00	100.00
2	*Allium sativum*	00.00	00.00	00.00	00.00	00.00	00.00	100.00	100.00	100.00	100.00	100.00	100.00
3	*Calotropisprocera*	13.00	00.00	08.00	00.00	07.00	00.00	56.66	100.00	80.00	100.00	83.33	100.00
4	*Ricinuscommunis*	21.00	15.00	20.00	14.00	19.00	13.00	30.00	50.00	50.00	65.00	54.76	69.04
5	*Citrus lemon*	22.00	16.00	20.00	11.00	20.00	10.00	26.66	46.66	50.00	72.5	52.38	76.19
6	*Acacia nilotica*	26.00	09.00	24.00	06.00	23.00	06.00	13.33	70.00	40.00	85.00	45.23	85.71
7	*Withaniasomnifera*	21.00	21.00	19.00	20.00	18.00	20.00	30.00	30.00	52.5	50.00	57.14	52.38
8	*Partheniumhisterophorus*	29.00	28.00	28.00	26.00	22.00	20.00	03.33	06.66	30.00	35.00	47.61	52.38
9	*Phyllanthusfraternus*	24.00	28.00	24.00	26.00	22.00	24.00	20.00	06.66	40.00	35.00	47.61	42.85
10	*Euphorbia hirta*	00.00	19.00	00.00	16.00	00.00	14.00	100.00	36.66	100.00	60.00	100.00	66.66
11	Fungicide	00.00	00.00	00.00	00.00	00.00	00.00	100.00	100.00	100.00	100.00	100.00	100.00
12	Control	30.00	-	40.00	-	42.00	-	00.00	-	00.00	-	00.00	-

DAI - Day after Incubation; Aq. –Aqueous plant extract; Ac. – Acetone plant extract; *Mean of three replica

The aqueous and acetone extract of *Parthenium histerophorus* found less effective which inhibits minimum growth of the pathogen on 3rd and 5th day of incubation; whereas aqueous extracts of *Acacia nilotica*(45.23%) and acetone extracts of *Phyllanthus fraternus* (42.85%) inhibits comparatively least effective against the *Phytophthora sp. in vitro* on 7th day of incubation. It was interestingly observed that except plant extract of *Zingiber officinale* and *Allium sativum* and aqueous extracts of *Euphorbia hirta* and acetone extracts of *Calotropis procera*, all other tested plant extracts recorded comparatively less effective since 3rd day of incubation. The commercial fungicide Mancozeb recorded highly effective since 3rd day of incubation against all thirteen plant extracts of different angiosperms taxa.

CONCLUSIONS

The antifungal properties of these selected plants were evaluated by poisoned food technique. The radial mycelial growth of each tested pathogen inhibited by different plant extracts were recorded on 3rd, 5th and 7th day of incubation. The per cent inhibition of mycelial growth was calculated by using standard formula. From the calculated data it was concluded that aqueous and acetone extract of *Zingiber officinale* and *Allium sativum* and aqueous extracts of *Euphorbia hirta* and acetone extracts of *Calotropis procera* recorded 100 per cent effective against *Phytophthora sp.* since 3rd day of incubation. The aqueous and acetone extract of *Parthenium histerophorus* found less effective which inhibits minimum growth of the pathogen on 3rd and 5th day of incubation.

Conflicts of Interest: The author declares no conflict of interest

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