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ECO FRIENDLY MANAGEMENT OF EARLY BLIGHT OF TOMATO USING BOTANICAL PLANT EXTRACTS

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ABSTRACT

Antifungal activities of 9 plant extracts were evaluated against *Alternaria solani* causing early blight of tomato using radial growth technique. While all tested plant extracts produced some antifungal activities, the results revealed that *Azadirachta indica* (neem), *Datura stramonium* (datura) and *Withania somnifera* (ashwagandha) showed significant antifungal activities. The leaf extract of Ashwagandha W. somnifera was most effective in inhibiting the mycelial growth of *A. solani* (62.56%). Extract of *D. stramonium* (34.65%) and *A. indica* (25.27%) exhibited moderate activity with average mycelial inhibition of 34.65 and 25.27% respectively. *Allium crispum* (jungli pyaj), *Mentha requienii* (pudina), *Lepidium sativum* (chandrasur), *Ocimum tenuiflorum* (Tulsi) and *Calotropis gigantia* (Aak) also inhibited mycelial growth of *A. solani*. Sporulation per microscopic field was found maximum in *C. gigantia* (89.11) and minimum in *A. crispum* (1.44).

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is an important vegetable crop grown throughout the world. It ranks second among vegetable crop in terms of food value and ranks first in processed food product. Tomato is vulnerable to many pathological problems which are most serious and significant in reducing yield and cause economic losses (Balanchard, 1945). Of them, early blight caused by *A. solani* has been reported to be most prevalent and destructive throughout the tomato growing areas causing loss of millions of dollars annually worldwide including India and is one of the major limiting factors in tomato production in the country.

Control of early blight disease has been accomplished mostly by the application of chemical fungicides, long crop rotations, pasteurizing seedbeds with steam or fumigants (Spletzer and Enyedi, 1999).

This disease is controlled mainly with agro-chemicals however the world wide trend towards environmentally-safe methods of plant disease control in suitable agri demands for reducing the use of these synthetic chemical fungicides. In an attempt to modify this condition some alternative methods of control have been adopted. Natural plant products are important sources of new agrochemicals for the control of plant diseases (Kagale *et al*., 2004).

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Biological screening of plant extracts is carried out throughout the world for the determination of their antifungal activity. Control of microorganism linked plant disease with plant extracts as components in integrated pest management strategy has been tested by many researchers. Chapagain *et al.* (2007) reported that saponin rich extracts (4%) from Balanites aegyptiaca fruit mesocarp, showed 34.7% growth inhibition against *A. solani.* Muto *et al.* (2005) tested the extracts derived from fresh and dry tissues of 14 plant species against *A. solani*. Mohana and Raveesha (2007) reported that the aqueous extract from Decalepis hamiltonii at 30% concentration caused 84.83% mycelial growth inhibition on *A. alternata* and increase in extract concentration up to 50% resulted in 100% inhibition. Yanar *et al.* (2011) tested 27 plant extracts and reported Circium arvense, Humulus lupulus, Lauris nobilis and Salvia officinalis as most effective in inhibiting the mycelial growth of *A. solani*. The objective of the present study is to evaluate the antifungal activity of extracts of 9 plant species against *A. solani* causing under *in vitro* conditions.

MATERIAL AND METHODS

The present investigation was carried out at the Department of Plant Pathology, IGKV Raipur during 2012 –2013 to determine the antifungal activity of 9 plant leaf extract viz. Tulsi (*Ocimum tenuiflorum*), Neem (*Azadirachta indica*), Karanj (*Pongamia pinnata*), Datura (*Datura stramonium*), Ashwagandha (*Withania somnifera*), Aak (*Calotropis gigantia*) Jangly pyaj (*Allium crispum*), Chandrasur (*Lepidium sativum*), and Pudina (*Mentha requienii*) along with control against *A. solani* in water by employing food poisoning technique.

Isolation and purification of early blight pathogen

The pathogenic isolates of *A. solani* was isolated from the tomato leaves showing typical *Alternaria* leaf spot symptoms i.e. water soaked circular or irregular brown spots by using potato dextrose agar (PDA) medium and identified as *A. solani* according to Simmsons (2007).

Collection of plants samples and Preparation of Plant extracts

20 g leaf of each plant was taken in 100 mL of water and boiled till the softening of the leaf and then extract was filtered. 2 g of dextrose and 2 g agar agar were mixed in filtrated leaf extract; the volume was make-up to 100 mL and then sterilization was done by autoclaving at 15 Ibs for 20 minutes. To avoid bacterial contamination, a little amount of streptomycin sulphate was added at the time of pouring of media. In each Petri plate 20 mL medium was poured in sterilized petriplates and allowed to solidify. PDA without leaf extract served as control. Five mm disc from ten days old culture of the test pathogen by the help of sterilized cork borer was placed at the center of medium; three replications were kept in each treatment along with control. The inoculated petriplates were then incubated at 27 ± 2°C and observation was recorded at alternate day's upto ten days. The inhibitory activity of each treatment was expressed as the percent growth inhibition as compared to the negative control (0%) using the following formula (Pandey *et al*., 1982):

Growth inhibition (%) = DC- DT/ DC × 100

Where

C = Diameter of fungus colony (mm) in control,

T = Diameter of fungus colony (mm) in treatment.

For the sporulation five mm disc was completely shaken in ten mL of sterilized water. Proper dilution was made for easier counting of spores. One drop of spore suspension was kept in cavity slide and spores were counted per microscopic field under compound microscope, observation was taken at three microscopic fields in one cavity slide and in one petriplate three discs from middle was used.

RESULTS AND DISCUSSION

Hot water extracts of 9 plant species were evaluated to observe the inhibitory activity of *A. solani* under *in-vitro* condition. It is clear from the data (Table 1) that all extract of botanical plants were significantly superior in reducing the radial growth over control. At 10 days after inoculation (DAI), maximum inhibition in growth was recorded in the Ashwagandha extract (62.57%) followed by Datura (35.32%), Neem (22.65%), Karanj (17.28%), Tulsi (8.07%), Pudina (7.87%), and Chandrasur (6.14%). Minimum inhibition was recorded in Jungli pyaj (5.95%).

Average inhibition percentage indicates that maximum inhibition of growth of *A. solani* recorded in Ashwagandha, datura, neem, and karanj extracts while average growth inhibition recorded minimum in leaf extract of tulsi (8.62%). The data further showed that all the plant extracts inhibited the growth of the *A. solani* from 62.57% in Ashwagandha to 5.95% in Jungi pyaj. Among the all plant extracts Ashwagandha

Table 1. Efficacy of different plant leaf extracts on inhibition of radial growth of *Alternaria solani*

S.N.	Botanicals	2 DAI	4 DAI		6DAI		8 DAI		10 DAI		Avg.	No. of spores/ microscopic field
		Growth (mm)	Inhibition (%)	Growth (mm)	Inhibition (%)	Growth (mm)	Inhibition (%)	Growth (mm)	Inhibition (%)	Growth (mm)	Inhibition (%)	
1.	Tulsi	20.67	6.61	38.00	9.14	52.50	9.48	66.00	9.79	79.83	8.07(16.47)	8.62	23.56
2.	Neem	16.17	27.17	30.17	27.88	43.67	24.71	55.67	23.92	67.17	22.65(28.42)	25.27	23.00
3.	Karanj	20.67	6.70	35.67	14.74	48.67	16.09	61.17	16.40	71.83	17.28(24.55)	14.24	22.22
4.	Datura	14.67	33.82	27.17	35.05	38.17	34.20	47.67	34.85	56.17	35.32(36.46)	34.65	9.78
5.	Aak (Madar)	18.50	16.45	35.50	15.13	52.00	10.34	67.00	8.43	80.50	7.29(15.66)	11.53	89.11
6.	Jungly Pyaj	17.67	20.26	35.17	15.92	51.17	11.78	67.17	8.20	81.67	5.95(14.10)	12.42	1.44
7.	Ashwagandha	7.83	64.63	15.83	62.17	22.33	61.49	27.83	61.96	32.50	(52.28)62.57	62.56	12.78
8.	Chandrasur	16.50	25.71	34.50	17.53	51.50	11.21	67.00	8.43	81.50	6.14(14.35)	13.80	43.22
9.	Pudina	19.00	14.19	36.00	13.92	52.00	10.34	66.50	9.11	80.00	7.87(16.29)	11.09	54.89
10.	Control	22.17	0.00	41.83	0.00	58.00	0.00	73.17	0.00	86.83	0.00(4.05)	0.00	42.00
SEm±										0.47	0.36		
CD (P= 0.05)										1.37	1.06		

Average of three replications, DAI- Days after inoculation, Figures in parenthesis are arc sine transformed value

showed maximum inhibition of growth of the A. solani at all time intervals from two to ten days. The other plant extract showed promising result against A. solani were Datura, Neem and Karanj. The Maximum sporulation per microscopic field was found in Aak (89.11).

The study agreed well with results of Parkash *et al.* (2005) reported that phytoextract of *W. somnifera* (Ashwagandha) inhibited maximum mycelial growth of *Phytophthora parasitica* followed by *A. alternata*, *Curvuleria lunata* and *Helminthosporium* species. Ranaware *et al.* (2010) noticed that *Allium sativum* bulb extract (48.68%) and *D. matel* (44.25%) inhibited maximum growth of *A. carthami.* Mesta *et al*. (2009) noticed that Neem leaf extract inhibited maximum (38.49%) spore germination and radial growth (43.90%) of *A. helianthi*. Babu *et al*., (2000) reported the effect of plant extracts, oils and Neem products on tomato early blight in the field. In conclusion, the results obtained from this study shows that the plant extracts of *Withania somnifera, Azadirachta indica* and *Datura stramonium* used in this study exhibit antifungal effect on *A. solani*. So these extracts could be useful in the treatment of fungal infections caused by *A. solani.*

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