



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(1): 2332-2334
Received: 14-11-2018
Accepted: 18-12-2018

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Bio-efficacy of plants extract against *Alternaria brassicicola* causing Alternaria leaf spot of cabbage

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Abstract

Cabbage (*Brassica oleracea*) is most important vegetable crop and several bacteria, fungi and virus infect it and cause disease. Alternaria leaf spot of cabbage is very worst disease and is distributed worldwide in all cabbage growing countries. The growth inhibition of mycelium of *Alternaria brassicicola* was tested by treatment of culture by five botanical extracts viz. *Azadirachta indica*, *Capsicum annum*, *Calotropis gigantea*, *Barbadoes aloe*, *Aegle marellos* and compared with control culture. These botanical extracts were added to the culture media at two concentration viz. 15 % and 25 % and tested by poisoned food technique. Neem and chilli plant extracts were found highly effective against pathogen at both 15 % and 25 % concentration and mycelial inhibition was recorded 68 % at 25 % concentration. Another two plant extracts Aloe vera and madar were also found to be effective against pathogen and both showed 55.33 percent inhibition at 25 % concentration. Minimum mycelia inhibition was recorded from Bel with only 37.77 percent inhibition at 25% concentration. Presently many farmers are using chemicals for control of Alternaria leaf spot of cabbage however, they cause health hazards. Therefore, this investigation will be helpful to the farmers for selection of suitable plant extracts, used as a control of Alternaria leaf spot of cabbage.

Keywords: *Alternaria brassicicola*, plant extracts, radial growth, inhibition

Introduction

Alternaria leaf spot of cabbage is widespread disease and it affects all the aerial parts of the plants such as leaves, and heads. *Alternaria* species are cosmopolitan and could survive as saprophytes as well as weak parasites. During, early stage of infection, the leaf spot remain as small circular in shape. Color of spot may be brown, olivaceous brown or black surrounded by halo- chlorotic tissues. With increasing infection the spot increases in size in a concentric manner and often coalesce, leading to blighted appearance. The disease starts from lower leaves and slowly progresses towards the upper shoots, leaves, petioles, and heads. The dissemination of pathogen spore can be occurred by water, wind and animals. Several factors such as wet weather with high temperature, plant age, inoculum concentration all affect the development of severity of leaf spot disease (Mridha and Wheeler, 1993) [5]. Thus this pathogen causes wide economic loss. Several effective chemical fungicides have been recommended against this pathogen but they are not considered as long term solution as these fungicides are too expensive for farmers, they cause health hazardous disease and also they are not eco- friendly. Thus to find safe, efficacious and environmentally friendly fungicide is considered to be source of concern.

Presently, search for natural products that can be used as disease management is very important task. As plants are eco-friendly, and they are effective against most of the plant pathogens, they can be used for disease management (Latha *et al.*, 2009) [3]. Mahapatra and Das (2013) [4] evaluated the effect of aqueous extract of three botanicals as leaves of neem (*Azadirachta indica*), bulbs of garlic (*Allium sativum*) and rhizome of ginger (*Zingiber officinale*) at four different doses (5, 10, 15, and 20%) against Alternaria leaf blight of mustard under field condition. The disease was adequately managed by the application of these three botanicals irrespective of their doses in comparison to untreated control. Two years data revealed that spraying of neem leaf extract @15% was more effective against this disease as well as increased the seed yield of mustard. Gaine *et al.* (2013) [2] evaluated effect of extracts of 5 plant extracts as *Azadirachta indica*, *Lantana camara*, *Ocimum sanctum*, *Eucalyptus globulus* and *Calotropis gigantean* by food poison technique @ 3, 5, 7 and 9 % concentration against *Aternaria brassicae*. *O. Sanctum* was found most efficacious with growth inhibition of

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(31.85%) followed by *E. Globules* (28.97%) and *L. camara* (23.60%), *A. indica* (22.30 %) and *C. gigantean* (21.35 %). Many plants extract has been found that contains antifungal effect and is used by farmers from several times to protect their crops. Thus these plants extract can be recommended as a source to manage disease. Therefore present investigation was carried out to see the bio-efficacy of different plants extract against *A. brassicicola* causing Alternaria leaf spot of cabbage.

Materials and Methods

The present investigation was carried out during Rabi season 2018 at the Department of Mycology and Plant Pathology, Institute of Agriculture Sciences, Banaras Hindu University, Varanasi.

The botanical extracts of five plants viz. Aloe vera (*Barbadoes aloe*), Bel (*Aegle marelos*), Chilli (*Capsicum annum*), Madar (*Calotropis gigantea*), and Neem (*Azadirachta indica*) were prepared using methanol method and effectiveness were tested against *Alternaria brassicicola* by measuring pathogen's mycelial growth using technique of Phasuda and Varipat (2007) [7] *in vitro*. The extracts were incorporated into the molten agar at a final concentration of 15% and 25% separately and were mixed well. Then, the medium were poured into Petri dishes. After overnight pre-incubation, the inoculation was done by a mycelia disc 5 mm, which was deposited in the center of the plate. Control plate was maintained without adding plant extract. The solution in each petri plate were swirled and allowed to solidify. The medium containing extract in each petri plate were then inoculated by 5 mm inoculum beads of *Alternaria brassicicola* at the center and were incubated at 25 °C to 28 °C for 8 days.

Radial growth of fungus was measured from the day of inoculation and the percent inhibition of growth of the pathogen was calculated using the formula of Vincent (1947).

$$I = \frac{C-T}{C} \times 100$$

Where,

I = percent inhibition

C = growth in control

T = growth in treatment

Table 1: List of plant extracts used against *Alternaria brassicicola*

Common name	Botanical name	Plant part used
Aloe Vera	<i>Barbadoes aloe</i>	Leaf
Bel	<i>Aegle marelos</i>	Leaf
Chilli	<i>Capsicum annum</i>	Leaf
Madar	<i>Calotropis gigantea</i>	Leaf
Neem	<i>Azadirachta indica</i>	Leaf

Results and Discussion

Effect of plants extract against pathogen

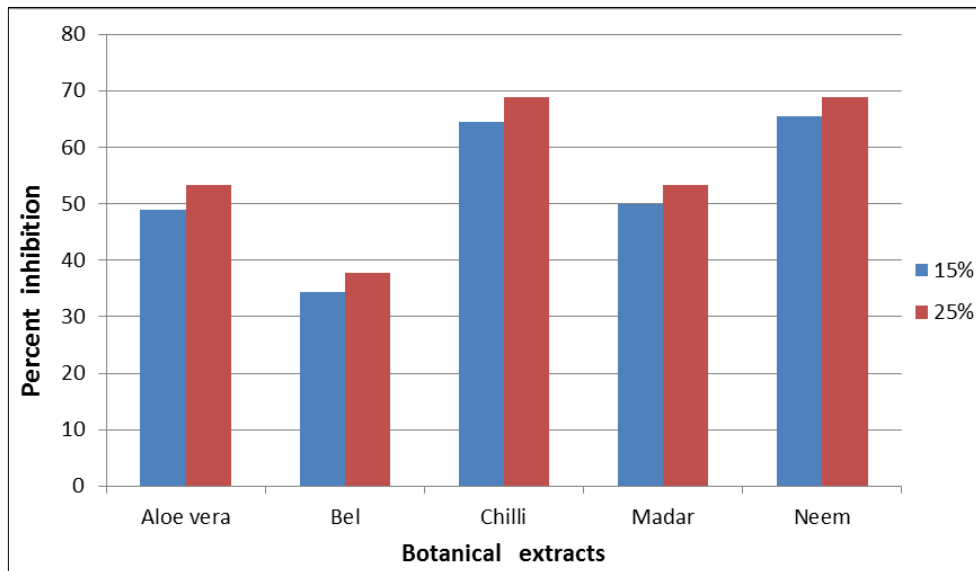
The mycelial growth inhibition of pathogen was tested by treatment of culture by five plants extract viz. Aloe vera, Bel, Chilli, Madar, Neem at 15 % and 25 % respectively and compared with control by poisoned food technique. The plant extracts were found to inhibit growth of fungus with increasing concentration in the medium. Higher inhibitions of the mycelia growth of *Alternaria brassicicola* was recorded at 25 % and found to be superior over the lower concentrations (15 %). The results showed that significant difference between treatments.

Neem (*Azadirachta indica*) leaf extract and Chilli (*Capsicum annum*) among the five plant extracts were found highly effective against pathogen at 25 percent concentration, and mycelial inhibition was recorded 68.88 %. Another two plant extracts Madar (*Calotropis gigantea*) as well as Aloe vera (*Barbadoes aloe*) were also effective against pathogen and both showed 53.33 % inhibition against *A. brassicicola*. Minimum inhibition was recorded in Bel (*Aegle marelos*) with 37.77 percent inhibition. Similarly at 15 % concentration maximum percent inhibition was observed in *Azadirachta indica* (65.55 %) followed by *Capsicum annum* (64.44 %), *Calotropis gigantea* (50 %), *Barbadoes aloe* (48.88 %), and *Aegle marelos* was found to least effective with percent inhibition of 34.44 %.

The result was found to be confirmative with the finding of Rashmi and Yadav (1999) [8]. They reported that there is a positive correlation between concentration and growth inhibition percentage that means plant extract at lower concentration will show less effectiveness as compared to plant extracts at higher concentration. Dalbeer (2013) [11], who reported that among Aloe vera, *Azadirachta indica*, and *Capsicum annum*, maximum inhibitory role was found to be present in *Azadirachta indica* (69.86 %) followed by *Capsicum annum* (69.66 %) and least in Aloe vera.

Table 2: Effect of different plant extracts on mycelial growth of *Alternaria brassicicola*

Botanical extracts	Radial growth (cm)		Percent inhibition (%)	
	15%	25%	15%	25%
Aloe Vera (<i>Barbadoes aloe</i>)	4.6	4.2	48.88	53.33
Bel (<i>Aegle marelos</i>)	5.9	5.6	34.44	37.77
Chilli (<i>Capsicum annum</i>)	3.2	2.8	64.44	68.88
Madar (<i>Calotropis gigantea</i>)	4.5	4.2	50	53.33
Neem (<i>Azadirachta indica</i>)	3.1	2.8	65.55	68.88
Control	9.0	9.0	—	—
CD (0.05)			0.084	0.133
CV			1.332	2.278



Graph 1: *In vitro* fungicidal activity of plant extracts against *A. brassicicola* with respect to percent

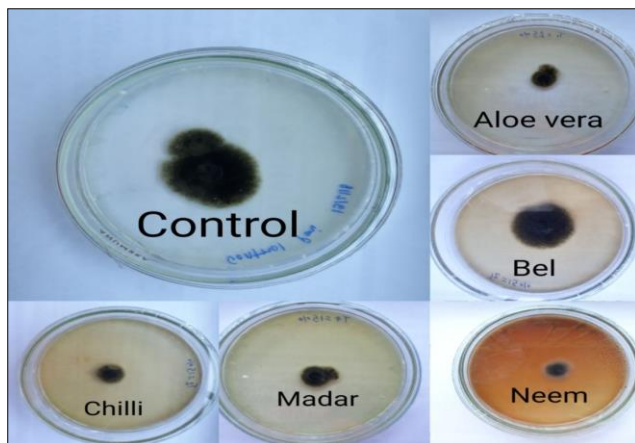


Fig 1: Effect of plant extracts on mycelia growth of *Alternaria brassicicola*

Conclusion

Alternaria leaf spot of cabbage is very worst disease and yield and quality losses due to this disease. This disease is caused by *Alternaria brassicicola* and pathogen affects the quality of cabbage and yield. In view of the summarized experimental findings it may be concluded that antifungal properties are presents in plant extracts. Suitable plant extracts can be used as biopesticides for control of *Alternaria* leaf spot disease. Neem and chilli plant extracts were found highly effective against pathogen at both 15 % and 25 % concentration and mycelial inhibition was recorded 68 % at 25 % concentration. There are different plant extracts are available in nature. However, some plant extracts are highly effective and some plant extracts are not effective against pathogen. Therefore, this investigation will be helpful to the farmers for selection of suitable plant extracts, used as a control of *Alternaria* leaf spot of cabbage.

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