SHORT COMMUNICATION

MANAGEMENT OF ALTERNARIA LEAF BLIGHT OF CARROT (*DAUCUS CAROTA* L.) BY USING PLANT EXTRACTS AND BIO CONTROL AGENTS

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Received-26.08.2021, Revised-08.09.2021, Accepted-19.09.2021

Abstract: Alternaria leaf blight (*Alternaria alternata)* is considerable damage to carrot crop on aerial part of the plant. The efficacy of six plant extracts and four bio- agents were evaluated against the *A. alternata* incite carrot leaf blight under *in vitro* condition. Extract of garlic (*Allium sativum)* (clover), and neem (*Azadirachta indica)* (leaf) were effectively inhibit the growth of pathogen, at two different concentrations *viz*. 5% and 10% along with control. Among the botanicals, the garlic cloves extract was observed to be all most effective resulting in 68.33% & 80% inhibiting the mycelial growth followed by Neem leaf extract resulting in 60.44% & 73.98% inhibiting the mycelial growth, at 5% and 10% concentration, respectively. Bio control agent i.e. *Trichoderma viride* and *Trichoderma harzianum* which *in vitro* evaluated could suppress the growth of pathogen. Among the all bio- inoculants *Trichoderma viride* was recorded superior in 77.13% mycelial growth inhibition followed by *Trichoderma harzianum* was recorded in 70.41% mycelial growth inhibition.

Keywords: Plant extracts, Bio-inoculants, Carrot, *In vitro*

INTRODUCTION

Carrot (*Daucus carota* L.), belongs to the the *Apiaceae* family among the most important vegetables root crop, are cultivated worldwide. It is well distributed throughout the temperate, tropical and subtropical parts of the world (Bose and Som, 1990). The edible part of carrot is the storage taproot. Carrot contains high amount of carotene (10 mg/100 g), thiamine (0.04 mg/100 g), and riboflavin (0.05 mg/100 g) and also serves as source of carbohydrate, protein, fat, minerals, vitamin C and calories (Yawalker, 1985). Carrot extracts, which serve as sources of antioxidants, have important functions in preventing many diseases. According to World Health Organization, vitamin A deficiency partially or totally blinds nearly 350,000 children from more than 75 countries every year. Carrot affected by several numbers of insect pest, fungal pathogens along with some bacterial and few physiological disorders. Almost around ten seed borne pathogens attack the carrot crop, as it is propagated by the seed (Richardson, 1990). Among the foliar diseases of carrot, the Alternaria leaf blight is major one, which occurs worldwide. Strandberg (1992), Tulek and Dolar (2015) reported that even *A. alternata, A. tenuissima, and A. radicina* also causes leaf blight disease of carrot. Chand and Singh (2011) recorded 60% yield losses due to leaf blight and leaf spot of carrot in India.

MATERIALS AND METHODS

In vitro evaluation of plant extracts

Six botanicals i.e. garlic (*Allium sativum)* (clover), tulsi (*Ocimum sanctum)* (leaf), ginger (*Zingiber officinale)* (rhizome), dhatura (*Datura stramonium)* (leaf), neem (*Azadirachta indica)* (leaf) and tumba *(Citrullus colocynthis)* (fruit cover) were evaluated at two different concentrations viz. 5% and 10% along with control against *A. alternata* each of the treatment was replicated three times. Botanical extract was prepared as per methods used by Thaware *et al*., (2010). Hundred grams leaves, clover, rhizome and fruit cover of plant were collected and washed 2-3 times with water and allowed to dry at room temperature (25±1°C) for 15 minute and surface sterilized with 2 % sodium hypochlorite and wash through sterile water. Before extraction of leaves of each plant (100 g) were crushed separately with 100 ml sterilized water. The extract was sterilized filtered through muslin cloth and centrifuged at 5000 rpm for 15 min. The extract of each plant was diluted in order to achieve two concentration *viz*., 5 and 10 per cent. Petri plates containing PDA supplemented with different phytoextracts, each with two concentrations and replicated four times were inoculated with 7 days old culture (5 mm dia. disc). A suitable control (without phytoextract) was also maintained. Fungal colony was measured after 10 days of incubation at 27±1°C. Per cent inhibition of mycelial growth over untreated control was calculated by applying the formula given by Vincent (1947).

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

Where,
I = Inhibition per cent
C = Colony diameter (mm) in control plate
T = Colony diameter (mm) in treated plate

In vitro evaluation of bio-inoculant

Evaluation of efficacy four bio-inoculants i.e. *Trichoderma viride, Trichoderma harzianum, Bacillus subtilis and Pseudomonas fluorescence* along with control against *A. alternata* by dual culture

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technique (Denis and Webster, 1971). Both bio-agents and test fungus were cultured on potato dextrose agar media each of the treatment was replicated four times.

Dual culture method

20 ml of sterilized and potato dextrose agar was poured into sterile Petri plates and allowed to solidify. For evaluation of fungal bio-agents, mycelial discs of test pathogen were inoculated at one end of the Petri plate and antagonistic fungus was placed opposite to it on the other end. In case of bacterial bio-agents evaluation, the bacteria were streaked one day earlier at one end of the Petri plate or at the centre of the Petri plate and the test fungus was placed at the opposite end. The plates were incubated at 27±1°C and zone of inhibition was recorded by measuring the clear distance between the margin of the test fungus and antagonistic organism. The colony diameter of pathogen in control plate was also recorded. The experiment was conducted in the CRD with three replications. Per cent inhibition of mycelial growth over untreated control was calculated by applying formula given by Vincent (1947).

RESULTS AND DISCUSSION

Six phytoextracts with two different concentrations (5% & 10%) along with control were tested *in vitro* against *A. alternata* by applying Poisoned food technique (Nene and Thapliyal, 1993) using Potato dextrose agar (PDA) as basal medium. Among the all botanicals, the garlic extract (68.33% & 80%) was observed to be all most effective inhibiting the mycelial growth, followed by neem extract (60.44% & 73.98%), moderate mycelial growth was recorded when treated with dhatura and Ginger (58.97% & 70.43%) and (50.03% & 60.85%) respectively, and minimum growth was observed when treated with colocynth (30.25% & 38.64%) followed by tulsi (38.33% & 49.15%) at 5% and 10% concentration according to the table given below (Table 1). Similar also found by Jadeja and Pipliya (2008); Panchal and Patil (2009); Bochalya *et al*. (2012).

Table 1. Effect of different phytoextracts against *A. alternata* under *in vitro*

S.No.	Scientific name	Common name	Percent mycelium growth inhibition* Concentrations 5%	10%
1.	Garlic	*Allium sativum*	68.33 (55.73)	80.00 (63.41)
2.	Tulsi	*Ocimum sanctum*	38.33 (38.23)	49.15 (44.49)
3.	Ginger	*Zingiber officinale*	50.03 (45.00)	60.85 (51.24)
4.	Dhatura	*Datura stramonium*	58.97 (50.15)	70.43 (57.05)
5.	Neem	*Azadirachta indica*	60.44 (51.00)	73.98 (59.31)
6.	Colocynth (Tumba)	*Citrullus colocynthis*	30.25 (33.35)	38.64 (38.41)
7.	Control	-	0.00 (0.00)	0.00 (0.00)

Factor	S.Em±	CD (p = 0.05)
Phytoextracts	**0.39**	**1.15**
Concentration (C)	**0.21**	**0.61**
Inter. (P x C)	**0.55**	**1.62**

*Average of three replications
Figures in parentheses are angular transformed values

Four bio-inoculants *viz*., *Trichoderma viride*, *T. harzianum*, *Bacillus subtilis* and *Pseudomonas fluorescens* were evaluated under laboratory condition for their antagonism activity against

Alternaria alternata by dual culture technique. Among the bio-inoculants significantly helped in inhibiting the mycelial growth of *A. alternata* over control. Highest per cent mycelial growth inhibition was recorded in *T. viride* (77.13%) followed by *T. harzianum* (70.41%) and *Pseudomonas fluorescence* (57.79%) after 7 day of incubation. *Bacillus subtillis* showed minimum per cent mycelial growth inhibition (51.22%) (Table 2). Almost similer results were also found by Jakatimath *et al*. (2017); Ravishankar *et al*. (2018).

Table 2. Effect of different bio-inoculants against *A. alternata in vitro*

S. No.	Bio-inoculants	Per cent inhibition of mycelial growth*
1.	*Trichoderma viride*	77.13 (61.42)
2.	*Trichoderma harzianum*	70.41(57.02)
3.	*Bacillus subtilis*	51.22 (45.68)
4.	*Pseudomonas fluorescence*	57.79 (49.46)
5.	Control	0.00 (0.00)
	S.Em±	**0.43**
	CD (p = 0.05)	**1.32**

*Average of four replications
Figures in parentheses are angular transformed values

CONCLUSION

Evaluations of six plant extracts for per cent growth inhibition of *Alternaria alternata* causal organism of Alternaria leaf blight of carrot under *in vitro* condition. Among the all botanicals, the garlic cloves extract was observed most effective resulting in 68.33% & 80% inhibiting the mycelial growth, at two different concentrations *viz.* 5% and 10% along with control. In bio- control agents *T. viride* was recorded in 77.13% inhibition mycelial growth ageist *Alternaria alternata* .

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