

Exploring Natural Solutions: Botanical Approaches for Controlling Early Blight in Tomato Plants under Laboratory Conditions

ABSTRACT:

Early blight of Tomato caused by *Alternariasolani* is most serious and destructive disease worldwide. In the present study, the concentration viz. 10% of each plant extract was tested by poison food technique to manage the mycelial growth of the *A. solani*. All the tested extracts were significantly inhibited the mycelial growth of pathogen when compared with control. Among the tested plant extracts, garlic clove extract was found expressively most efficacious and indicated maximum percentage inhibition that was 90.54% at 10% concentration followed by Neem leaf extract (87.83%), Ginger (83.78%), Eucalyptus (75.67%), Bael (71.67%), Onion bulb extract (68.67%) and Ashwagandha (63.51%) respectively. While, Lantana (52.70%), was the least effective extract with 35 mm mycelial growth. Mancozeb was the most effective fungicide against early blight of tomato percentage inhibition was 93.24% at 0.25% concentration gave the best control over mycelial development of *Alternariasolani* after seven days of incubation at 24°C. Presently many farmers are using chemicals for control of early blight of tomato however, they cause health hazards. Therefore, this investigation will be helpful to the farmers for selection of suitable plants extract, used as control of early blight of tomato.

KEYWORDS: Early blight of Tomato, *Alternariasolani*, Plant extracts, Natural fungicides, biological control, Garlic clove extract, Neem leaf extract

Introduction

Tomato is the important vegetable crop and grown in world wide. It is very good source of vitamin A, B, C and minerals viz. Iron, calcium, potassium, phosphorus and sulphur. Tomato crop is highly susceptible to plant pathogens viz. bacteria, fungi, and viruses which deteriorate the yield and quality of tomato food [18, 19]. Among the fungal diseases early blight is caused by *Alternariasolani* (Ellis and Martin) (Biradar et al., 2021) [1,7]. During all stages of plant development, *A. solani* causes disease (leaf blight, stem rot, fruit lesions) and results in severe damage across the country [4, 18]. Early blight is most catastrophic disease incurring loss under field and post-harvest stages causing 50 to 86% reduction in fruit yield [19, 9].

The disease managed by the use of several conventional fungicides Neha et al. (2021) [8, 14, 22] but due to development of resistance in most common pathogenic fungi against fungicides and also the factor of exposure risks fungicide residues and human health hazards have given a push for obtaining alternatives to control *A. solani*. It is very essential to determine the efficacy of botanicals agents and their integrations against early blight of tomato. In addition, given the increasing self-awareness on the sides of producers and consumers and the increasing tendency towards organic products, it is obvious that botanical plants will gain much more importance in the context of integrated pathogen control [5, 15, 20, 21]. In this study, it was aimed to determine the availability of botanical plant extracts which are eco-friendly and unharmed to health of human and other living creatures as botanical control against early blight disease pathogen *A. solani* causes significant yield losses in tomato.

MATERIALS AND METHODS

The experiment was conducted in the Department of Plant Pathology and Agricultural microbiology, College of Agriculture, Pune, during 2017-2018, in order to evaluate the efficacy of different plants extracts against early blight of tomato.

Isolation of pathogen

Infected tomato plant showing symptoms of early blight was collected from the field and washed thoroughly with water then after placed in between blotting paper to remove excess moisture. The infected leaf was cut aseptically into small pieces and surface sterilized with mercuric chloride (0.1%) for 10 sec. followed by two to three washed with sterilized distilled water and then placed aseptically on solidified potato dextrose agar (PDA) in petri plates. Inoculated petri plates were

incubated in BOD incubator at 25°C for mycelial growth of pathogen. The pure culture of this fungus was sub cultured and maintained for further investigation.

Preparation of plants Extract

The plants parts were grinded with sterilized water and filtered through a muslin cloth to produce a 100% crude extract. The required quantity of each plant extract was added separately so as to get a requisite concentration by using potato dextrose agar which was used as nutrient medium. The plant extracts were carefully mixed by stirring and about 10 ml extract contained medium was poured to each of the 9 cm petri dishes and allowed for solidification. Potato dextrose agar plate without the plant extract was used as control. Inoculated plates were incubated at 26±1 °C in BOD Incubator for twelve days and the colony diameter was recorded and the percent inhibition was calculated using the formula.

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

I = percent inhibition of mycelial growth, C = radial growth of fungus in control, T = radial growth of fungus in treatment

RESULT AND DISCUSSION

In-vitro assessment of plant extracts and fungicide against *Alternariasolani* was done by poisoned food technique. The treatments evaluated after seven days of colony growth by taking average mycelial growth and inhibition percentage. In present study, all the tested extracts at 10% concentration were significantly ($P \leq 0.01$) reduced linear growth and increased inhibition percentage compared to control. Among the tested plant extracts, garlic clove extract was found expressively most efficacious and indicated maximum percentage inhibition that was 90.54% at 10% concentration followed by Neem leaf extract (87.83%), Ginger (83.78%), Eucalyptus (75.67%), Bael (71.67%), Onion bulb extract (68.67%) and Ashwagandha (63.51%) respectively. While, Lantana (52.70%), was the least effective extract with 35 mm mycelial growth. Mancozeb was most effective fungicide against early blight of tomato percentage inhibition was 93.24% at 0.25% conc. gave the best control over mycelial development.



Fig 1. *In vitro* evaluation of botanicals and fungicide against *Alternariasolani*

T1=?, T2=?, T=?, T4=?, T5=?.....T10=?

In case of plant extracts, garlic was found to be significant and gave maximum percentage inhibition i.e. 90.54 at 10%. While neem was the second most effective extract followed by ginger, onion and eucalyptus at 10% concentration which was found to be at par with each other. The results revealed that the concentrations of all the botanicals compressed the growth of *Alternariasolani*, however, the garlic application at 10% concentration revealed determined control over the mycelial development of *Alternariasolani* after seven days of incubation at 24°C. The inhibitory effect of these extracts may be due to their direct lethal effect on the pathogen growth or antimicrobial activity against fungal pathogens under *invitro*.

The result of present study is in accordance to the finding of Deshmukh (2020)[6, 7], Naik et al (2020) [13, 14] and Biradar et al. (2021) [3] tested plant oils and plants products clove extract of *Allium sativum* (10%) recorded the highest reduction of the mycelial growth of 100% followed by leaf extract (10%) of Daturametel (68.44%) and oil (3%) of *Azadirachtaindica* (59.88%) Biradar et al. (2021) and Sahu et al. (2014) [2,10] tested plant extracts produced some antifungal activities,

Comment [E11]: Talk about the component of extracts

whereas *Azadirachta indica* (neem), *Datura stramonium* (datura) and *Withania somnifera* (ashwagandha) showed significant antifungal activities. The leaf extract of *W. somnifera* was most effective in inhibiting the mycelial growth of *A. solani* (62.56%) followed by *D. stramonium* (34.65%) and *A. indica* (25.27%) [11].

Table1. In vitro evaluation of plant leaf extracts and fungicide against *Alternariasolani*

* = Mean of four replications, Figure in parenthesis are Arcsine transfer values

Tr.No.	Treatments	Mean colony diameter* (mm)	Inhibition over control (%)
1	Ginger	12.02 (20.69)	83.78
2	Garlic	6.9 (15.21)	90.54
3	Ashwagandha	27.1 (31.42)	63.51
4	Lantana	35 (36.22)	52.70
5	Neem	8.93 (17.43)	87.83
6	Onion	23 (28.73)	68.91
7	Eucalyptus	18.3 (24.98)	75.67
8	Bael	21.1 (27.49)	71.67
9	Mancozeb	5 (12.91)	93.24
10	Control	74.25 (59.5)	00

SE(m)±
CD (5%)

0.44
1.29

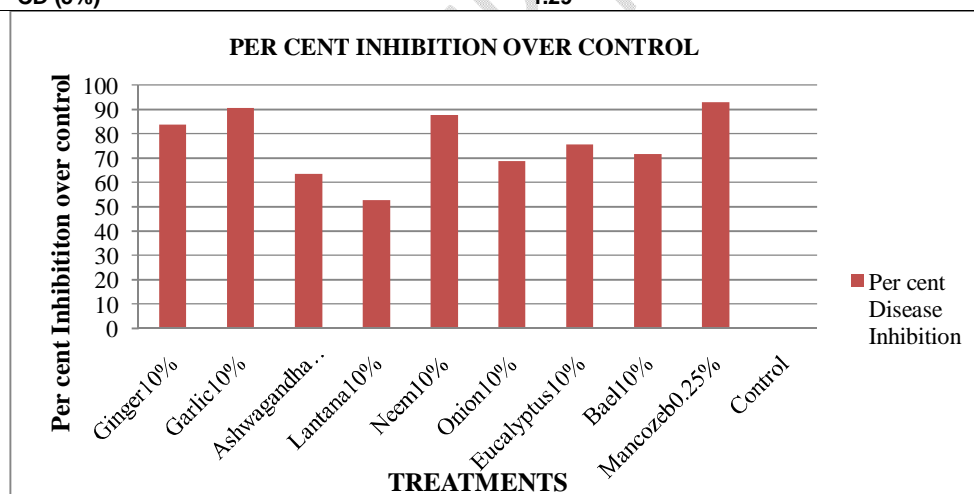


Fig. 2 Inhibition of colony growth of *Alternariasolani* over control

CONCLUSION

Early blight of tomato is very worst disease and yield and quality losses due to this disease. In the view of summarized experimental finding, it may conclude that, antifungal properties are present in the plant extracts. Suitable plants extracts can be used as antifungal against *Alternariasolani*. The use of fungicide (harmful chemicals) can lead health hazards for farmers as well as consumers and it also harms the plant and fruits. Plant extract of garlic and neem were highly effective against pathogen. There are different [types-families or varieties](#) of plants available

in the nature with medicinal properties. However, some plant extracts are effective and some are not effective against pathogen. Therefore, this investigation will be helpful to farmers for selection of suitable and effective plant extract for managing Early blight disease of tomato.

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