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Evaluation of different plant extracts against *Alternaria solani* (Ellis and Martin) Sorauer caused early blight of tomato (*Solanum lycopersicum* L.)

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Abstract

Early blight of Tomato caused by *Alternaria solani* is most serious and destructive disease worldwide. Different plants extracts viz. Lemon grass (*Cymbopogon citratus*), Giloy (*Tinospora cordifolia*), Papaya (*Carica papaya*), Madar (*Calotropis gigantean*) and Mix. (*Cymbopogon citratus*, *Carica papaya*, *Tagetes sp.*) were evaluated for mycelial growth inhibition of *Alternaria solani*. Two concentration viz. 10% and 15% of each plant extract was tested by poison food technique. All the tested extracts were significantly inhibited the mycelial growth of pathogen when compared with control. The mixture of plants extract (66.67%) and *Tinospora cordifolia* (57.44%) were significantly superior over other treatments followed by *carica papaya* (55.55%), *Cymbopogon citratus* (48.55%). Least mycelia inhibition was observed in *Calotropis gigantean* (46.66%). 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: *Alternaria solani*, early blight, plants extract, inhibition percentage, mycelial growth

Introduction

Tomato is the important vegetable crop and grown in world wide. It is world most important product also known as 'super food'. 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. Among the fungal diseases early blight is caused by *Alternaria solani* (Ellis and Martin)^[6]. During all stages of plant development, *A. solani* causes disease (leaf blight, stem rot, fruit lesions) and results in severe damage across the country^[5]. The toxins act on the host protoplast to disturb physiological processes that sustain plant health^[8]. Early blight is most catastrophic disease incurring loss under field and post harvest stages causing 50 to 86% reduction in fruit yield^[9].

The disease managed by the use of several conventional fungicides⁽¹⁰⁾ 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*. Nivedha *et al.* (2019) tested plant oils and plants products clove extract of *Allium sativum* (5%) recorded the highest reduction of the mycelial growth of 100% followed by leaf extract (10%) of *Datura metel* (68.44%) and oil (3%) of *Azadirachta indica* (59.88%). Sahu *et al.* (2014) tested plant extracts produced some antifungal activities, 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%). It is very essential to determine the efficacy of botanicals agents and their integrations against early blight of tomato. Therefore, keeping in view of above facts present investigation was carried out see the efficacy of different plant extract against *Alternaria solani* caused early blight of tomato.

Materials and Methods

The experiment was conducted in the Department of Mycology and Plant Pathology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, during 2018-2019, in order to evaluate the efficacy of different plants extracts against early blight of tomato.

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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 subcultured and maintained for further investigation.



Fig 1: Infected tomato leaf by *A. Solani*

Preparation of plants Extract

The extracts of five plants viz. Mixture of three plants, Glioy, Papaya, Lemon grass and Madar were prepared using “Decotion method”, the basic operation included steps, such as pre-washing, drying, grinding to obtain a homogenous sample and often improving the kinetics of analytic extraction and also increasing the contact of sample surface with the solvent system. The grinded plants parts were boiled 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 15 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

Table 1: The list of plant extract detail, used against *Alternaria solani*

| Common name | Scientific name | Plant part used |
|----------------------------------|--|-----------------|
| Papaya | <i>Carica papaya</i> | Leaf |
| Lemon grass | <i>Cymbopogon citratus</i> | Leaf |
| Madar | <i>Calotropis gigantea</i> | Leaf |
| Glioy | <i>Tinospora cordifolia</i> | Stem |
| Marry gold+ lemon grass + papaya | <i>Tagetes sp.+ Cymbopogon citratus+ Carica papaya</i> | Leaf |

Result and Discussion

Five plants extract, belonging to the different families were selected and evaluated for antifungal activity in laboratory for their effectiveness against *A. solani*, causative agent of early blight of tomato. Plants extract tested at two concentrations 10% and 15% each by food poisoned technique. The results indicated that there was significant difference among tested plants extract for inhibiting the mycelia growth of the pathogen. The plant extracts evaluated after seven days of colony growth by taking average mycelial growth and inhibition percentage. Results (table-2) revealed that tested extracts at tested concentration were significantly reduced linear growth and increased inhibition percentage compared to control. Among tested plants extract, mixture of plants were most effective in increasing the inhibition percentage of *A. solani* (66.67%) followed by *Tinospora cordifolia* (57.44%), *Carica papaya* (55.55%), *Cymbopogon citratus* (48.55%), and the least inhibition percent by *Calotropis gigantean* (46.66%) at 15% of plant extract concentration. And at 10% of plant extract concentration the maximum mycelial growth was also inhibited by mixture of three plant extract (58.55%) followed by *Tinospora cordifolia* (46.66%), *Carica papaya* (48.22%), *Cymbopogon citratus* (41.11%), and observed the least inhibition percent by *Calotropis gigantean* (37.77%).

Table 2: Efficacy of different plant extracts against *Alternaria solani*

| Plant extract name | Radial growth (cm) | | Percent inhibition | |
|--|--------------------|--------|--------------------|--------|
| | At 10% | At 15% | At 10% | At 15% |
| Papaya(<i>Carica papaya</i>) | 4.66 | 4.00 | 48.22% | 55.55% |
| Lemon grass (<i>Cymbopogon citratus</i>) | 5.30 | 4.63 | 41.11% | 48.55% |
| Madar(<i>Calotropis gigantean</i>) | 5.60 | 4.80 | 37.77% | 46.66% |
| Glioy(<i>Tinospora cordifolia</i>) | 4.80 | 3.83 | 46.66% | 57.44% |
| <i>Tagetes sp.+ Cymbopogon citratus+ Carica papaya</i> | 3.73 | 3.00 | 58.55% | 66.67% |
| Control | 9.0 | 9.0 | - | - |
| SE(m) | 0.06 | 0.06 | | |
| C.D.(5%) | 0.19 | 0.17 | | |
| C.V. in (%) | 1.95 | 1.93 | | |

Several researchers have been reported on the tested extracts, Joseph et.al (2017) [2] investigated that extracts of *C. papaya* was the most effective in reducing the severity of early blight. Similarly Bisht and Agrawal (2016) [1] phytochemical analysis of crude ethyl acetate extracts of plant leaf has shown the presence of almost all the phytochemicals in *C. papaya* leaves showed the presence of alkaloids, which are probably an important element in defense against plant pathogen.

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 concluded that, antifungal properties are present in the plant extracts. Suitable plants extracts can be used as biopesticide against *Alternaria solani*. The use of fungicide (harmful chemicals) can lead health hazards for farmers as well as consumers and it also harms the plant and fruits. Mixture extract of marry gold+ lemon grass + papaya, and Giloy plant extract were hingly effective against pathogen. There are different types 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 management of Early blight of tomato.

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