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**Amit Kumar Tiwari**  
Department of Microbiology, Dr.  
Ram Manohar Lohia Awadh  
University, Ayodhya, Uttar  
Pradesh, India

**Ram Chandra**  
Department of Mycology and  
Plant Pathology, Institute of  
Agricultural Sciences, Banaras  
Hindu University, Varanasi,  
Uttar Pradesh, India

**Manisha Sen**  
Amit Kumar Tiwari  
Department of Microbiology, Dr.  
Ram Manohar Lohia Awadh  
University, Ayodhya, Uttar  
Pradesh, India

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

**Amit Kumar Tiwari, Ram Chandra and Manisha Sen**

### Abstract

Early blight of tomato caused by *Alternaria solani* (Ellis & Martin) Sorauer is the most destructive disease that hampered its successful production all over the world. In the present study, fungi toxic activity of fungicides, namely Score (Difenoconazole 25.0% M/M), Lustré (Flusilazole 12.5% + Carbendazim SE), Emesto Prime (Penflufen 22.43%), Plusor (Thifluzamide 24% SC), Cursor (Flusilazole 40% EC) was evaluated by poisoned food technique at laboratory of Department of Mycology and Plant Pathology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, India during 2018-2019 for the management of early blight of tomato caused by *Alternaria solani*. All the tested chemicals significantly ( $P \leq 0.01$ ) inhibited the mycelial growth of a pathogen when compared with control. However, among all five tested fungicides 100% mycelia growth was inhibited from cursor (fusilazole 40% EC), (Difenoconazole 25.0% m/m) score, (Flusilazole 12.5% + carbendazim SE) lustre and found highly efficient in controlling the mycelial growth of *Alternaria solani*. Followed by (Penflufen 22.43%) Emesto prime 64% mycelial growth. This reduction was gradually increased by increasing the incorporated concentration. Least mycelial inhibition was observed in Pulsor (Thifluzamide 24% SC) 66%.

**Keywords:** *Alternaria solani*, early blight, Fungicides, *Solanum lycopersicum* L. Mill, Inhibition percentage

### 1. Introduction

Tomato (*Solanum lycopersicum* Linnaeus), native to the Andean region of South America, is one of the most common horticultural crops and cultivated throughout the world. It can be grown in a wide range of climates from tropical to temperate. Tomato is consumed in our daily life because it contains good source of antioxidants and also have balanced source of vitamins i.e. A, C and E, which is necessary for metabolic activities for maintaining good human health (Olaniyi *et al.* 2010) [7]. Various factors are responsible for low yield and among them diseases are of most concern. Tomato crop is prone to different fungal, bacterial, nematode and viral diseases. Among the fungal diseases, Tomato early blight disease caused by *Alternaria solani* become the most destructive in all over the world and yield losses up to 80% (Chandravanshi *et al.*, 1994) [1]. The disease in severe cases can lead to complete defoliation and is most damaging on tomato in regions with heavy dew, rainfall, high humidity, and fairly high temperatures. All above ground parts of the plant can have symptoms of this disease. Tomato crop is vulnerable to infect by bacterial, viral, nematode and fungal diseases. Among the fungal diseases, *Alternaria* leaf blight of tomato caused by *Alternaria solani* (Ellis and Martin) (Jones and Grout, 1897) [5] is a soil inhabiting air-borne pathogen responsible for leaf blight, collar and fruit rot of tomato disseminated by fungal spores (Datar and Mayee, 1981) [2]. *Alternaria solani* contains enzymes such as cellulases which degrade the host cell wall and also contain pectin methyl galacturonase which facilitate host colonization (Shahbazi *et al.*, 2011) [11]. Disease affect crop production as they cause premature defoliation and result in heavy losses in production by reducing quality and quantity of fruit (Holm *et al.*, 2003) [4]. Crowded plantation, high rainfall and extended period of leaf wetness are responsible factors to induce disease development (Gondal *et al.*, 2012) [3]. This disease is very difficult to control (Pasche *et al.*, 2004) [6]. Failure to control this disease can cause reduction in yield (Malik *et al.*, 2014). It need to develop new effective fungicide with mode of action which will be helpful for increase in quality and quantity of tomato production (Sahu *et al.*, 2013) [10]. However, the main objective of this study was to evaluate the in-situ efficacy of different fungicides with different concentrations against early blight of tomato.

### Correspondence

**Amit Kumar Tiwari**  
Department of Microbiology, Dr.  
Ram Manohar Lohia Awadh  
University, Ayodhya, Uttar  
Pradesh, India

## 2. Materials and Methods

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

### 2.1 Fungicides

Fungicides were used for the experiments and are presented in the table separately.

$$\text{Inhibition} = \frac{C - T}{C} \times 100$$

C = Radial growth in control

T = Radial growth in the treatment

### 2.2 Isolation of pathogen from diseased samples

The pathogen was isolated from infected tomato leaves and then these leaves cut into small pieces along with growing margins of about 1.5-2cm. Surface of these leaf cuttings sterilized with 0.1% bleach for approximately 2 minutes then washed three times with distilled water and placed on petri plates containing potato dextrose agar (PDA). These petri plates were incubated at 26 ± 1°C for one week to check the sporulation for further studies. Pure culture was obtained with the help of single spore technique by incubating at about 28°C for seven days and observed it daily to get rid of contamination such as bacteria and other pathogens.



Fig 1: Symptoms of early blight on leaves of tomato



Fig 2: Conidia of *A. solani*

On the cause of symptomology and conidial characteristics of the fungus, was identified as *A. solani*, causative agent of early blight of tomato (Fig 2).

### 2.3 Evaluation of fungicides

Five different fungicides at different tested concentrations (Table 1) i.e. 0.2 and 0.5% and each concentration replicated thrice through use of poisoned food technique against *A. solani*, causative agent of early blight of tomato.

Table 1: The list of fungicides, used against *Alternaria solani*

Fungicides	Formulation
Score	Difenoconazole 25.0%M/M
Lustre	Flusilazole12.5%+Carbendazim SE
Emesto Prime	Penflufen 22.43%
Plusor	Thifluzamide 24%SC
Cursor	Flusilazole 40% EC

### 2.4 Preparation of fungicides concentration

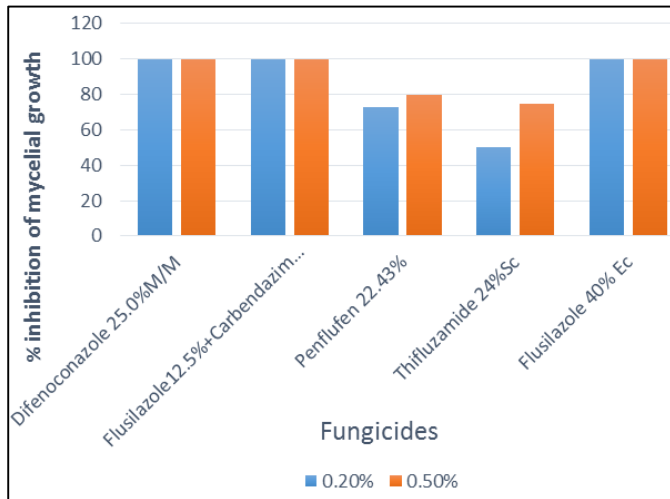
Molten pure PDA was used and required concentration of each fungicide was added separately so as to get a requisite concentration of that chemical used. The fungicides were thoroughly mixed by rousing and about 15 ml poisoned medium was poured to each of the 90 mm petri dishes and permitted for solidification. The actively growing periphery of the seven days old culture of the pathogen, *A. solani* was carefully cut using cork borer and transferred aseptically to the center of each solid petri dish containing the poisoned medium. Appropriate control was maintained by growing the culture on PDA having no fungicide. The plates were incubated at 26 ± 1°C for seven days and the colony diameter was recorded after seven days growth. After the inoculation, data was taken starting from 24 hours after application for period of 7 days and measured the mycelial mean growth (millimeter, mm) per plate according to the description.

### 3. Results

Five fungicides were evaluated in vitro at two concentrations for knowing their efficacy against the pathogen, *A. solani* causing early blight of tomato through poisoned food technique. The results showed that all tested fungicides with both concentrations significantly ( $P \leq 0.01$ ) inhibit the mycelial growth of the pathogen compared with control (Table 2) the fungicides evaluated after seven days of colony growth by taken average mycelial growth and inhibition percentage of all tested concentrations. Data regarding mycelial growth (Table 2) revealed that 100% mycelia growth was inhibited from cursor (fusilazole 40% EC), (Difenoconazole 25.0%m/m) score, (Flusilazole 12.5%+ carbendazim SE) lustre and found highly efficient in controlling the growth of *Alternaria solani*. Results also indicated that the inhibition percentage was increased by increasing the concentrations of fungicides tested. Emesto (Penflufen 22.43%) also found effective against pathogen and showed 60% inhibition at 0.2% concentration and 64% inhibition at 0.5% concentration and minimum mycelial inhibition recorded with Pulsor (Thifluzamide 24%SC) showed 33% at 0.2% concentration and 66% inhibition at 0.5% concentration of fungicide dose.

Table 2: Efficacy of different fungicides against *Alternaria solani*

Fungicides trade name	Radial growth (cm)		Percent inhibition	
	At 0.2%	At 0.5%	At 0.2 %	At 0.5%
Difenoconazole 25.0%M/M	nil	nil	100%	100%
Flusilazole12.5%+ Carbendazim SE	nil	nil	100%	100%
Penflufen 22.43%	3.6	3.2	60%	64%
Thifluzamide 24%SC	6.00	3.0	33%	66%
Flusilazole 40% EC	nil	nil	100%	100%
Control	9.0	9.0		
SE(m)	0.07	0.03		
C. D. (5%)	0.21	0.10		
C.V. (%)	3.79	2.28		



**Fig 3:** Inhibition % of mycelial growth of *Alternaria solani*

#### 4. Discussion

The effect of five fungicides, *i.e.* Difenconazole 25.0%M/M, Fusilazole 12.5% + Carbendazim SE, Penflufen 22.43%, Thifluzamide 24% SC, Fusilazole 40% EC, were tested *in vitro* for their inhibitory effect on the linear growth of *A. solani*, the causal of tomato early blight. Obtained data revealed that all tested chemicals caused significant reduction in linear growth of *A. solani* but among them cursor (fusilazole 40% EC), (Difenconazole 25.0% m/m) score, (Fusilazole 12.5% + carbendazim SE) lustre were found most capable of inhibiting infection. The inhibitory effect of chemicals on fungus reported by many researchers, earlier. Similar findings were reported by several workers who found carbendazim, Difenconazole was the most effective fungicide for the controlling of *A. solani*. Sharma *et al* (2018) [12] reported that the lowest percent disease intensity (PDI) was observed in carbendazim 12 % + mancozeb 63 % WP at 0.2 % (18.77) followed by difenoconazole 25 EC @ 0.025 % (20.59). Similar trends were reported by Prasad and Nayak, (2003). They also reported that carbendazim and mancozeb was the most effective fungicides recorded minimum disease intensity against early blight of tomato. The results of present study lined with all above mentioned reports that the tested chemicals caused mycelial inhibition of *A. solani*.

#### 5. Conclusion

Conclusively, it is urged that fungicide application is one of a sharp tool against disease control in plants if use in integrated manner. Therefore, results of present study demonstrated that if timely application of fungicides with regular intervals during peak infection levels of pathogens, could be effective to control and manage early blight of tomato caused by *A. solani* in field or in green house.

#### 6. References

1. Chandravanshi SS, Singh BP, Thakur MP. Persistence of different fungicides used against *Alternaria alternata* in tomato. *Indian Phytopathol.* 1994; 47:241-244.
2. Datar VV, Mayee CD. Assesment of loss in tomato yield due to early blight. *Indian Phytopathol.* 1981; 34:191-195.
3. Gondal AS, Ijaz M, Riaz K, Khan AR. Effect of different doses of fungicide (Mancozeb) against *Alternaria* leaf blight of tomato in Tunnel. *Plant Pathology and Microbiology.* 2012; 3(3):1-3.
4. Holm AL, Rivera VV, Secor GA, Gudmestad NC.

Temporal sensitivity of *Alternaria solani* to foliar fungicides (*Short communication*). *Amer J of Potato Research.* 2003; 80:33-40.

5. Jones LR, Grout AJ. Notes on two species of *Alternaria*. *Bulletin of the Torrey Botanical Society.* 1897; 24:254-258.
6. Mallik I, Arabiat S, Pasche JS, Bolton MD, Patel JS, Gudmestad NC. Molecular characterization and detection of mutations associated with resistance to succinate dehydrogenase inhibiting fungicides in *Alternaria solani*. *Phytopathology.* 2014; 104:40-49.
7. Olaniyi JO, Akanbi WB, Adejumo TA, Akande OG. Growth, fruit yield and nutritional quality of tomato varieties. *African Journal of Food Science.* 2010; 4:398-402.
8. Pasche JS, Piche LM, Gudmestad NC. Effect of the F129L mutation in *Alternaria solani* on fungicides affecting mitochondrial respiration. *Plant Dis.* 2005; 89:269-278.
9. Prasad Y, Naik MK. Evaluation of genotypes, fungicides and plant extracts against early blight of tomato caused by *Alternaria solani*. *Indian J Plant Prot.* 2003; 31(2):49-53.
10. Sahu DK, Khare CP, Singh HK, Thakur MP. Evaluation of newer fungicide for management of early blight of tomato in Chhattisgarh. *The Bio Scan.* 2013; 8(4):1255-1259.
11. Shahbazi H, Aminian H, Sahebani N, Halterman D. Effect of *Alternaria solani* exudates on resistance and susceptible potato cultivars from two different pathogen isolates. *The Plant Pathology Journal.* 2011; 27(1):14-19.
12. Sharma RK, Patel DR, Chaudhari DR, Kumar V, Patel MM. Effect of Some Fungicides against Early Blight of Tomato (*Lycopersicon esculentum* Mill.) Caused by *Alternaria solani* (Ell. & Mart.) Jones and Grout and Their Impact on Yield. *Int. J Curr. Microbiol. App. Sci.* 2018; 7(07):1395-1401.