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INFLUENCE OF DIFFERENT MEDIA AND NUTRIENT SOURCES ON THE GROWTH DYNAMICS OF *ALTERNARIA SOLANI* ASSOCIATED WITH TOMATO EARLY BLIGHT

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ABSTRACT

Early blight of tomato (*Solanum lycopersicum* L.) caused by *Alternaria solani* is highly destructive, causing yield loss up to 80 per cent. This study focuses on the growth characteristics of *A. solani* under different cultural conditions. The pathogen was isolated from infected tomato plants in Tamil Nadu, India, and its growth was assessed on various solid, liquid, carbon, and nitrogen source media. Among the solid media, Potato Dextrose Agar (PDA) supported the highest radial mycelial growth (89.50 mm), while Peptone Glucose Agar (89.40 mm) and Malt Extract Agar (81.40 mm) also performed well. In liquid media, Potato Dextrose Broth resulted in the highest mycelial dry weight (554 mg). Regarding carbon sources, dextrose (control) supported the maximum mycelial growth (73.55 mm), followed by maltose and sucrose. Ammonium nitrate was the most effective nitrogen source, promoting a radial growth of 83.34 mm. The study provides insights into the optimal conditions for the growth of *A. solani*, which can inform future research and disease management strategies for early blight in tomato.
Keywords **:** Early blight; *Alternaria solani*; tomato; cultural media; mycelial growth; nutrient sources.

Introduction

The tomato (*Solanum lycopersicum* L.), native to South America, is one of the most popular vegetables raised in fields around the world. China is the greatest tomato producer (31%), with India and the United States coming in second and third. Essential amino acids, vitamins, and minerals are found in the vegetable, which makes them a key component of human nutrition (Sainju *et al*., 2003). Different types of fungi, bacteria, viruses and nematodes can infect tomatoes and cause several diseases (Balanchard, 1992). One of the most devastating tomato diseases in the world is early blight, which is caused by *Alternaria solani* (Ellis, 1971). Early blight is also known as target spot disease. It infects many parts of the plant, like leaves, roots, seeds and destroyed up to 79% of the plants in the worldwide (Chaerani *et al*.,2006). In regions with high dew, precipitation, and relative humidity, early blight is among the most prevalent and damaging tomato diseases. According to Datar and Mayee (1981), a severe tomato epidemic in India caused the fruit output to drop by 78%. The genus is characterized by its variety of conidia that can appear singly or in short or long chains. The conidia can have

cross, longitudinal, or pointing septa, and their beaks can be long or short.

Furthermore, the fungus *A. solani* requires several kinds of specific compounds to grow, even though it can be found all over the world. In an in vitro study, a fungus is isolated as a pure culture in a specific medium to investigate its growth, nutrition, physiology and management. Different types of media may be used to isolate the *A. solani* fungus, which supports their radial growth, dry weight, and sporulation (Diba *et al*., 2007). However, the nutrient requirements for optimal development of the fungi are different from the nutrient requirements for good sporulation; various media composition additionally impacts the different colony morphology of *A. solani*.

Materials and Methods

Isolation of the pathogen

Based on the symptoms of early blight of tomato, infected plant specimens will be collected from major tomato-growing areas of Tamil Nadu. The pathogen will be isolated from these infected samples. A plant showing typical symptoms will be washed under running tap water and air-dried. Small pieces (5 mm) of diseased and healthy tissues from the advancing margin of infection will be cut using a sterile scalpel. The tissues will be surface-sterilized with 1% sodium hypochlorite solution for one minute and then rinsed three times with sterile distilled water. The disinfected pieces will be placed aseptically on Potato Dextrose Agar (PDA) medium, and the plates will be incubated at room temperature in an inverted position to avoid contamination.

Growth of the Alternaria spp. in different Solid media

The growth of *Alternaria* spp. was evaluated on ten different solid media: Czapek Dox medium, Yeast Extract Agar, Water Agar, Peptone Glucose Agar, Sabouraud Agar, Waksman Agar, Malt Extract Agar, Nutrient Agar, Richard's Agar, and Potato Dextrose Agar. All media were prepared and autoclaved at 121°C. Twenty millilitres of each medium were poured into Petri plates, and a virulent pathogen isolate was inoculated at the centre of each plate. The plates were incubated at 25 ± 2°C for 5-10 days. After incubation, radial mycelial growth was measured (Rajesha *et al*., 2020).

Growth of the Alternaria spp. in different liquid media

Ten different liquid media, viz., Potato Dextrose Broth, Malt Extract Broth, Peptone Glucose Broth, Water Broth, Czapek Dox Broth, Richard's Broth, and Yeast Extract Broth, were prepared in 250 ml conical flasks. Each broth was inoculated with a 9 mm mycelial plug from a seven-day-old actively growing culture of *A. solani* (TA-1). The inoculated flasks were incubated for 15 days at 28 ± 2°C. After incubation, the mycelial mat was separated by filtering through Whatman No. 1 filter paper, oven-dried, and the dry mycelial weight was recorded in milligrams (Das *et al*., 2023).

Growth of the *Alternaria* spp. in different carbon source media

The growth of the pathogen was evaluated on different carbon sources, including mannitol, starch, lactose, maltose, and sucrose. In the PDA medium, glucose was replaced with each of the above carbon sources to assess their effect on the growth of *Alternaria* spp. Each medium was prepared separately and sterilized at 121.6°C under 15 lb pressure for 20 minutes. After sterilization, the media were poured into sterile Petri plates and allowed to solidify (Kumar *et al*., 2023). Mycelial discs (9 mm diameter) of the virulent pathogen were placed at the centre of the plates, which were then incubated at 25 ± 2°C for 5–10 days. PDA served as the control.

Growth of the *Alternaria* spp. in different nitrogen source media

Different nitrogen sources such as peptone, ammonium sulfate, ammonium oxalate, potassium nitrate, and sodium nitrate were used to study their effect on pathogen growth. Each nitrogen source was incorporated separately into the medium and sterilized at 121.6°C under 15 lb pressure for 20 minutes. After sterilization, the media were poured into sterile Petri plates and allowed to solidify (Rex & Rajasekar, 2021). Mycelial discs (9 mm diameter) of the virulent pathogen were placed on the plates, which were incubated at 25 ± 2°C for 5–10 days. Richard's agar medium without any nitrogen source served as the control.

Results

Effect of different media on the growth of *A. solani*

Ten different solid culture media were used to study the growth of *A. solani*. The highest radial growth of 89.50 mm was observed on Potato Dextrose Agar (PDA), followed by Peptone Glucose Agar (89.40 mm) and Malt Extract Agar (81.40 mm), which were statistically on par with each other. The least radial growth (5.88 mm) was recorded on Nutrient Agar. The fungal colonies developed a blackish-brown colour on PDA, Peptone Glucose Agar, Malt Extract Agar, and Czapek's Dox Agar (Table 1 and Plate 1).

Effect of different liquid media on the mycelial dry weight of *A. solani*

The growth of *A. solani* was also assessed in liquid broth media. The results indicated that the highest dry mycelial weight of 554 mg was obtained in Potato Dextrose Broth, followed by Czapek Dox Broth with a dry weight of 506 mg. The lowest dry weight (180 mg) was observed in Malt Extract Broth. Sporulation was abundant in Potato Dextrose Broth and Czapek Dox Broth, while it was comparatively low in Richard's Broth, Malt Extract Broth, and Waksman Broth (Table 2 and Plate 2).

Effect of different carbon sources on radial mycelial growth of *A. solani*

Effect of different carbon sources on radial mycelial growth of *A. solani* on potato dextrose agar medium. The influence of various carbon sources viz., Mannitol, sucrose, maltose, fructose, lactose and starch on radial mycelial growth of *A. solani* on Potato dextrose agar medium was studied and the result was presented in Table 3. Among the carbon sources dextrose (control) recorded a maximum radial mycelial growth of 73.55 mm. This was followed by maltose (69.99 mm), sucrose (66.90 mm), lactose (69.99 mm), starch (63.11 mm) and lactose (63.05 mm) (Plate 3).

Effect of different Nitrogen sources on radial mycelial growth of *A. solani*

The radial growth of *A. solani* on Richard's Agar medium was examined using different nitrogen sources, namely ammonium nitrate, ammonium sulphate, potassium nitrate, peptone, and sodium nitrate. The results are presented in Table 4. Among the nitrogen sources, ammonium nitrate resulted in the highest radial growth (83.34 mm), followed by peptone (82.35 mm), sodium nitrate (76.83 mm), potassium nitrate (68.09 mm), ammonium sulphate (43.45 mm), and the control (80.38 mm) (Plate 4).

Table 1 : Effect of different solid media on radial mycelial growth of *A. solani*

S.No	Different Solid media	Radial mycelial growth (mm)
1.	PDA	89.50^{aa}
2.	Czapek dox medium	54.06^{g}
3.	Water agar medium	5.33^{h}
4.	Peptone glucose agar	89.40^{aa}
5.	Sabouraud agar	61.08^{e}
6.	Waksman agar	76.00^{cc}
7.	Nutrient agar	65.09^{d}
8.	Yeast extract agar	59.98^{f}
9.	Richard agar	76.18^{cc}
10.	Malt Extract agar	81.4^{b}
CD (0.05)		0.288

*Mean of three replications

Table 2 : Effect of different liquid media on the mycelial dry weight of *A. solani*

S.No	Different liquid media	Mycelial dry weight (mg)
1.	Potato dextrose broth	554.68^{a}
2.	Malt extract broth	180.00^{g}
3.	Peptone glucose broth	208.80^{e}
4.	Waksman broth	380.66^{d}
5.	Richard broth	481.09^{c}
6.	Yeast extract broth	190.98^{f}
7.	Czapek dox broth	506.76^{b}
CD (0.05)		0.276

*Mean of three replications

Table 3 : Effect of different carbon sources on radial mycelial growth of *A. solani* on Potato dextrose agar medium

S.No	Media	Mycelial Growth (mm)
1.	Sucrose	66.90^{c}
2.	Mannitol	55.87^{e}
3.	Starch	63.11^{dd}
4.	Lactose	63.05^{dd}
5.	Maltose	69.99^{b}
6.	Control	73.55^{a}
CD (0.05)		0.205

*Mean of three replications

Table 4 : Effect of different nitrogen sources on radial mycelial growth of *A. solani* on Richard's agar medium

S.No	Media	Mycelial Growth (mm)
1.	Peptone	82.35^{b}
2.	Ammonium sulphate	34.45^{f}
3.	Ammonium nitrate	83.34^{a}
4.	Potassium nitrate	68.09^{e}
5.	Sodium nitrate	76.83^{d}
6.	Control	80.38^{c}
CD (0.05)		0.230

*Mean of three replications

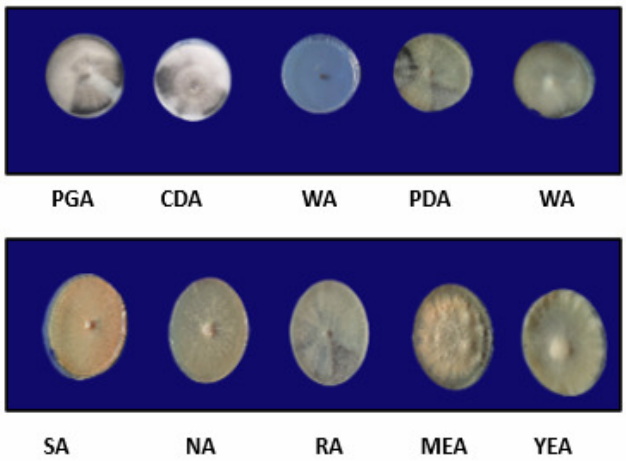

Fig. 1 : Effect of different solid media on radial mycelial growth of *A. solani*

Fig. 2 : Effect of different liquid media on mycelial dry weight of *A. solani*

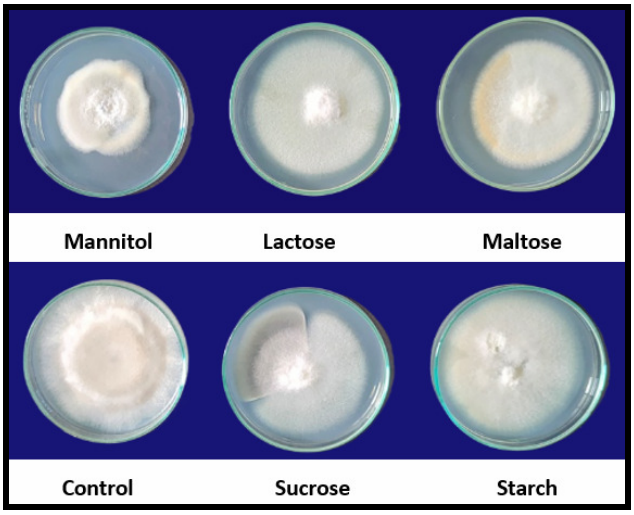

Fig. 3 : Effect of different carbon sources on radial mycelial growth of *A. solani* on PDA medium

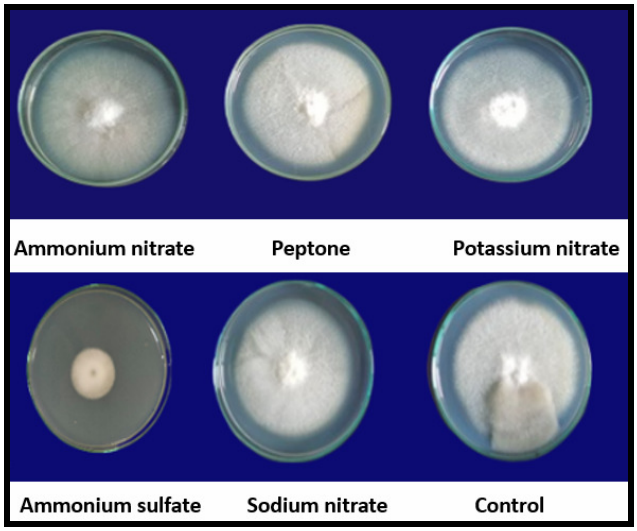

Fig. 4 : Effect of different nitrogen sources on radial mycelial growth of *A. solani* on Richard's agar medium

Discussion

The growth of *A. solani* was markedly influenced by the type of culture media and nutrient sources used. Among the solid media tested, Potato Dextrose Agar (PDA) supported the highest radial mycelial growth (89.50 mm), followed closely by Peptone Glucose Agar and Malt Extract Agar, which showed comparable performance. Minimal growth was observed on Water Agar and Nutrient Agar, indicating that *A. solani* requires a nutrient-rich environment for optimal development. These findings align with those of Rajesha *et al.* (2020), who also reported PDA as the most suitable medium for *Alternaria* spp., followed by Malt Extract Agar, due to their high carbohydrate availability and favourable pH.

In liquid media, a similar trend was observed. Potato Dextrose Broth yielded the highest mycelial dry weight (554 mg), followed by Czapek Dox Broth (506 mg). Malt Extract Broth supported the least biomass production (180 mg). The superior performance of PDA-based broth corroborates the findings of Das *et al.* (2023), who reported that potato-based media promote vigorous fungal growth and enhanced sporulation due to the presence of easily metabolizable sugars and growth-promoting compounds.

Carbon source evaluation revealed that dextrose (control) was the most effective carbon substrate, resulting in the highest radial growth (73.55 mm). Maltose and sucrose also supported satisfactory growth, whereas mannitol, starch, and lactose were less favourable. These results are consistent with Kumar *et al.* (2023), who demonstrated that simple carbohydrates such as dextrose are readily utilized by *A. solani*, thereby enhancing mycelial development.

Nitrogen source evaluation showed that ammonium nitrate was the most effective, promoting a radial growth of 83.34 mm, followed by peptone and sodium nitrate. Ammonium sulphate resulted in the lowest growth, indicating a possible inhibitory effect. Similar observations were made by Rex and Rajasekar (2021), who reported ammonium nitrate as the most efficient inorganic nitrogen source for *Alternaria* spp., while ammonium sulphate suppressed growth due to ionic imbalance or reduced nitrogen assimilation efficiency.

Overall, the study demonstrates that *A. solani* exhibits optimal growth on media rich in simple carbohydrates and accessible nitrogen forms. Understanding these nutritional preferences is essential for improving pathogen isolation, culturing, and further physiological or pathogenicity studies. The insights gained also support future research aimed at developing targeted management strategies for early blight disease in tomato.

Conclusion

The growth behaviour of *A. solani*, the fungus causing early blight in tomato, clearly depends on the type of media and nutrients available. Nutrient-rich media such as PDA, along with simple sugars like dextrose and inorganic nitrogen sources like

ammonium nitrate, provided the most favourable conditions for its development. Understanding these nutritional preferences offers valuable guidance for future work, including pathogenicity studies, antifungal screening, and designing better strategies to manage early blight in tomato crops.

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