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# Physiological Studies of Mulberry Root Rot Pathogens

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**ABSTRACT: Mulberry root rot is incited by fungal pathogens like *Macrophomina phaseolina, Lasiodiplodia theobromae* and *Fusarium solani* due to perennial nature of the crop pathogens thrives well into soil and infect the plant. The growth of mulberry root rot pathogens *viz.*, *M. phaseolina, L. theobromae* and *F. solani* were found best under temperature of 25 to 30°C with acidic pH of 5, 6 and neutral pH 7.**

**Keywords:** *Fusarium solani,* Mulberry, temperature.

## INTRODUCTION

Mulberry is belonging to family (Moraceae) it is the fast growing deciduous plant grown extensively for feeding the silkworms. Mulberry silk is majorly produced in Karnataka. Mulberry is grown under different types of soil and varied climatic conditions from temperate to tropical regions. Due to the perineal nature of the crop and repeated harvesting of mulberry leaves the soil nutrients get depleted and plant is succumb to many soil borne disease. The mulberry diseases are caused by the many pathogens like fungi, bacteria virus and nematodes. The data on survey conducted in major mulberry growing districts of Southern Karnataka revealed that mulberry root rot is initiated by these fungal pathogens *viz.*, *Fusarium solani, Lasiodiplodia theobromae* and *Macrophomina phaseolina*. Mulberry root rot is reported both in nurseries and established gardens in different types of spacing's, different soil and climatic conditions. Once the pathogen sporulated extensively then it is very difficult to manage them. Keeping this in view present investigation were carried out on different physiological characteristics of the root rot pathogens.

## MATERIALS AND METHODS

The present investigation on the physiological studies of mulberry root rot causing pathogens were studied during 2021-22 in the Department of Sericulture, University of Agricultural Sciences, Bengaluru, Karnataka, India. The materials used and methodology fallowed described below.

*A. Effect of temperature on the growth of root rot pathogens*

The fungal pathogens growth was tested at different temperature regimes *viz.*, 15°C, 20°C, 25°C, 30°C, 35°C and 40°C on PDA medium. Fifteen ml of PDA medium was poured into each Petri plate and allowed to solidify. Such plates were inoculated with 5 mm discs of the pathogen cut from periphery of the actively growing culture and incubated at 28 ± 1°C temperature. The experiment was conducted by using Completely Randomized Design (CRD) and each treatment was replicated thrice. Observations were taken when the growth of any culture covers the entire petri plate to know the optimum temperature for growth and development of the test fungus.

*B. Effect of hydrogen ion concentration on the growth of pathogen*

The growth of pathogen was tested at six different pH levels *viz.,* 5, 6, 7, 8, 9 and 10 respectively on PDA medium. Hydrogen ion (pH) concentration of media was determined by using pH meter. Adjustment of pH was done using 0.1 N alkali (Sodium hydroxide) and 0.1 N acid (Hydrochloric acid) and sterilized in an autoclave at 121.6°C for 15 minutes. 15 mL of each sterilized medium with different pH level was poured into each petri plate and allowed to solidify. Such plates were inoculated with 5 mm discs of the pathogen cut from periphery of the culture and incubated at 28±1°C. Observation was taken when the growth of any culture covered the entire Petri plate. The experiment was conducted by using Completely Randomized Design (CRD) and each treatment was replicated thrice. The ideal pH for growth of the fungus

was determined by considering the colony diameter at 7 days of incubation.

## RESULTS AND DISCUSSION

The results on the physiological studies of mulberry root rot caused by *Fusarium solani*, *Macrophomina phaseolina* and *Lasiodiplodia theobromae* conducted during the 2021-22 are presented in this chapter.

*A. Effect of different temperature regimes for the growth of M. phaseolina, L. theobromae and F. solani causing root rot of mulberry on PDA medium*

Temperature is most important factor influencing the growth and metabolism of *M. phaseolina, L. theobromae* and *F. solani.* Different levels of temperature *viz.,* 15°, 20°, 25°, 30°, 35° and 40°C were studied on the growth of mulberry root rot pathogens on PDA medium. The results obtained on the effect of different temperature levels on PDA solid media indicated that the growth and morphological characters of fungus varied with the varying temperature. Fungus can survive under wide range of temperature regimes but minimum, optimum and maximum temperature are required for their growth.

The variation in the growth of *M. phaseolina* was observed among the different temperature levels on potato dextrose agar medium (Table 1, Fig. 1 and Plate 1a). Among the different temperature levels evaluated 20°C to 35°C was found to be the best for the growth of the pathogen with 90 mm colony diameter on PDA medium. However, the growth of the pathogen was very poor at 15°C and 40°C. These studies were conformity with the findings of Parmar *et al.* (2018), they also reported the effects of different temperatures on mycelial growth and sclerotial formation by *Macrophomina phaseolina.* Different temperatures were tested for suitable fungal growth and it was observed that temperature range of 25°C to 35 °C was found optimum for growth and sclerotial formation. Whereas 30°C (79.44 mm) was the ideal temperature for the growth of the fungus. Similarly, De Sousa *et al.* (2020) studied the growth of *M. phasiolina* exposed to the different temperature regimes *viz.,* 25°C, 28°C, 31°C, 34 °C and moderate growth of pathogen was observed at 28 – 30°C and more growth of disease is observed at 34°C.

The variation in the growth *L. theobromae* among the different temperature levels on potato dextrose agar medium was found statistically significant (Table 1, Fig. 1 and Plate 1b). Among the different temperature levels evaluated, 25°C was found to be the best for growth of the pathogen with colony diameter 90.00 mm and the next best was 30°C with 87.67 mm mycelial growth. However, the growth of the pathogen was very less at 15°C and 40° C. At 20°C the growth was very well supported with mycelial growth of 82.33 mm respectively. These findings were similar with the findings of Saha *et al.* (2008) who reported that the optimum temperature for growth of *L. theobromae* was 28° C. However, no growth of fungus was recorded at 40°C. Similarly, Baloch *et al.* (2018) who reported the effect of temperature on mycelial growth of *L. theobromae* and that pathogen could grow well at temperature of 20 to 30° C. The maximum colony diameter was observed at 30°C. There was no growth of fungus at 10°C.

The variation in the growth *F. solani* among the different temperature levels potato dextrose agar solid media was found statistically significant (Table 1, Fig. 1 and Plate 1c). Among the different temperature levels evaluated none of the temperature found good for the growth of pathogens. However, temperature of 25 °C was found to be the best temperature for the growth of pathogen and the next best was 30°C with colony diameter of 45.67 and 45.00 mm respectively, the growth of the pathogen was very less at 20°C and 35°C. The results are in conformity the findings of Jat and Ahir (2013) they also studies the effect of different levels of temperature (15, 20, 25, 30 and 35°C), on growth and sporulation pathogen *F. solani* under *in vitro* conditions. Maximum mycelial growth and sporulation were found at 25°C temperature (84.15 mm). Similar findings were recorded by Gupta *et al.* (2010) and they studied the cultural and physiological (temperature and pH) characters of *Fusarium oxysporum* and *F. solani*. The data revealed that maximum on PDA mycelial growth was recorded of temperature 30°C for *F. oxysporum* and *F. solani*.

**Table 1: Effect of different temperature levels on mycelial growth of *Macrophomina phaseolina, Lasiodiplodia theobromae, Fusarium solani* causing root rot of mulberry on PDA media.**

| Sr. No. | Temperature (°C) | Mycelial colony growth (mm) | | |
|---|---|---|---|---|
| | | ***Macrophomina Phaseolina*** | ***Lasiodiplodia theobromae*** | ***Fusarium solani*** |
| 1. | 15 | 69.33 | 53.67 | 20.00 |
| 2. | 20 | 90.00 | 82.33 | 42.33 |
| 3. | 25 | 90.00 | 90.00 | 45.67 |
| 4. | 30 | 90.00 | 87.67 | 45.00 |
| 5. | 35 | 90.00 | 57.67 | 42.33 |
| 6. | 40 | 58.33 | 42.33 | 21.00 |
| | **S. Em±** | **0.509** | **1.46** | **5.55** |
| | **CD @ 1%** | **1.586** | **4.56** | **17.28** |

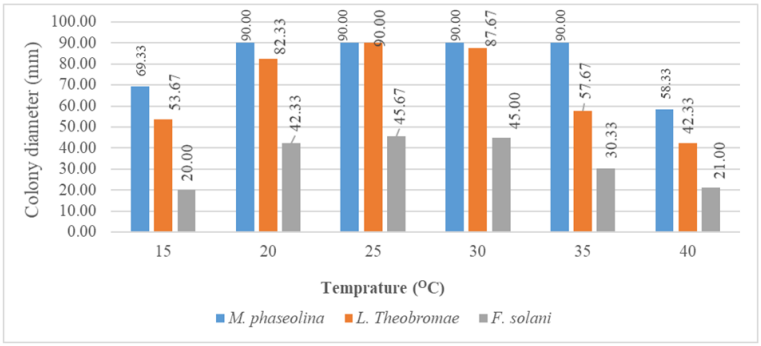


**Fig. 1.** Effect of different temperature levels on mycelial growth of *M. phaseolina, L.theobromae* and *F. solani*.

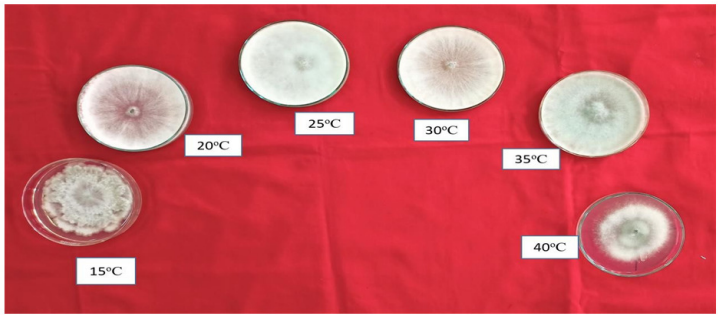


**Plate 1a.** Effect of temperature levels on mycelial growth of *M. phaseolina* on PDA medium.

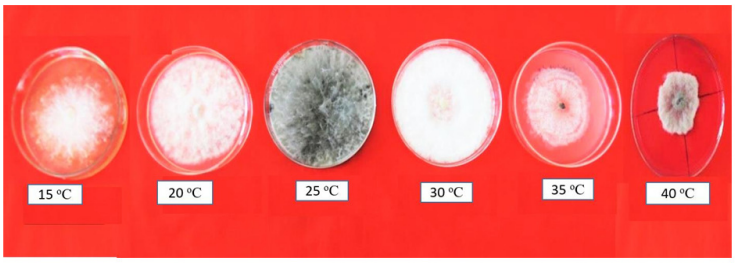


**Plate 1b.** Effect of temperature on mycelial growth of *L. theobromae* on PDA medium.

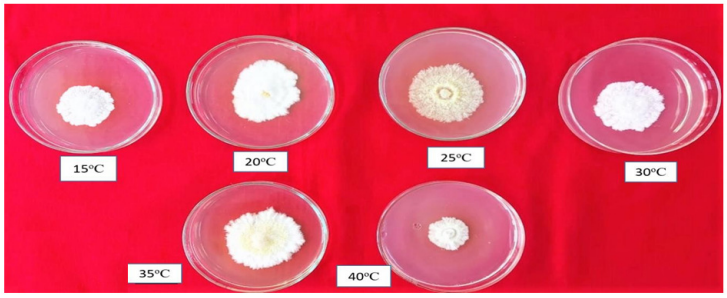


**Plate 1c.** Effect of temperature on mycelial growth of *F. solani* on PDA medium.

*B. Effect of hydrogen ion concentration (pH) on the growth of M. phaseolina, L. theobromae and F. solani.*

The hydrogen ion concentration influences the growth of fungi. Every organism has its own maximum, optimum and minimum pH levels for its growth and development. The results of the pH requirement for the growth of *M. phaseolina* was studied on potato dextrose agar medium and data is presented in Table 2, Fig. 2 and Plate 2a.

The growth of pathogen was varied significantly with growth in different pH levels. The hydrogen ion (pH) concentration of 5, 6 and 7 were found to be good on the PDA medium with colony diameter of 90 mm. The pH 8 was also found best and statistically on far with 5 6 and 7. The moderate growth of 80.00 mm was recorded at pH 9 However, the least growth of mycelia was observed in pH 10 (69.33mm).

This result was similar with the findings of Khamari *et al.* (2018) who conducted an experiment to study influence of physiological parameters like temperature, pH and light period on growth and sporuation of *M. phaseolina* It was found that, the pathogen grew well at slightly acidic pH 6.5 (285.8 mg) followed by neutral pH of 7 (278.0 mg). Similarly, Csondes *et al.* (2012) who reported that optimal pH for the growth of *M. phaseolina* was PH of 6.0. However, growth of pathogen was observed even at pH values of 3, 7 and 8. The results of the pH requirement of *L. theobromae* for

its growth was studied on potatodextrose agar medium and data is presented in Table 2, Fig. 2 and Plate 2b.

The growth of pathogen was varied significantly at different pH levels. The hydrogen ion (pH) concentration of 5, 6 and 7 were found to be good PDA medium. The mean maximum mycelial growth was recorded at pH 5 & 6 and 7 with colony diameter of 90 mm on PDA medium. Next best was pH 8 (85.13 mm) and pH 9 (75.33) with moderate mycelial growth however least growth of mycelia was observed in pH 10 with colony diameter of (63.33mm).

Similarly, findings of Latha *et al.* (2013) they also reported that the fungus *L. theobromae* grow well at pH ranged from 5.0 to 9.0. and the optimum pH for growth of fungus was pH 7.0. Similarly, Baloch *et al.* (2018) who also reported that pH 7.0 and 8.0 were optimum for the growth of *L. theobromae.* Whereas, minimum growth was obtained at pH 4.0. Similarly, Dheepa *et al.* (2018) recorded the optimum growth of *L. theobromae* at pH 7.0.

The results of the pH requirement of *F. solani* for its growth was studied on potato dextrose agar medium and data is presented in Table 2, Fig. 2 and Plate 2c.

The growth of pathogen was varied significantly with different pH levels. The hydrogen ion (pH) concentration of 5, 6 and 7 were found to be moderate for the growth of *F. solani*. The mean maximum mycelial growth was recorded at pH 7 (55.66 mm) followed by pH 5 and 6 with 52.00 mm and 47.00 mm respectively. Next best was pH 8 with colony diameter of 45.66 mm. The less growth of 24.67 mm and 20.67 mm was recorded at pH 9 and pH 10 respectively.

These findings are in conformity with the results obtained by Patel *et al.* (2020) who also reported that the *F. solani* thrives well under different hydrogen ion concentrations. However, the growth of *Fusarium solani* was less at pH 4 and pH 10. It was observed that the pH 7 and 8 were found optimum for the growth of *F. solani.* Similarly, Singh *et al.* (2017) evaluated the growth of *F. solani* under different pH levels *viz.,* 5, 6, 7 and 8 to find out optimum pH for the growth of the fungus. The fungus showed maximum radial growth at pH 6.0 (84.43 mm).

**Table 2: Effect of different pH levels on mycelial growth of *M. phaseolina*, *L. theobromae* and *F. solani* on PDA media.**

| Sr. No. | pH | Mean mycelial growth (mm) | | |
|---|---|---|---|---|
| | | ***Macrophomina phaseolina*** | ***Laseodiplodia theobromae*** | ***Fusarium solani*** |
| 1. | 5 | 90.00 | 90.00 | 52.00 |
| 2. | 6 | 90.00 | 90.00 | 47.00 |
| 3. | 7 | 90.00 | 90.00 | 55.67 |
| 4. | 8 | 89.67 | 85.13 | 45.67 |
| 5. | 9 | 80.00 | 75.33 | 24.67 |
| 6. | 10 | 69.33 | 63.33 | 20.67 |
| | **S. Em ±** | **0.45** | **0.60** | **1.00** |
| | **CD @ 1%** | **1.41** | **1.87** | **3.14** |

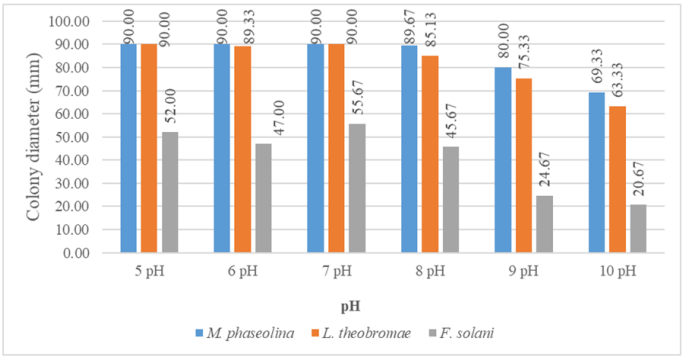


**Fig. 2.** Effect of different pH levels on growth of *M. phaseolina, L. theobromae* and *F.solani* on PDA media.

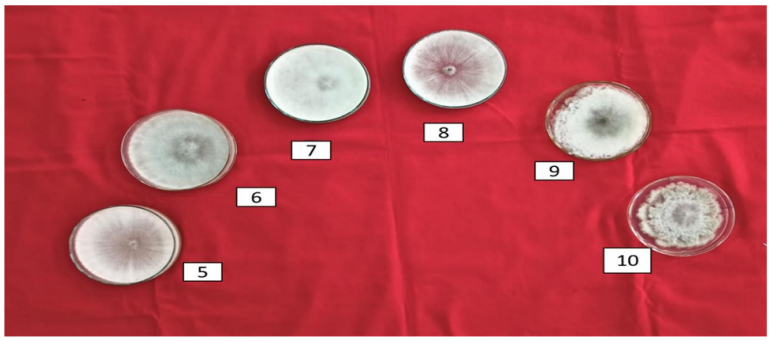


**Plate 2a.** Effect of different pH levels on mycelial growth of *M. phaseolina* on PDA medium.

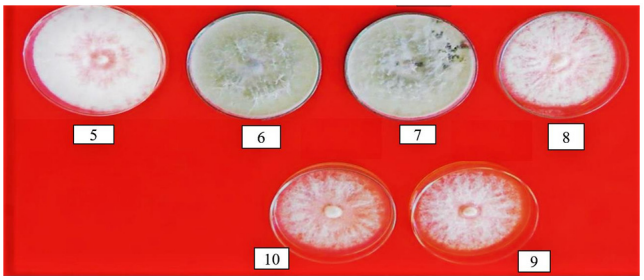


**Plate 2b.** Effect of different pH levels on mycelial growth of *L. theobromae* on PDA medium.

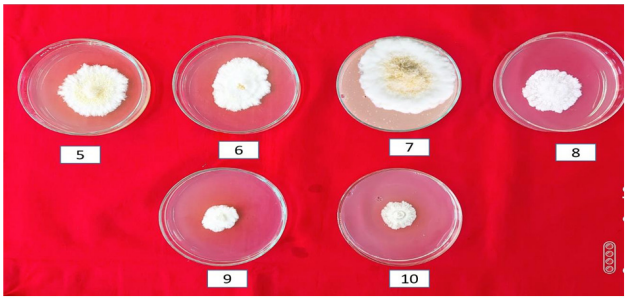


**Plate 2c.** Effect of different pH levels on mycelial growth of *F. solani* on PDA medium.

## CONCLUSIONS

The temperature regimes of 25 to 30° C was found favorable for the growth of all three pathogens *viz., Macrophomina phaseolina, Lasiodiplodia theobromae, Fusarium solani* with mean colony diameter of 90 mm. whereas, maximum mycelial growth of growth *M. phaseolina, L. theobromae* was observed at pH 7 with colony diameter of 90 mm and moderate mycelial growth was observed in *F. solani* at pH 7. However least colony growth of all 3 pathogens observed at pH 10.

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