



"Optimizing Temperature And Ph For *Trichoderma Viride* FCNBM#25 To Control Sooty Mold Disease In Palash"

Ritika Tiwari¹, Dr. Sushma Dubey^{1*}

Department of Biotechnology Kalinga University Naya Raipur Chhattisgarh, Pin 492101 India

ABSTRACT

In India, palash (*Butea monosperma*) is a highly valued and revered plant, used for dye, medicine, animal feed, resin, and durable wood. Its wood is notably resistant to water, making it ideal for crafting well curbs and water scoops. Additionally, palash wood is prized for producing high-quality charcoal. However, sooty mold infections on palash trees have compromised their medicinal properties. One of the most effective antagonistic fungi for controlling sooty mold is *Trichoderma viride* FCNBM#25, a dark-pigmented, superficial, and non-parasitic fungus found on plants. In this study, the *T. viride* FCNBM#25 strain was isolated from palash using conventional methods for further research. The growth of this biocontrol agent was evaluated under varying physical conditions, specifically pH and temperature. Results showed that *T. viride* FCNBM#25 exhibited optimal growth at 28°C and was unable to grow at or below 10°C. The highest growth and sporulation occurred at pH 6, while moderate growth was observed at pH 7.0.

Keywords: *Butea monosperma*, *Trichoderma viride* FCNBM#25, temperature, pH

INTRODUCTION

Butea monosperma, commonly known as Palash, is an important forest plant valued for its high economic significance. Various parts of the plant are traditionally used in tribal areas as medicine, insecticides, and natural dyes. Additionally, its leaves serve practical purposes such as making inexpensive plates and cups for meals in rural communities, and are also used for wrapping tobacco. Numerous studies have highlighted the socio-religious and economic importance of this plant [1–3].

Sooty mold, as the name suggests, appears as a black, powdery or velvety coating on leaves, branches, and fruits. This coating is caused by fungal growth and is not a true disease. The fungus forms a black, velvety layer on the surfaces of fruits, leaves, and twigs. Sooty mold fungi grow saprophytically on the sugary honeydew secreted by sap-sucking insects such as aphids, whiteflies, and scales. They reside only on the surface of the plant and do not infect plant tissues.

Although sooty mold causes no direct infection, its presence is primarily an aesthetic problem. It blocks sunlight from reaching the leaf surface, which can occasionally stunt plant growth and cause yellowing of foliage. When honeydew-producing insects heavily infest shrubs, the thick sooty mold layer can impair chlorophyll function, potentially leading to significant damage or even plant death. Thus, while

largely cosmetic, sooty mold reduces photosynthetic efficiency and diminishes the economic value of affected plants [4–6].

Most infections occur in January, leading to substantial economic losses for those relying on Palash. Due to the economic importance of the plant and the negative impact of sooty mold, the antagonistic fungal strain *Trichoderma viride* FCNBM#25 was selected for disease management. This study aims to investigate the effects of temperature and pH on the growth of *T. viride* FCNBM#25 to optimize the large-scale production of secondary metabolites for controlling sooty mold in Palash.

MATERIALS AND METHODS

Fungal Culture

Trichoderma viride FCNBM#25 isolates were obtained from diseased samples collected from Palash plants at various locations throughout Raipur, India. Isolation was performed on PDA medium using the serial dilution plate technique described by Walksman [8]. Identification up to the species level was based on phenotypic characteristics such as colony color, growth pattern, and the morphology of conidiophores, phialides, and conidia. Reference materials were used to confirm identification [10]. The isolated cultures were stored at -4°C for further studies.

Fungal Growth at Various Temperatures

To evaluate the effect of temperature on the mycelial growth of *Trichoderma viride* FCNBM#25, cultures were incubated for 14 days at different temperatures: 5°C, 10°C, 15°C, 20°C, 25°C, 28°C, 30°C, 32°C, 35°C, 40°C, and 45°C ± 1°C. Mycelial biomass was measured as previously described [8].

Fungal Growth at Various Hydrogen Ion Concentrations

The hydrogen ion concentration (pH) of the culture medium is a critical factor influencing fungal growth rate and biomass production. While microorganisms can tolerate a broad pH range, fungi generally do not grow well in highly alkaline substrates. The pH of the basal medium was adjusted before autoclaving using 1N HCl and/or 1N NaOH. The optimal pH determined from preliminary experiments was used for further studies.

Results and Discussion

Isolation and Identification

Trichoderma viride FCNBM#25 isolates from various diseased Palash samples collected across Raipur were identified and used for subsequent optimization studies.

Effect of Temperature

Temperature is known to influence fungal growth and sporulation, with reproductive activity often occurring in a narrower temperature range than growth. Most fungi have a minimum growth temperature between 0°C and 20°C, though some can tolerate lower. Maximum growth temperatures typically range between 27°C and 50°C [9]. In this study, *T. viride* FCNBM#25 did not grow at or below 10°C. Growth initiated at 15°C, increased steadily, and peaked at 28°C. Beyond this temperature, biomass production gradually declined. These findings align with observations reported by other researchers [10]. Maintaining the optimal temperature is thus essential for maximizing biomass yield of *T. viride* FCNBM#25.

Effect of Hydrogen Ion Concentration (pH)

The hydrogen ion concentration of the growth medium significantly affects in vitro growth of *T. viride* FCNBM#25. The fungus grew well over a broad pH range, with optimal growth observed between pH 6 and 8. Peak growth occurred at pH 6, with moderate growth at pH 7 and 8, followed by a sharp decline beyond this range. These results are consistent with previous studies [10–11].

Table 1. Effect of different pH on the growth of *Trichoderma viride* FCNBM#25.

	Hydrogen-ion Concentration (pH)	Dry mycelial wt. (mg.)
1.	3.0	000.04 ± 0.02
2.	4.0	120.00 ± 0.25
3.	5.0	155.00 ± 0.24
4.	6.0	610.00 ± 0.16
5.	7.0	585.00 ± 0.15
6.	8.0	315.00 ± 0.16
7.	9.0	165.00 ± 0.12
8.	10.0	035.00 ± 0.15
9.	11.0	000.16 ± 0.02
10.	12.0	000.00 ± 0.00
11.	13.0	000.00 ± 0.00

Table 2. Effect of different temperature on the growth of *Trichoderma viride* FCNBM#25.

S.No.	Temperature (°C)	Dry mycelial wt. (mg.)
1.	5	000.00 ± 0.00
2.	10	000.00 ± 0.00
3.	15	082.10 ± 0.20
4.	20	266.20 ± 0.26
5.	25	480.30 ± 0.15
6.	28	588.50 ± 0.25
7.	30	490.80 ± 0.14
8.	32	335.00 ± 0.00
9.	35	310.00 ± 0.00
10.	40	025.20 ± 0.16
11.	45	010.00 ± 0.00

CONCLUSION

Based on these observations, the growth of *Trichoderma viride* FCNBM#25 is significantly affected by physiological factors such as pH and temperature. Maintaining optimal pH and temperature conditions is essential for the large-scale biomass production of this biocontrol agent, enabling effective and eco-friendly management of sooty mold disease in Palash.

REFERENCES

1. Manhas, R.K. and P.K. Rao (2012). *Journal of Biosphere*. **1**: 51
2. Bilgrami, K.S., Jamaluddin and M.A. Rizwi (1979). Fungi of India, Part - I, List and References, *Today and Tomorrow Printers and Publishers, New Delhi*, pp. 467.
3. Bilgrami, K.S., Jamaluddin and M.A. Rizwi (1981). Fungi of India, Part - II, Host index and Addenda, *Today and Tomorrow Printers and Publishers, New Delhi*, pp. 128.
4. Stover, R.H. (1975). *Tran. Brit. Mycol. Soci.* **65**: 328-330.
5. Kessler, K.J. Jr (1992). In: *North Central Distribution Center, Forest Product Laboratory. One Gifford Pinchot Drive, Madison, WI 53705-2398*.
6. Frank, S.D., S.B. Bambara and R.K. Jones (2002). Sooty molds-what & How. *N C state university, USA*.
7. Samuels, G.J., K.O. Petrini, K.E. Lieckfeldt and C.P. Kubicek (1998). *Stud. Mycol.* **41**: 1-54.
8. Sibtain, A., G. Mustafa, M. Arshad, and M.I. Rajoka (2017). *BioMed Research International*, vol. 2017, Article ID 6232793, 9 pages, 2017. doi:10.1155/2017/6232793.
9. Lilly, V.G. and H.L. Barnett (1951). *Physiology of the fungi*. McGraw Hill, New York.
10. Rajak, R.C. and A.K. Pandey (1987a). *Nova Hedwigia*. **44(3-4)**: 531-536.
11. Rajak, R.C. and A.K. Pandey (1987b). *Studies on the genus Haplosporella* II. Effect on the different hydrogen-ion concentration on the morphology and cultural characters. In: *Perspectives in Mycological Research, Vol. 1, Prof. G.P. Agarwal Festschrift Volume* (Hasija, S. K.ed.).