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Influence of different temperature and relative humidity levels on the mycelial growth, conidial germination and anthracnose incidence of *Colletotrichum gloeosporioides*

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ABSTRACT

Mango anthracnose caused by *Colletotrichum gloeosporioides* is a highly destructive pathogen that causes considerable damage, inflicting severe qualitative and quantitative losses. Among the external factors which influence the growth of fungi, temperature and relative humidity plays an important role. Each pathogen has got its own cardinal temperature and relative humidity; also understanding about these factors will help to standardize the management strategies. Among the six temperature levels tested, 25°C was found to be more conducive for the mycelial growth (88.33 mm), conidial germination (69.00%) of *C. gloeosporioides*, and maximum disease development (97.00 %) which was followed by room temperature (28±2°C). The maximum disease incidence of 97.00 per cent in the fruits was recorded at 25°C followed by room temperature (28±2°C) (83.33 %) after 10 days of inoculation. Among the seven relative humidity levels tested, the maximum mycelial growth (87.00 mm), conidial germination (72.00%) and maximum disease incidence (97.00 %) was recorded at 100 per cent relative humidity, which was followed by 92.9% relative humidity level (83.00 mm; 61.67% mycelial growth and conidia germination, respectively). The least mycelial growth (7.33 mm) and conidial germination (0.0%) was recorded at 36.8% relative humidity level.

KEYWORDS: *C. gloeosporioides*, temperature, relative humidity, growth and sporulation

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INTRODUCTION

Mango (*Mangifera indica* L.) is one of the most important tropical fruit crops in the world. It belongs to the family Anacardiaceae and it is called as “King of fruits” [1]. Mango cultivation is an important agribusiness in India. Even though it has the largest area, the productivity is very low due to a number of diseases. Mango trees are affected by several fungal, bacterial and viral diseases, of which mango anthracnose caused by *Colletotrichum gloeosporioides* Penz. is a highly destructive pathogen that causes considerable damage, inflicting severe qualitative and quantitative losses [2]. Each pathogen has got its own cardinal temperature and understanding the temperature requirement of the pathogen will help to standardize the management strategies. Relative humidity is another major factor in determining the growth, conidial germination and disease development [3]. Prabakar *et al.* [4] found that *C. gloeosporioides* showed variation in its growth, conidial

germination and disease development at different relative humidity levels. The present study was conducted to estimate the effect of different temperature and relative humidity levels on the mycelial growth, conidial germination and anthracnose incidence of *Colletotrichum gloeosporioides*

MATERIALS AND METHODS

Sampling And Isolation Of *C. Gloeosporioides*

The pathogen causing anthracnose disease in mango was isolated from diseased leaf and fruit samples. The infected tissue bits were separated with a sterile blade and surface sterilized with 1 per cent sodium hypochlorite solution for 1 min. and subsequently washed three times with sterile distilled water. Then they were transferred into a sterile Petri dish containing Potato Dextrose Agar (PDA) medium [5] amended with streptomycin. The plates were then incubated at room temperature (28 ± 2°C) for four days. The emerging colonies

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were sub cultured on to PDA slants. Single hyphal tip method was followed for making pure culture and maintained on PDA slants [6]. The identity of isolate was confirmed by microscopic observations based on morphological characteristics as per the key suggested by Barnett *et al.* [7].

Effect of Temperature and Relative Humidity on the Growth, Sporulation and Infectivity of *C. Gloeosporioides*

I. Effect of Temperature

Mycelial growth and conidial germination were studied based on standard methods [4] and as explained earlier [8].

Fruit Infection

The fruits were inoculated with conidial suspension (1×10^5 conidia ml^{-1}) of *C. gloeosporioides* by pinprick method and incubated at different temperatures in BOD incubator. Three replications were maintained for each treatment with five fruits per replication. The disease incidence was recorded at 10 days after inoculation.

II. Effect of Relative Humidity

A. Mycelial Growth

The pathogen was inoculated in Petri plates containing PDA medium. The inoculated Petri plates were placed in desiccators over different conc. of H_2SO_4 to give appropriate relative humidities viz., 36.8, 46.8, 56.9, 66.8, 82.9, 92.9 and 100 per cent [4]. Each treatment was replicated thrice. The radial growth was measured at 7 days after incubation.

B. Conidial Germination

The cavity slides containing 0.1 ml of conidial suspension (1×10^5 conidia ml^{-1}) were placed in Petri plates containing moist filter papers at the bottom and incubated for 24h. at different relative humidity as mentioned earlier. Each treatment was replicated thrice and in each replication 100 conidia were observed for assessing the germination.

C. Diseases Incidence In Fruits

The fruits were inoculated with conidial suspension (1×10^5 conidia ml^{-1}) of *C. gloeosporioides* by pinprick method

and incubated at different relative humidity levels as mentioned above. Three replications were maintained for each treatment with five fruits per replication. The disease incidence was recorded 10 days after inoculation.

RESULTS AND DISCUSSION

Effect of Temperature Levels on the Mycelial Growth, Conidial

Germination and Anthracnose Incidence of *C. Gloeosporioides*

Among the six temperature levels tested, 25°C was found to be more conducive for the mycelial growth (88.33 mm) and conidial germination (69.00%) of *C. gloeosporioides* which was followed by room temperature ($28 \pm 2^\circ\text{C}$). The exposure of *C. gloeosporioides* to high temperature i.e. 30°C and 35°C was not conducive for the growth. The maximum disease incidence of 97.00 per cent in the fruits was recorded at 25°C followed by room temperature ($28 \pm 2^\circ\text{C}$) (83.33 %) after 10 days of inoculation (Table. 1). Temperature affects almost every function of fungi, including growth, spore germination and reproduction. Temperature plays an important role in reducing physiological deterioration and disease development. In the present study, among the temperature levels tested, 25°C was found to be ideal for the maximum mycelial growth, conidial germination and high disease incidence of mango anthracnose. This result is in accordance with the report of several authors [2,9-11].

Effect of Relative Humidity on the Mycelial Growth, Conidial Germination and Anthracnose Incidence of *C. Gloeosporioides*

The result presented in Table. 2 showed that among the seven relative humidity levels tested, the maximum mycelial growth (87.00 mm), conidial germination (72.00%) and maximum disease incidence (97.00 %) was recorded at 100 per cent relative humidity, which was followed by 92.9 per cent relative humidity level (83.00 mm; 61.67% mycelial growth and conidia germination, respectively). The least mycelial growth (7.33 mm) and conidial germination (0.0%) was recorded at 36.8 per cent relative humidity level. Relative humidity is one of the major limiting factor determining the growth, conidial germination and disease development in fruits. *C. gloeosporioides* showed variation in its growth, conidial germination and disease

Table 1: Effect of different temperature levels on the mycelial growth, conidial germination and anthracnose incidence of *C. gloeosporioides* (I_8)

T.No	Temperature ($^\circ\text{C}$)	Mycelial growth (mm)	Conidial germination (%)	Per cent disease index in fruits
1	10	07.33	08.67	4.00
2	15	33.33	19.00	15.67
3	20	79.00	53.33	68.33
4	25	88.33	69.00	97.00
5	30	68.67	42.67	60.33
6	35	54.67	28.33	46.67
7	Room temperature ($28 \pm 2^\circ\text{C}$)	82.00	66.00	83.33

Table 2: Effect of relative humidity on the mycelial growth, conidial germination and anthracnose incidence of *C.gloeosporioides* (I_g)

T.No	Relative humidity (%)	Mycelial growth (mm)	Conidial germination (%)	Per cent disease index in fruits
1	36.8	7.33	0.00	0.00
2	46.8	18.33	4.33	3.33
3	56.8	48.00	16.67	17.00
4	66.8	65.33	34.33	39.33
5	82.9	76.67	48.67	59.33
6	92.9	83.00	61.67	80.67
7	100.0	87.00	72.00	97.00
8	Room relative humidity	68.67	41.67	50.67

development at different relative humidity levels, being maximum at 100 per cent and least at 36.80 per cent. Similarly, the earlier reports of Fitzell and Peak [12], Estrada [13] and Prabakar *et al.* [4] observed maximum disease incidence of 98.33 per cent at the relative humidity of 100 per cent while, only 8.33 per cent disease incidence was observed at 56.8 per cent relative humidity level. Imtiaj *et al.* [14] reported that the highest percentage of conidial germination and mycelial growth of *C. falcatum* was observed at 90 to 100% relative humidity. Development of *Botryodiplodia theobromae* rot was explained earlier and its relation with humidity [15].

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